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Photo
The cover picture shows *Arctesthes titanica* Patrick, Patrick & Hoare, sp. nov.

See paper of **Patrick et al.** (2019) Review of the endemic New Zealand genus *Arctesthes* Meyrick (Lepidoptera, Geometridae, Larentiinae), with descriptions of two new range-restricted species).

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Temporal niche partitioning of Swiss black scavenger flies in relation to season and substrate age (Diptera, Sepsidae)

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Abstract

Understanding why and how multiple species manage to coexist represents a primary goal of ecological and evolutionary research. This is of particular relevance for communities that depend on resource rich ephemeral habitats that are prone to high intra- and interspecific competition. Black scavenger flies (Diptera: Sepsidae) are common and abundant acalyptrate flies associated with livestock dung decomposition in human-influenced agricultural grasslands worldwide. Several widespread sepsid species with apparently very similar ecological niches coexist in Europe, but despite their ecological role and their use in evolutionary ecological research, our understanding of their ecological niches and spatio-temporal distribution is still rudimentary. To gain a better understanding of their ecology, we here investigate niche partitioning at two temporal scales. First, we monitored the seasonal occurrence, often related to thermal preference, over multiple years and sites in Switzerland that differ in altitude. Secondly, we also investigate fine-scale temporal succession on dairy cow pastures. In accordance with their altitudinal and latitudinal distribution in Europe, some species were common over the entire season with a peak in summer, hence classified as warm-loving, whereas others were primarily present in spring or autumn. Phenological differences thus likely contribute to species coexistence throughout the season. However, the community also showed pronounced species turnover related to cow pat age. Some species colonize particularly fresh dung and are gradually replaced by others. Furthermore, the correlation between co-occurrence and phylogenetic distance of species revealed significant under-dispersion, indicating that more closely related species are frequently recovered at the same location. As a whole, our data suggests temporal niche differentiation of closely related species that likely facilitates the rather high species diversity on Swiss cattle pastures. The underlying mechanisms allowing close relatives to co-occur however require further scrutiny.

Introduction

The mechanisms driving species diversity and its persistence are of paramount interest in ecological research. In spite of longstanding and continuing scientific scrutiny, the phenomenal species diversity observed on earth, particularly within ecological guilds, remains puzzling (Tilman 1982, Levine and HilleRisLambers 2009). This is in part due to the challenges in uncovering the mechanisms driving species co-occurrence, because environmental filtering and interspecific competition (among other processes) can act in all aspects of an organism's life including what individuals eat, where and when they develop and reproduce, and what (abiotic) environmental conditions they prefer (Chesson 2000). To better understand the ecology and evolution of any species, descrip-

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tive studies of their population biology, meaning their spatio-temporal distribution and habitat preferences, are therefore indispensable.

Seasonality is a paramount environmental factor that systematically affects the population biology and distribution of organisms. Systematic latitudinal or altitudinal variation in climate and seasonality mediates prominent macro-ecological gradients that strongly contribute to the distribution of entire species assemblages (Tauber et al. 1986, Danks 1987, Addo-Bediako et al. 2000, Deutsch et al. 2008, Blanckenhorn et al. 2018, Gaston and Blackburn 2000, Gaston et al. 2008, Rohner et al. 2015, 2018, Roy et al. 2018). Such spatial patterns may affect the phenotype of co-existing species in a similar fashion, but equally often contribute to geographic species replacements along latitude or altitude (Loboda et al. 2018). In addition, species exhibit temporal, i.e. both seasonal and diurnal patterns of occurrence, which equally reflect their thermal niches and competitive interactions (e.g. Cárdenas et al. 2016). For example, the heat-sensitive yellow dung fly abounds on pastures in early spring and late autumn but largely disappears from their mating sites (dung pats) during the hottest summer months, and also shows corresponding diurnal activity patterns, being active midday on cool days but in the late afternoon on warm days (Parker 1970, Jann et al. 2000, Blanckenhorn 2009). The intrinsic physiological temperature tolerance thus underlies mostly plastic (but sometimes genetic) behavioural variation that phenomenologically gives rise to seasonal and diurnal patterns of species occurrence.

Similarly, insect communities, in particular those that inhabit ephemeral and resource rich habitats, are often characterized by pronounced species turnover (e.g. Hanski and Cambefort 1991, Jiri et al 2017). While this may be driven by environmental filtering (e.g. via diurnal patterns of activity), it can also be influenced by differences in the resources individuals forage for and how they reproduce. Such patterns of succession may help individuals evade direct competition for food and/or space by colonizing the same habitat at different times. Thus, spatio-temporal gradients, both along seasons and substrate colonization, co-define the ecological niche of closely related species that belong to the same ecological guild, and as such aid in understanding the mechanisms of species coexistence.

Closely related species are often found to be ecologically and phenotypically more similar compared to more distantly related taxa (Neeson and Mandelik 2014). Hence, the phylogenetic relationship among species can affect species interactions and community composition. If environmental filtering (e.g. via thermal adaptation) is the main driver of species assembly, closely related species are expected to co-occur more often than expected by chance because they are more likely to share an adaptation that enables them to colonize a given niche (that is, they are phylogenetically underdispersed or clustered: Webb et al. 2002). In contrast, if competition for resources is strongly limiting co-occurrence, close relatives are expected to co-occur less often than expected by chance due to competitive exclusion (i.e. they are phylogenetically overdispersed: Elton 1946, Webb et al. 2002). Incorporating the phylogenetic relationship among species can therefore aid in understanding the putative processes driving species assembly.

Black scavenger flies (Diptera: Sepsidae) are common worldwide (Ozerov 2005, Ang et al. 2013; see http://sepsidnet-rmbr.nus.edu.sg/), and are used as model organisms in a broad range of research fields ranging from classic behavioural and evolutionary ecology to developmental biology and ecotoxicology (e.g. Eberhard 2001, Bowsher and Nijhout 2007, Ingram et al. 2008, Puniamoorthy et al. 2009, 2012, 2014, Berger et al. 2013, Blanckenhorn et al. 2013, Roy et al. 2018). These flies generally depend on decaying organic matter for reproduction and larval development. There are broad differences between genera in terms of substrate specialization limiting direct competition (e.g. *Orygma* on rotting brown algae, *Zuskamira* and *Ortalischema* on horse dung, or *Themira* on waterfowl dung), but often the same species can dwell on very different sources ranging from vertebrate dung to rotting plant matter. Members of the genus *Sepsis* are most commonly found near livestock faeces (Pont and Meier 2002), a ubiquitous habitat in human-influenced agricultural grasslands, and hence are among the most common sepsids in Central Europe. Several widespread species of *Sepsis* with apparently very similar ecological niches coexist in Europe, which are somewhat, but not very clearly separated along latitude and altitude (Pont 1987, Ozerov 2005, Rohner 2015, Rohner et al. 2015). Our understanding of the spatio-temporal distribution of these closely related species is still rudimentary at the local, regional, and global scale. For example, all 12 *Sepsis* species occurring in Switzerland were found in a single sample from one pasture in Lenzerheide, Switzerland (Rohner et al. 2014), even though so far unpublished laboratory rearing experiments suggest direct larval resource competition between species. Based on the principle of competitive exclusion, these closely related species are expected to inhabit different diurnal, seasonal or foraging niches, facilitating their coexistence (Holt 2009, Shimadzu et al 2013). But so far, the ecological differentiation between species received little attention despite its immediate relevance for ecological and evolutionary studies (but see Püchel 1993, Bährmann and Bellstedt 2012, Jiri et al. 2017).

To further our faunistic and ecological understanding of sepsid flies in central Europe, we here systematically monitor the seasonal occurrence of the entire family over 3 years at multiple Swiss sites that differ in altitude, and complement these broad, seasonal patterns with detailed observations on species occurrence and turnover relating to cow dung age. We also investigate seasonal variation in species diversity and community structure and combine these faunistic data with information on the relatedness among species to test for phylogenetic under- or over-dispersion. If thermal adaptation contributes to temporal variation, we expect species to differ in their

phenology, and that those taxa common at high latitudes and altitudes are more abundant in spring and/or autumn while warm adapted species should peak in summer.

Materials and methods

Seasonal occurrence patterns

Two low altitude (Siglistorf and Zürich) and two higher altitude sites (Wolzenalp and Schönenboden) with dairy cow pastures were haphazardly picked as monitoring locations for the years 2014–2016 based on convenience and proximity to people's homes (Table 1). All locations were repeatedly sampled in haphazard and uncoordinated intervals (between 2 and 5 weeks). Sampling consisted of netting (30 cm diameter) insects close to the ground by walking a transect of variable distance (between 50 and 400 m, depending on population density) across the pasture, thus encountering old as well as fresh dung (pats). If available, dung piles next to farmhouses were additionally netted because anecdotal evidence suggests this community to be different from the one found on cattle pastures. All insects were subsequently frozen and stored in ethanol for later identification.

We additionally considered samples obtained with a malaise trap in the Swiss Jura (Le Cachot) in 1973 (Haenni and Matthey 1984; Table 1). Note that this type of collection method cannot be directly compared to the netting described above, also because this trap was not located on a cattle pasture (although a cattle pasture was only about 100 m distant from the trap). Nevertheless, these data still permit seasonal comparisons of relative species abundances at least within sites.

Although we counted all individuals, we only identified male sepsid flies (taxonomic authorities listed in Table 2), as females are difficult if not impossible to identify to species level (Pont and Meier 2002). Based on the number of male specimens, and assuming that this well reflects the number and distribution of females, we calculated the relative abundance of each species per sample. These relative abundances were plotted over the season. As descriptors of diversity, we used the first three Hill numbers (Hill 1973, Gotelli and Chao 2013) following:

$$ {}^{q}D = \left(\sum_{i=1}^{S} p_i^q\right)^{\frac{1}{1-q}} $$

where q denotes the order of the Hill index. The relative influence of rare species on the diversity index decreases with q in that ${}^{0}D$ equals species richness, ${}^{1}D$ represents the exponential Shannon entropy that can be interpreted as the number of typical species, while ${}^{2}D$ resembles the reciprocal form of the Gini-Simpson Index that relates to the number of highly abundant species (sensu Gotelli and Chao 2013).

Seasonal variation and differences between sampling schemes and habitat types were tested using linear mixed models with sampling location as random effect. The effects of season (continuous variable, Julian day ranging from 1 to 365) and habitat type (dung pile versus pasture) on community composition were simultaneously analysed using a canonical correspondence analysis (with the R package *vegan*, Oksanen et al 2018). Non-metric multidimensional scaling was used to visualize seasonal community composition (as incorporated in the R package *MASS*, Venables and Ripley 2002). The latter analysis was restricted to our sweep net data (four sites in Table 1 except Bielefeld and Le Cachot).

Table 1. Sampling sites (all in Switzerland except Bielefeld) ordered by altitude.

Locality	Year sampled	Altitude (m)	Coordinates (Lat, Long)
Bielefeld (D)	1991	155 m	52.04N, 8.48E
Siglistorf (AG)	2014–16	440 m	47.54N, 8.38E
Ziegelhütte, Zürich (ZH)	2014–16	480 m	47.40N, 8.57E
Wolzenalp, Nesslau (SG)	2014–16	1110 m	47.23N, 9.15E
Tourbière du Cachot, Le Cachot (NE)	1973	1050 m	47.01N, 6.66E
Schönenboden, Sörenberg (LU)	2014–16	1260 m	46.81N, 8.06E

Relationship between ecology and phylogeny

We further computed Schoener's index of co-occurrence (Schoener 1917) as

$$ C_{ij} = 1 - 0.5 \sum_{k=1}^{n} |p_{ik} - p_{jk}| $$

where C denotes the proportional similarity between species i and j across n sites, p_{ik} is the proportion of species i in sample k, and p_{jk} is the proportion of species j in sample k. This estimate of proportional similarity is well suited to quantify pairwise co-occurrence (Neeson and Mandelik 2014). Phylogenetic distances were derived by constructing a cladogram based on previous publications (Zhao et al. 2013, Rohner et al. 2014) and setting all branch lengths to unity. Relationships (i.e. correlations) between ecological co-occurrence and phylogenetic distance were tested by randomizing the tips of the phylogeny 999 times using the R package *picante* (Kembel et al 2010). A positive correlation between genetic and ecological distance measures would suggest that closely related species are also more prone to co-occur (Hardy 2008).

Colonisation as function of dung pat age

As interspecific variation in the timing of substrate colonization could contribute to niche differentiation as well, we were also interested in temporal succession relating to substrate (i.e. cow dung) age. Our seasonal data were hence complemented by detailed longitudinal observations of the colonization by sepsid flies of fresh dung pats. These data stem from a so far unpublished Diploma thesis of the University of Bielefeld, Germany (Püchel 1993). Dung pats were dated upon appearance and subsequently observed over 1 to 7 days. Individual females appearing on these dung pats were first fixed by putting a glass vial over them and then observing their oviposition

Table 2. Percent average abundance of all sepsid species across all sampled seasons and years for each sampling site.

Species	Wolzenalp, Nesslau (SG)	Tourbière du Cachot, Le Cachot (NE)	Siglistorf (AG)	Schönenboden, Sörenberg (LU)	Ziegelhütte, Zürich (ZH)	Mean across sites
Nemopoda nitidula (Fallén, 1820)	0.00	0.08	1.02	0.23	0.36	0.40
Saltella nigripes Robineau-Desvoidy, 1830	0.00	0.00	0.15	0.00	5.49	2.32
Saltella sphondylii (Schrank, 1803)	2.26	0.34	9.42	1.84	6.74	5.21
Sepsis biflexuosa Strobl, 1893	1.43	0.00	1.60	1.00	1.11	1.09
Sepsis cynipsea (Linnaeus, 1758)	49.97	45.76	29.39	39.09	29.91	34.79
Sepsis duplicata Haliday, 1838	3.37	1.53	5.98	1.72	9.51	5.88
Sepsis flavimana Meigen, 1826	11.66	0.35	6.14	25.44	11.99	12.63
Sepsis fulgens Meigen, 1826	18.57	0.96	12.78	11.67	2.31	7.29
Sepsis luteipes Melander & Spuler, 1917	0.00	0.33	1.30	1.22	0.00	0.56
Sepsis neocynipsea Melander & Spuler, 1917	11.65	1.20	7.67	8.92	2.99	5.57
Sepsis nigripes Meigen, 1826	0.00	0.00	0.14	0.00	0.13	0.08
Sepsis orthocnemis Frey, 1908	0.35	35.81	2.89	1.15	0.87	4.94
Sepsis punctum (Fabricius, 1794)	0.00	10.82	5.20	0.00	5.50	4.42
Sepsis thoracica (Robineau-Desvoidy, 1830)	0.30	0.00	8.91	0.87	9.29	5.80
Sepsis violacea Meigen, 1826	0.14	2.81	4.90	1.31	0.15	1.59
Themira annulipes (Meigen, 1826)	0.30	0.01	2.20	5.42	12.93	7.06
Themira gracilis (Zetterstedt, 1847)	0.00	0.00	0.00	0.03	0.00	0.01
Themira leachi (Meigen, 1826)	0.00	0.00	0.00	0.00	0.70	0.29
Themira minor (Haliday, 1833)	0.00	0.00	0.11	0.09	0.03	0.05
Themira nigricornis (Meigen, 1826)	0.00	0.00	0.19	0.00	0.00	0.04

for 30 min. Once oviposition terminated, females would walk up the glass vial to be captured and later identified to species. These observation times were later categorized according to pat age (hours 1 to 7 on the first day; hours 22 to 29 h on the second day; thereafter only by day).

Results

Seasonal patterns

We obtained a total of 17,010 sepsid specimens, of which 8,816 were male. 95 of our 265 samples contained 20 or more specimens. Of the 28 species native to Switzerland (Rohner 2015, Rohner and Bächli 2016), 20 species were recovered in our samples at the monitored sites: 12 species of *Sepsis*, 5 species of *Themira*, 2 species of *Saltella*, and *Nemopoda nitidula* (Figs 1, 2, Table 2). Most *Themira* species were very rare, except *T. annulipes*, which was found in low numbers at all sites throughout the season (April – September). *N. nitidula* only occurred in Siglistorf, a northern Swiss low altitude site, in early summer, and at Le Cachot, a western, higher altitude site, in late summer, but not at the other three sites. *Saltella nigripes* only occurred at the Zürich site during July-September, whereas *Saltella sphondylii* was common at all sites throughout the season.

Of the 12 Swiss *Sepsis* species, *S. nigripes*, *S. luteipes* and *S. biflexuosa* were generally rare, all others more or less common at most sites (Table 2). Interestingly, the Malaise trap at Le Cachot never trapped *S. thoracica*, *S. nigripes*, *S. duplicata*, or *S. biflexuosa*, and also no *T. annulipes*. *Sepsis punctum*, *S. violacea* and *S. thoracica* were present only at low altitude sites (except in the Swiss Jura at Le Cachot, where the former two species also occurred regularly). It is important to note, however, that different sampling methods may catch different species at different proportions (Bährmann and Bellstedt 2012), limiting direct comparisons.

For the common species, some seasonal patterns emerged. *S. cynipsea*, *S. orthocnemis*, *S. punctum*, *S. thoracica*, *S. duplicata* and *Saltella sphondylii* were commonly observed over the entire season with a peak in summer; they can hence be classified as warm-loving. *S. neocynipsea*, *S. violacea* and *S. fulgens* peaked in spring, and *S. flavimana* (plus possibly *Saltella sphondylii* at low altitude) in autumn (Fig. 1). Continued activity of *S. flavimana* (but not *Saltella sphondylii*) late in the season (September) was also apparent in Püchel's (1993) seasonal data from Bielefeld, Germany.

The first three Hill numbers were highest in spring and summer and decreased towards the end of the season in autumn (^{0}D: $\chi^2_{(1)} = 23.22$, $P < 0.001$, ^{1}D: $\chi^2_{(1)} = 14.53$, $P < 0.001$, ^{2}D: $\chi^2_{(1)} = 9.13$, $P = 0.003$; Fig. 2). That is, not only species richness, but also evenness and diversity decrease towards winter. All three indices were lower for dung piles compared to pastures and the Malaise sampling (all $\chi^2_{(2)} \geq 9.73$, $P \leq 0.008$, Fig. 2). In contrast to the findings reported in Rohner et al (2015), diversity was generally higher at low latitude sites (^{0}D: $\chi^2_{(1)} = 2.95$, $P = 0.086$, ^{1}D: $\chi^2_{(1)} = 12.53$, $P < 0.001$, ^{2}D: $\chi^2_{(1)} = 11.55$, $P < 0.001$). Canonical variate analyses also revealed community structure to vary significantly over the season ($\chi^2_{(1)} = 0.14$, $P = 0.001$, Fig. 3) and between pastures and dung piles ($\chi^2_{(1)} = 0.37$, $P = 0.001$).

Relationship between ecology and phylogeny

The correlation between species co-occurrence and their phylogenetic distance across all samples revealed significant under-dispersion, with an observed correlation

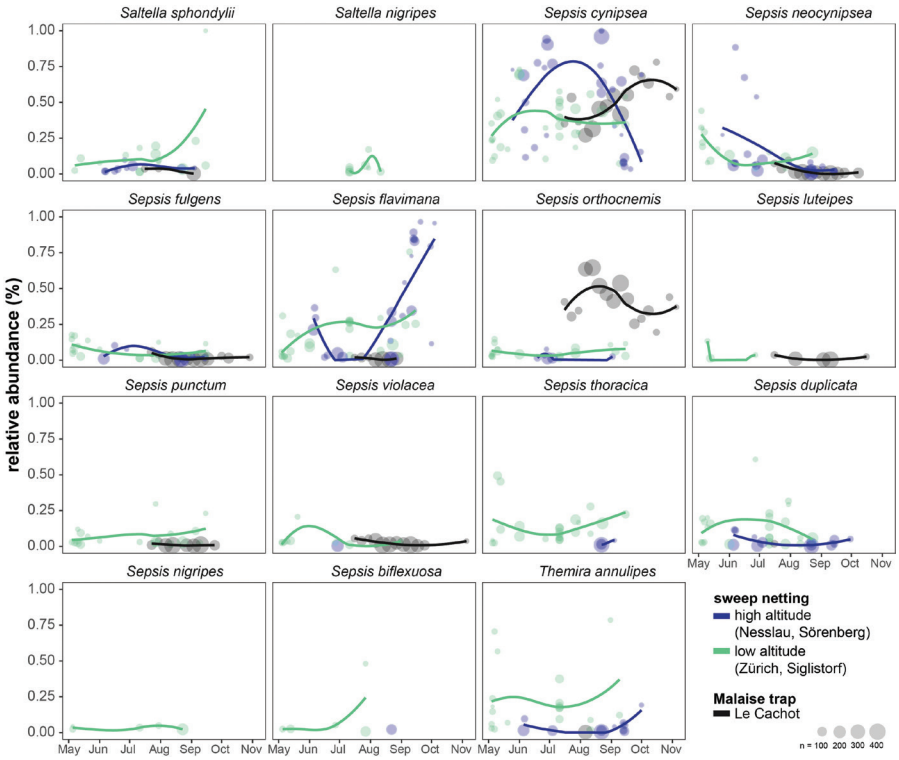


Figure 1. Relative abundance of males of different sepsid species across the season on pastures (all years pooled). Patterns are indicated separately for high (blue) and low (green) altitude sites. Species trapped in a Malaise trap are shown in black. Point size is proportional to the total number of males contained in the respective sample.

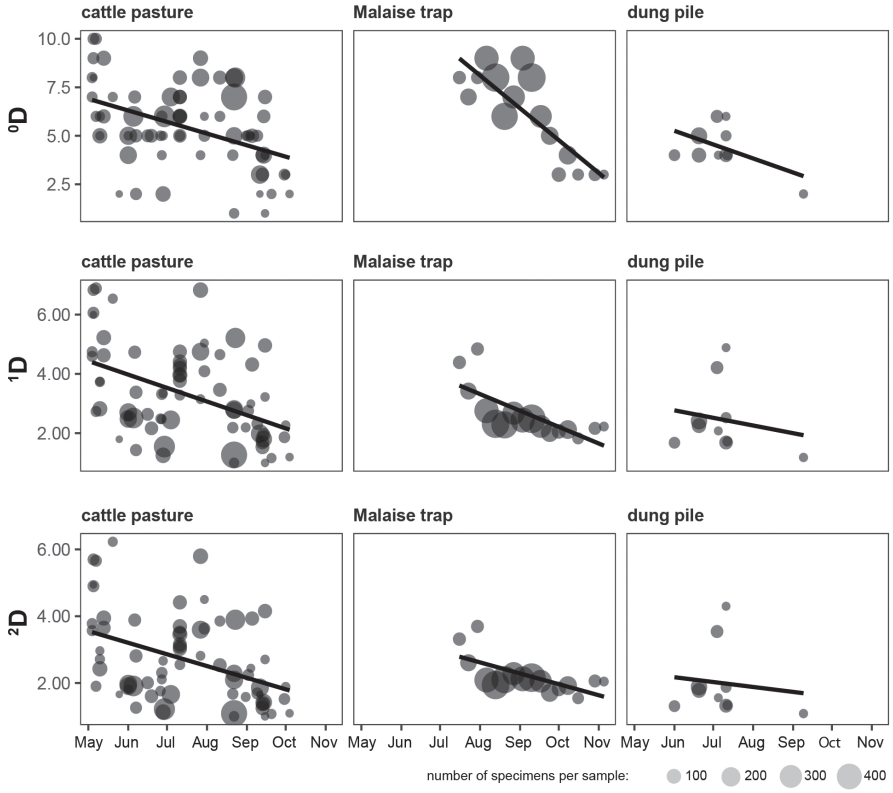


Figure 2. Seasonal patterns of species diversity, expressed by the first three Hill indices, for sepsid communities captured by sweep netting on cow pastures, dung piles or Malaise capturing in a peat bog. ^{0}D equals species richness, ^{1}D represents the exponential Shannon entropy (evenness) that can be interpreted as the number of typical species, while ^{2}D resembles the reciprocal form of the Gini-Simpson Index that relates to the number of highly abundant species. We only plotted samples with 20 or more individuals (all years combined). The size of the points is proportional to the number of individuals present in the sample.

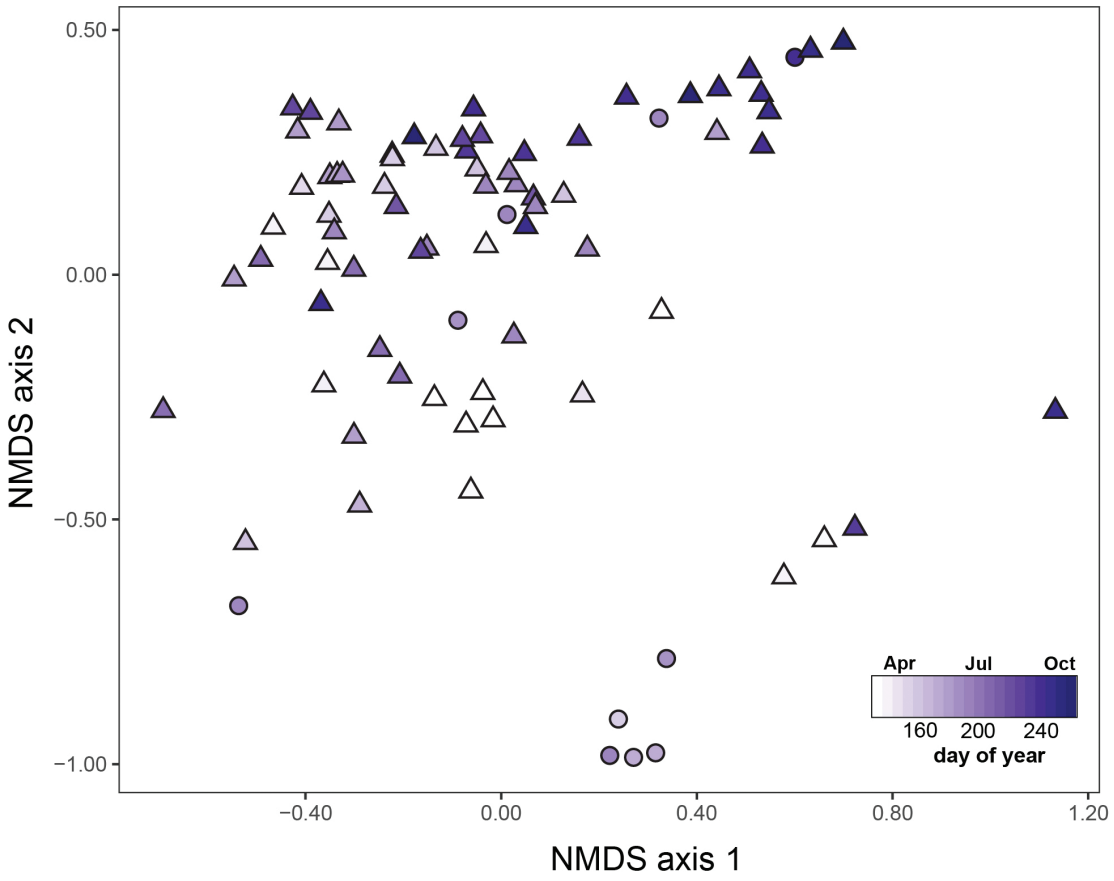


Figure 3. Non-metric multidimensional scaling (NMDS) visualizing seasonal variation in species composition as well as differences between cattle pastures (triangles) and dung piles (circles). The smaller the distance between two samples, the greater their similarity.

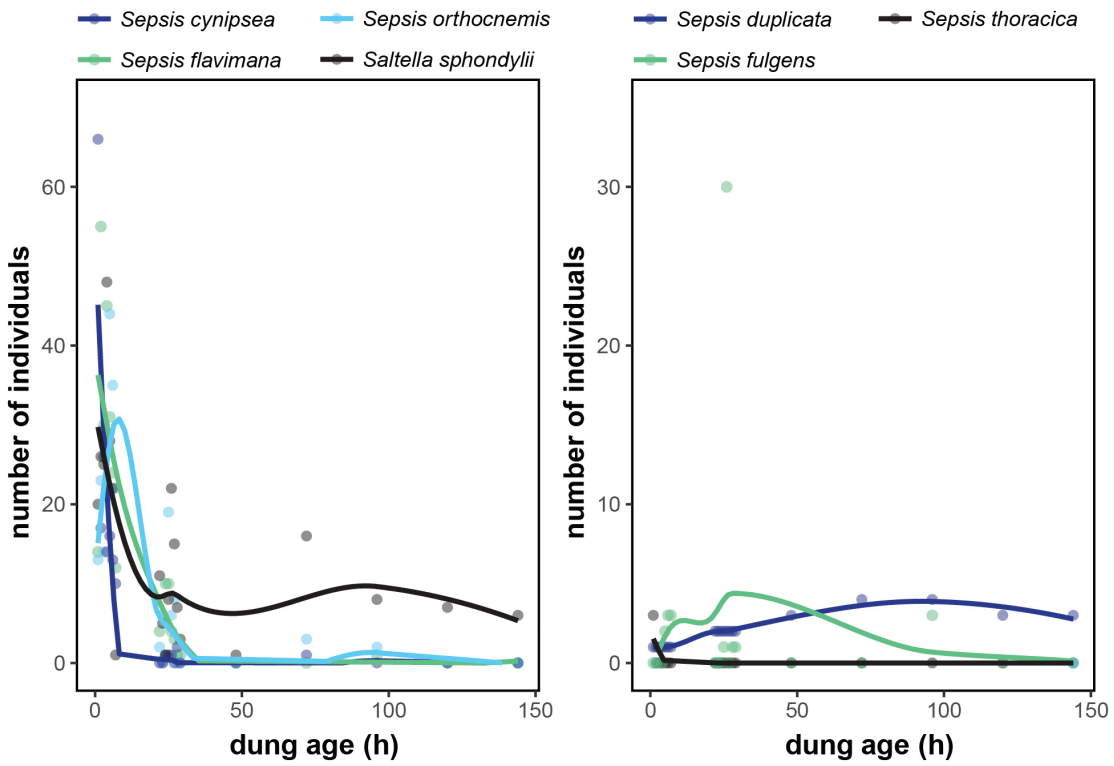


Figure 4. Number of individuals of seven common sepsid species as a function of dung age (in hours (h)). While *S. cynipsea*, *flavimana* and *orthocnemis* are disproportionally often observed on fresh dung, *S. duplicata* and *Saltella sphondylii* gain in relative abundance over time. (Note the different scaling of the y-axes; data from Püchel 1993; *S. duplicata* data only qualitative.)

of r = -0.46 when using the (extended) phylogeny of Zhao et al. (2013). Hence, close relatives were more prone to be found in the same sample than expected by chance.

Colonisation as function of dung pat age

Species clearly differ in their absolute (as well as relative) abundance as a function of cow pat age. The 1991 data collected in Bielefeld show *S. cynipsea*, *S. flavimana* and *S. orthocnemis* to be particularly abundant on fresh cow dung, while *S. duplicata* and *Saltella sphondylii* were common throughout the first 7 days (Fig. 4). Accordingly, the species community varied with time (canonical correspondence analysis: $\chi^2_{(18)} = 0.19$, P = 0.038). Note that *S. duplicata* often enters dung beetle tunnels when dung is dry. This behaviour makes it very difficult to quantify the species' occurrence and oviposition; therefore its abundance is likely underestimated in this dataset.

Discussion

Temporal niche partitioning represents a major axis of species differentiation that can allow for and maintain species diversity, particularly in ephemeral habitats such as vertebrate dung (Hanski and Cambefort 1991). We here found seasonal variation in species occurrence, diversity and community composition, suggesting temporal, presumably thermal niche differentiation among closely related species. Additionally, detailed longitudinal data show pronounced species turnover of sepsids on individual cowpats, suggesting temporal segregation on a much finer scale relating to desiccation, in addition to broad phenological differences. We in the following discuss the implications of temporal and thermal niche differentiation for our understanding of the natural history of black scavenger flies.

The seasonal distribution patterns of a total of 20 (16 of them common) Swiss sepsid fly species north of the Alps (*Mittelland*) agree well with their distribution and thermal niches previously inferred from their spatial distribution in Switzerland (Rohner et al. 2015) and Central Europe as a whole (Pont and Meier 2002, Ozerov 2005). Along with *Nemopoda nitidula*, which we only found in early summer at one northern Swiss low altitude site (Siglistorf), and *Saltella nigripes*, which only occurred at the Zürich site in late summer, *Sepsis nigripes*, *S. luteipes*, *S. biflexuosa,* and most *Themira* species were generally very rare around cattle pastures. Only *T. annulipes* was found in low numbers at most sites throughout the season (April – September). *Themira* spp. are known to be often specialized on bird (waterfowl) excrements (Pont and Meier 2002), so our pasture sites may simply be the wrong habitats to find them.

Saltella sphondylii is cosmopolitan in Switzerland, though generally more common at lower altitudes. Of the 12 *Sepsis* spp. reported in Switzerland (Haenni 1998; Rohner et al. 2014, Rohner 2015; Rohner and Bächli 2016), which are also common in northern Germany (Bielefeld: Püchel 1993), 9 were common at low altitudes, with only 5 of them also common at higher altitudes above 1000 m. *Sepsis punctum*, *S. violacea* and *S. thoracica* were almost exclusively present at low altitude sites (ca. 500 m) but rarely if ever observed above 1000 m. At the special site Le Cachot in the Swiss Jura (ca. 1100 m) sampled with a Malaise trap in 1973 (Haenni and Matthey 1984), *S. orthocnemis* was extraordinarily common, for unknown reasons, and *S. punctum* and *S. violacea* also regularly occurred, whereas *S. thoracica*, *S. nigripes* and *S. biflexuosa* were definitely absent. The Malaise trap, however, was not placed directly on a pasture, and is therefore not directly comparable to the other samples, as this type of trap likely catches moving or migrating rather than reproducing or foraging individuals (Bährmann and Bellstedt 2012).

For the common species, some seasonal patterns emerged in the lowlands: *S. cynipsea*, *S. orthocnemis*, *S. punctum*, *S. thoracica,* and *S. duplicata*, as well as *Saltella sphondylii*, were all commonly present over the entire season with a peak in summer. Presupposing that these phenological patterns reflect thermal preferences, the latter can therefore be classified as warm-loving or warm-adapted (as is definitely the case for *S. thoracica*: Busso and Blanckenhorn 2018). *S. neocynipsea*, *S. fulgens* and *S. violacea* peaked in spring, and *S. flavimana* (and lowland *Saltella sphondylii*) in autumn (Fig. 1). Save *S. violacea,* the latter species are also common at highland sites in the Alps and can therefore be classified as cold-loving or cold-adapted (Rohner et al. 2015). Correspondingly, *S. fulgens, S. violacea* and *S. flavimana* also abound at higher latitudes (Bährmann and Bellstedt 2012; Pont and Meier 2002). As *S. orthocnemis* and *S. punctum*, *S. violacea* appears to be found most everywhere, though in low numbers, some local abundance notwithstanding (*viz.* Le Cachot); the Swiss *Mittelland* may actually mark *S. violacea*'s southern distribution edge (Pont and Meier 2002). *S. neocynipsea*, in contrast, is known to be rare in Europe and restricted to higher altitudes, whereas this species is common in North America, even in warm lowlands such as Arizona (pers. obs.), where it apparently takes the ecological niche that *S. cynipsea* has in Europe (Pont 1979, Rohner et al. 2015, 2016, Giesen et al. 2017). Though repeatedly reported in Britain even in the lowlands, but not in Scandinavia (Pont 1979, Pont and Meier 2002), our own experience is that *S. neocynipsea* is difficult if not impossible to find in Europe except in mountainous regions such as Asturias (Spain), Cevennes (France), or the (Swiss) Alps, where it can be locally abundant (Rohner et al. 2014, 2015, 2016), a somewhat puzzling distribution pattern. The sister species *S. neocynipsea* and *S. cynipsea* coexist and meet regularly at our Sörenberg site and throughout the Swiss Alps (e.g. Rohner et al 2015, Rohner 2015, Rohner and Bächli 2016). These two species hybridize readily in the laboratory, though hybridization is apparently prevented in nature by behavioural incompatibility (Giesen et al. 2017, 2018).

Rohner et al. (2015) demonstrated greater sepsid species richness at higher altitudes in the Swiss Alps. Al-

though diversity tended to be lower at high altitudes here, species diversity was highest in spring and summer and dropped off towards the end of the season in autumn (Fig. 2). This result is unsurprising given that *S. flavimana* is the only species with a phenology peaking late in the season (see also Püchel 1993), and knowing that *Sepsis* spp. in general seem to overwinter as adults, thus being ready to reproduce early in the season (Blanckenhorn 1998, Zeender 2015).

Given that members of the same taxonomic group are expected to use similar resources, and thus to compete most intensely, such high species diversity is intriguing, particularly in an ephemeral habitat that is characterized by severe intra- and interspecific competition for food and space (e.g. Jiri et al 2017, Papp 1992, 2007, Hanski and Cambefort 1991). Intraspecific resource competition has been demonstrated repeatedly in sepsids (Rohner et al 2016, Busso and Blanckenhorn 2018), and yet unpublished laboratory data provide direct evidence for some larval competition between *S. cynipsea* and *S. punctum*. Still, we found here and elsewhere (Rohner et al. 2015; Rohner and Bächli 2015) that more closely related species are more prone to co-occur. In order to evade direct competition, species are therefore expected to differ in aspects other than phenology. In this context, temporal succession in the colonization of dung pats has been suggested, as some species seem to be associated with particularly fresh (e.g. *S. cynipsea*) or older cow dung (e.g. *S. duplicata* or *S. fulgens*; Jiri et al. 2017, Pont and Meier 2002, Rohner et al. 2015). Based on Püchel's (1993) work, we could here confirm this (Fig. 4). Niche differentiation may thus be revealed at much finer temporal scales. Furthermore, specialization on specific substrates (i.e. cattle dung versus excrements of other large vertebrates), or spatial separation within substrates, may account for the co-occurrence of species within the genus *Sepsis*. However, even if species dwell and reproduce in the same substrate simultaneously, it is unclear whether larvae actually feed on the same compounds. Sepsids are presumed to filter-feed on small particles such as fungi and bacteria (Pont and Meier 2002), but whether different species or different larval stages feed on different nutrients is unknown. Further anecdotal evidence suggests that some species use a very broad range of substrates (e.g. *S. fulgens* is found on cow, pig, chicken dung as well as compost: Pont and Meier 2002), while other are highly specialized (*Sepsis duplicata* is mostly found on dry cow dung). In addition to different substrate preferences, such a specialist – generalist continuum may further facilitate coexistence. Both niche differentiation by substrate choice and specialization, as well as fine-scale temporal succession within cattle pastures, hence should be studied further.

Our finding that species that regularly co-occur tend to be more closely related than expected by chance can also be interpreted as evidence against a strong influence of competitive exclusion, i.e. that other mechanisms, such as environmental filtering, may be more important. However, this assumes phylogenetic inertia of those traits related to competition. Although body size and development times show phylogenetic signals in Sepsidae (e.g. Rohner et al. 2016), behavioural traits evolve very rapidly across species (Ang et al. 2008, Puniamoorthy et al. 2009, Puniamoorthy 2014, Tan et al. 2011). Given our lack of data on larval physiology and nutritional ecology, we cannot yet link co-occurrence to interspecific variation (or population differentiation within species) in the larval ecology of sepsids, but this clearly warrants further scrutiny.

Conclusions

The seasonal distribution patterns of Swiss sepsid fly species on Swiss cow pastures north of the Alps agree well with their previously documented spatial distribution patterns (Ozerov 2005, Pont and Meier 2002, Rohner et al. 2014, 2015). *Nemopoda nitidula*, *Saltella nigripes*, most *Themira* spp. (except *T. annulipes*), *Sepsis nigripes*, *S. luteipes* and *S. biflexuosa* are generally rare on Swiss dairy cow pastures (see also Rohner et al. 2015). *Sepsis punctum*, *S. violacea* and *S. thoracica* were absent to rare at high altitude sites >1000 m (except the Jura). Abundances of the more common and widespread species throughout Europe (*S. cynipsea*, *S. orthocnemis*, *S. punctum*, *S. thoracica*, *S. duplicata*, *Saltella sphondylii*) peaked in summer, whereas species also common at high latitudes peaked in spring (*S. neocynipsea*, *S. fulgens*, *S. violacea*) or autumn (*S. flavimana*). Phenology and thermal adaptation alone are however unlikely to explain the high levels of species diversity and coexistence. As closely related species are more likely to be present in a sample, temporal succession and substrate specialization may limit direct competition and enable coexistence even of close relatives.

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References

Addo-Bediako A, Chown SL, Gaston KJ (2000) Thermal tolerance, climatic variability and latitude. Proceedings of the Royal Society B-Biological Sciences 267: 739–745. https://doi.org/10.1098/rspb.2000.1065

Ang YC, Puniamoorthy J, Pont AC, Bartak M, Blanckenhorn WU, Eberhard WG, Puniamoorthy N, Silva V, Munari L, Meier R (2013) Sepsidnet: A plea for digital reference collections and other science-based digitization initiatives in taxonomy. Systematic Entomology 38: 637–644. https://doi.org/10.1111/syen.12015

Ang, YC, Puniamoorthy N, Meier R (2008) Secondarily reduced foreleg armature in *Perochaeta dikowi* sp.n. (Diptera: Cyclorrhapha: Sepsidae) due to a novel mounting technique. Systematic Entomology 33(3): 552–559. https://doi.org/10.1111/j.1365-3113.2008.00422.x

Bährmann R (1993) Zum Vorkommen der Sepsidae in unterschiedlichen Rasenökosystemen Thüringens. Beiträge zur Entomologie 43: 97–113.

Bährmann R, Bellstedt R (2012) Neuere öko-faunistische Untersuchungen an Schwingfliegen (Insecta: Diptera: Brachycera-Acalyptratae: Sepsidae) Thüringens. Thüringer Faunistische Abhandlungen 17: 93–110.

Berger D, Postma E, Blanckenhorn WU, Walters RJ (2013) Quantitative genetic divergence and standing genetic (co)variance in thermal reaction norms along latitude. Evolution 67: 2385–2399. https://doi.org/10.1111/evo.12138

Blanckenhorn WU (2009) Causes and consequences of phenotypic plasticity in body size: the case of the yellow dung fly (Diptera: Scathophagidae). In: Whitman DW, Ananthakrishnan TN (Eds) Phenotypic plasticity of insects: Mechanisms and consequences. Science Publishers, Strixton, 313–366. https://doi.org/10.1201/b10201-11

Blanckenhorn WU, Puniamoorthy N, Schäfer MA, Scheffczyk A, Römbke J (2013) Standardized laboratory tests with 21 species of temperate and tropical sepsid flies confirm their suitability as bioassays of pharmaceutical residues (ivermectin) in cattle dung. Ecotoxicology and Environmental Safety 89: 21–28. https://doi.org/10.1016/j.ecoenv.2012.10.020

Blanckenhorn WU, Bauerfeind SS, Berger D, Davidowitz G, Fox CW, Guillaume F, Nakamura S, Nishimura K, Sasaki H, Stillwell CR, Tachi T, Schäfer MA (2018) Replicated latitudinal life-history clines on three continents in the widespread yellow dung fly. Ecography 41. https://doi.org/10.1111/ecog.03752 [in press]

Bowsher JH, Nijhout HF (2007) Evolution of novel abdominal appendages in a sepsid fly from histoblasts, not imaginal discs. Evolution & Development 9: 347–354. https://doi.org/10.1111/j.1525-142X.2007.00171.x

Busso JP, Blanckenhorn WU (2018) Climatic factors shaping plastic trade-offs in the polyphenic black scavenger fly *Sepsis thoracica* (Diptera: Sepsidae). Journal of Biogeography 45: 593–603. https://doi.org/10.1111/jbi.13140

Cárdenas RE, Basset Y, Gilbert F (2016) Fine-scale climatic variation drives altitudinal niche partitioning of tabanid flies in a tropical montane cloud forest, Ecuadorian Chocó. Insect Conservation and Diversity 9: 87–96. https://doi.org/10.1111/icad.12146

Chesson P (2000) Mechanisms of maintenance of species diversity. Annual Review of Ecology and Systematics 31: 343–366. https://doi.org/10.1146/annurev.ecolsys.31.1.343

Danks HV (1987) Insect dormancy: an ecological perspective. Biological Survey of Canada, Ottawa.

Deutsch CA, Tewksbury JJ, Huey RB, Sheldon KS, Ghalambor CK, Haak DC, Martin PR (2008) Impacts of climate warming on terrestrial ectotherms across latitude. Proceedings of the National Academy of Sciences of the United States of America 105: 6668–6672. https://doi.org/10.1073/pnas.0709472105

Eberhard WG (2001) Species-specific genitalic copulatory courtship in sepsid flies (Diptera, Sepsidae, *Microsepsis*) and theories of genitalic evolution. Evolution 55: 93–102. https://doi.org/10.1111/j.0014-3820.2001.tb01275.x

Elton CS (1946) Competition and the structure of animal communities. Journal of Animal Ecology 15: 54–68. https://doi.org/10.2307/1625

Gaston KJ, Blackburn TM (2000) Pattern and Process in Macroecology. Blackwell Science. https://doi.org/10.1002/9780470999592

Gaston KJ, Chown SL, Evans KL (2008) Ecogeographical rules: elements of a synthesis. Journal of Biogeography 35: 483–500. https://doi.org/10.1111/j.1365-2699.2007.01772.x

Gotelli NJ, Chao A (2013) Measuring and estimating species richness, species diversity, and biotic similarity from sampling data. In: Levin SA (Ed.) Encyclopedia of Biodiversity, Vol. 5, Academic Press, Waltham, Massachusetts, 195–211. https://doi.org/10.1016/B978-0-12-384719-5.00424-X

Giesen A, Schäfer MA, Blanckenhorn WU (2017) Behavioural mechanisms of reproductive isolation between two hybridizing dung fly species (*Sepsis cynipsea* & *S. neocynipsea*: Diptera: Sepsidae). Animal Behaviour 132: 155–166. https://doi.org/10.1016/j.anbehav.2017.08.008

Giesen A, Schäfer MA, Blanckenhorn WU (2018) Patterns of postzygotic isolation between two closely related sepsid fly species (*Sepsis cynipsea* and *S. neocynipsea*; Diptera: Sepsidae). Journal of Zoological Systematics and Evolutionary Research. https://doi.org/10.1111/jzs.12239 [in press]

Haenni J-P (1998) Sepsidae. In: Merz B, Baechli G, Haenni J-P, Gonseth Y (Eds) Diptera – Checklist. Fauna Helvetica, Vol. 1. Schweizerische Entomologische Gesellschaft, Neuchâtel, 249–250.

Haenni J-P, Matthey W (1984) Utilisation d'un piège d'interception (tente malaise) pour l'étude entomologique d'une tourbière du Haut-Jura. I, Introduction et résultats généraux. Bulletin de la Société Neuchâteloise des Sciences Naturelles 107: 111–122. http://doi.org/10.5169/seals-89219

Hanski I, Cambefort Y (1991) Dung Beetle Ecology. Princeton, Princeton University Press. https://doi.org/10.1515/9781400862092

Hardy OJ (2008) Testing the spatial phylogenetic structure of local communities: statistical performances of different null models and test statistics on a locally neutral community. Journal of Ecology 96: 914–926. https://doi.org/10.1111/j.1365-2745.2008.01421.x

Hill MO (1973) Diversity and evenness: A unifying notation and its consequences. Ecology 54: 427–431. https://doi.org/10.2307/1934352

Holt RD (2009) Bringing the Hutchinsonian niche into the 21st century: Ecological and evolutionary perspectives. Proceedings of the National Academy of Sciences 106: 19659–19665. https://doi.org/10.1073/pnas.0905137106

Ingram KK, Laamanen T, Puniamoorthy N, Meier R (2008) Lack of morphological coevolution between male forelegs and female wings in *Themira* (Sepsidae: Diptera: Insecta). Biological Journal of the Linnean Society 93: 227–238. https://doi.org/10.1111/j.1095-8312.2007.00922.x

Jann P, Blanckenhorn WU, Ward PI (2000) Temporal and microspatial variation in the intensities of natural and sexual selection in the yellow dung fly Scathophaga stercoraria. Journal of Evolutionary Biology 13: 927–938. https://doi.org/10.1046/j.1420-9101.2000.00230.x

Jiri SFX, Sulakova H, Konvicka M (2017) Temporal segregations in the surface community of an ephemeral habitat: Time separates the potential competitors of coprophilous Diptera. Entomological Science 20: 111–121. https://doi.org/10.1111/ens.12240

Kembel SW, Cowan PD, Helmus MR, Cornwell WK, Morlon H, Ackerly DD, Blomberg SP, Webb CO (2010) Picante: R tools for integrating phylogenies and ecology. Bioinformatics 26:1463–1464. https://doi.org/10.1093/bioinformatics/btq166

Kumar S, Stecher G, Tamura K (2016) MEGA7: Molecular Evolutionary Genetics Analysis version 7.0 for bigger datasets. Molecular Biology and Evolution 33: 1870–1874. https://doi.org/10.1093/molbev/msw054

Lei Z, Ang SHA, Srivathsan A, Su KFY, Meier R (2013) Does better taxon sampling help? A new phylogenetic hypothesis for Sepsidae

(Diptera: Cyclorrhapha) based on 50 new taxa and the same old mitochondrial and nuclear markers. Molecular Phylogenetics and Evolution 69: 153–64. https://doi.org/10.1016/j.ympev.2013.05.011

Levine JM, HilleRisLambers J (2009) The importance of niches for the maintenance of species diversity. Nature 461: 254–257. https://doi.org/10.1038/nature08251

Loboda S, Savage J, Buddle CM, Schmidt NM, Høye TT (2018) Declining diversity and abundance of High Arctic y assemblages over two decades of rapid climate warming. Ecography 41: 265–277. https://doi.org/10.1111/ecog.02747

Oksanen J, Blanchet FG, Friendly M, Kindt R, Legendre P, McGlinn D, Minchin PR, O'Hara LB, Simpson GL, Solymos P, Stevens MHM, Szoecs E, Wagner H (2018) vegan: Community Ecology Package. R package version 2.5–3. https://CRAN.R-project.org/package=vegan

Neeson TM, Mandelik Y (2014) Pairwise measures of species co-occurrence for choosing indicator species and quantifying overlap. Ecological Indicators 45: 721–727. https://doi.org/10.1016/j.ecolind.2014.06.006

Ozerov A (2005) World catalogue of the family Sepsidae (Insecta: Diptera). Zoologicheskie Issledovania (Zoological Studies) 8: 1–74.

Papp L (1992) Fly Communities in Pasture Dung – Some Results and Problems (Diptera). Acta Zoologica Hungarica 38(1–2): 75–88.

Papp L (2007) A study of the cow pat Diptera on the Hortobágy, Hungary. Folia Entomologica Hungarica 68: 123−135.

Parker GA (1970) Reproductive behaviour and nature of sexual selection in *Scatophaga stercoraria L* (Diptera Scatophagidae). 1. Diurnal and seasonal changes in population density around site of mating and oviposition. Journal of Animal Ecology 39: 185–204. https://doi.org/10.2307/2895

Pont AC (1979) Sepsidae. Diptera, Cyclorrhapha, Acalyptrata. In: Fitton MG (Ed.) Handbook for the Identification of British Insects, Vol X, Part 5. Royal Entomological Society, London, 1–35.

Pont AC (1987) Provisional atlas of the Sepsidae (Diptera) of the British Isles. Biological Records Centre Institute of Terrestrial Ecology, 1–34.

Pont AC, Meier R (2002) The Sepsidae (Diptera) of Europe. Fauna Entomologica Scandinavica 37: 1–221.

Püchel F (1993) Untersuchungen über die Besiedlung von Kuhdung durch Sepsiden (Diptera). (Diploma Thesis) University of Bielefeld, Germany.

Puniamoorthy N, Ismail MRB, Tan DSH, Meier R (2009) From kissing to belly stridulation: comparative analysis reveals surprising diversity, rapid evolution, and much homoplasy in the mating behaviour of 27 species of sepsid flies (Diptera: Sepsidae). Journal of evolutionary Biology 22: 2146–2156. https://doi.org/10.1111/j.1420-9101.2009.01826.x

Puniamoorthy N, Blanckenhorn WU, Schäfer MA (2012) Differential investment in pre- versus post-copulatory sexual selection reinforces a cross-continental reversal of sexual size dimorphism in *Sepsis punctum* (Diptera: Sepsidae). Journal of Evolutionary Biology 25: 2253–2263. https://doi.org/10.1111/j.1420-9101.2012.02605.x

Puniamoorthy N, Schäfer MA, Römbke J, Meier R, Blanckenhorn WU (2014) Ivermectin sensitivity is an ancient trait affecting all ecdysozoa but shows phylogenetic clustering among sepsid flies. Evolutionary Applications 7: 548–554. https://doi.org/10.1111/eva.12152

Puniamoorthy N (2014) Behavioural barriers to reproduction may evolve faster than sexual morphology among populations of a dung fly (Sepsidae). Animal Behaviour 98: 139–148. https://doi.org/10.1016/j.anbehav.2014.10.005

Rohner PT, Puniamoorthy N, Ang Y, Lei Z, Blanckenhorn WU, Meier R (2014) Genetic data confirm the species status of *Sepsis nigripes,* Meigen 1826 (Diptera: Sepsidae) and adds one species to the Alpine fauna while questioning the synonymy of *Sepsis helvetica,* Munari 1985. Invertebrate Systematics 28: 555–563. https://doi.org/10.1071/IS14023

Rohner PT, Bächli G (2016) Faunistic data of Sepsidae (Diptera) from Switzerland and additional countries including the first Swiss record of *Meroplius fukuharai* (Iwasa, 1984). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 89: 237–260.

Rohner PT, Bächli G, Pollini Paltrinieri L, Duelli P, Obrist MK, Jochmann R, Blanckenhorn WU (2015) Distribution, diversity gradients and Rapoport's elevational rule in the black scavenger flies of the Swiss Alps (Diptera: Sepsidae). Insect Conservation and Diversity: https://doi.org/10.1111/icad.12114

Rohner PT (2015) An updated checklist of the Sepsidae (Diptera) of Switzerland, including the first record of *Themira superba* (Haliday, 1833). Mitteilungen der Schweizer Entomologischen Gesellschaft 88: 371–378.

Rohner PT, Blanckenhorn WU, Puniamoorthy N (2016) Sexual selection on male size drives the evolution of male-biased sexual size dimorphism via the prolongation of male development. Evolution 70: 1189–1199. https://doi.org/10.1111/evo.12944

Rohner PT, Pitnick S, Blanckenhorn WU, Snook RR, Bächli G, Lüpold S (2018) Global macroecology of size, sexual size dimorphism, dispersal and range size in fruit flies (Diptera: Drosophilidae). Ecography 41. https://doi.org/10.1111/ecog.03382 [in press]

Roy J, Blanckenhorn WU, Rohner PT (2018) Life history traits along a latitudinal cline in European *Sepsis fulgens.* Oecologia. https://doi.org/10.1007/s00442-018-4166-7 [in press]

Schoener TW (1970) Nonsynchronous spatial overlap of lizards in patchy habitats. Ecology 51: 408–418. https://doi.org/10.2307/1935376

Shimadzu H, Dornelas M, Henderson PA, Magurran AE (2013) Diversity is maintained by seasonal variation in species abundance. BMC Biology 11(1): 98. https://doi.org/10.1186/1741-7007-11-98

Tan DSH, Ng SR, Meier R (2011) New information on the evolution of mating behaviour in Sepsidae (Diptera) and the cost of male copulations in *Saltella sphondylii*. Organisms Diversity & Evolution 11(4): 253–261. https://doi.org/10.1007/s13127-011-0054-2

Tauber MJ, Tauber CA, Masaki S (1986) Seasonal adaptations of insects. Oxford University Press, Oxford.

Tilman D (1982) Resource Competition and Community Structure. Princeton Univ.

Webb CO, Ackerly DD, McPeek MA, Donoghue MJ (2002) Phylogenies and community ecology. Annual Review of Ecology and Systematics 33: 475–505. https://doi.org/10.1146/annurev.ecolsys.33.010802.150448

Venables WN, Ripley BD (2002) Modern Applied Statistics with S. Fourth Edition. Springer, New York. https://doi.org/10.1007/978-0-387-21706-2

Zeender V (2015) Effects of temperature, photoperiod and developmental stage on diapause in black scavenger flies (Diptera: Sepsidae). (MSc Thesis) University of Zurich, Switzerland.

Zhao L, Ang ASH, Srivathsan A, Su KFY, Meier R (2013) Does better taxon sampling help? A new phylogenetic hypothesis for Sepsidae (Diptera: Cyclorrhapha) based on 50 new taxa and the same old mitochondrial and nuclear markers. Molecular Phylogenetics and Evolution 69: 153–164. https://doi.org/10.1016/j.ympev.2013.05.011

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PENSOFT

Alpine Entomology

Hidden diversity in European bees: *Andrena amieti* sp. n., a new Alpine bee species related to *Andrena bicolor* (Fabricius, 1775) (Hymenoptera, Apoidea, Andrenidae)

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DNA-barcoding

Abstract

We revise the Alpine bee taxa related to *Andrena bicolor* (Fabricius, 1775), including *A. montana* Warncke, 1973 and *A. allosa* Warncke, 1975, the status of which has remained contentious. Phylogenetic analyses of one mitochondrial gene and one nuclear gene, as well as morphological examination reveal the presence of four Alpine species in this complex, one of which is new to science, *A. amieti* **sp. n.** This new species is widely distributed in the Alps from southern France throughout Switzerland, northern Italy and southern Germany to Austria; a single record is known from the Apennines. The type locality is located within the Unesco World Heritage site "Swiss Alps Jungfrau-Aletsch". Two widely divergent mitochondrial lineages are found in sympatry in *A. amieti* **sp. n.**; the status of these lineages, which together form a paraphyletic unit from which *A. allosa* arose, is briefly discussed. We show that *A. allosa*, *A. amieti* **sp. n.** and *A. montana* are polylectic but that each species exhibits a distinct spectrum of pollen hosts: the univoltine *A. allosa* shows affinities for pollen of the early-blooming Alpine plant genus *Crocus*. *A. amieti* **sp. n.** is bivoltine and, as in *A. bicolor*, the summer generation exhibits a distinct preference for Campanulaceae, while the spring generation is widely polylectic. *A. montana* has a single generation in the summer and forages on a diversity of flowers such as Campanulaceae, Cistaceae and Caryophyllaceae. An identification key is presented for central European members of the subgenus *Euandrena* Hedicke, 1932. Lastly, the new Alpine species appears to represent the tip of the iceberg of substantial cryptic diversity in southern European *Andrena* (*Euandrena*): *A. croatica* Friese, 1887 is resurrected from synonymy with *A. bicolor* and treated as a valid species (**stat. rev.**), *A. pileata* Warncke, 1875, described as a subspecies of *A. allosa*, is elevated to species rank (**stat. n.**), and three additional unclear taxa are briefly described.

Introduction

The conservation of species depends on accurate data regarding their distributions and a sound understanding of their ecological requirements. While the distributions and ecology are well-known for a large part of the bee fauna in northern and central Europe (Peeters et al. 2012, Scheuchl and Willner 2016, Else and Edwards 2018, Westrich 2018), some Alpine and numerous southern European bee taxa remain poorly investigated. In part, this situation is due to open taxonomic questions and ambiguous morphology-based identifications, both of which strongly limit studies on species' distribution and biology.

Within central European bees, one complex of species that remains insufficiently investigated is the group of taxa related to *Andrena bicolor* (Fabricius, 1775), referred to here as the "*bicolor*-group". *Andrena bicolor* is one of the most widely distributed species of wild bees in

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Europe (Gusenleitner and Schwarz 2002, Scheuchl and Willner 2016). In Switzerland it is found in all biogeographic regions in numerous habitats from low elevations to the tree line (Amiet et al. 2010). The taxonomic status of two alpine taxa related to *A. bicolor* remains debated, *A. allosa* Warncke, 1975 and *A. montana* Warncke, 1973. These two taxa were recognized as specifically distinct from *A. bicolor* by Schmid-Egger and Scheuchl (1997), although both Westrich (2006) and Schmid-Egger (2012) indicated that the taxonomy of the *bicolor*-group was not fully elucidated. In agreement with this finding, Amiet et al. (2010) report that the morphological delimitation of *A. allosa* and *A. montana* in the Swiss Alps was difficult because of intermediate forms that bridge the morphological gap among taxa. In particular, Amiet et al. (2010) point to an unclear, Alpine "form" of *A. bicolor* in which the vestiture of both female and male is extensively white instead of yellow-brown and thus transitional between *A. bicolor* and *A. montana*.

In a recent, comprehensive DNA barcoding study of central European bees, Schmidt et al. (2015) presented DNA barcodes for three taxa of the *bicolor*-group and indicated that these taxa were clearly divergent from one another, supporting the hypothesis that there are three well separated species. While this result appears to solve the controversy on the status of these species, sequencing more specimens, especially those intermediate forms mentioned by Amiet et al. (2010), is still critical to our understanding of how to delimitate these species using morphological criteria. Such morphological delimitation is a necessary step for the revision of museum specimens and for obtaining details on species' life-histories and distributions.

The biology of *A. allosa* and *A. montana* remains virtually unknown. The nominal subspecies of *A. allosa* is so far known from less than 20 individuals from France and Switzerland. Two subspecies have been described from Greece and Turkey, respectively, *A. allosa pileata* Warncke, 1975 and *A. allosa canigica* Warncke, 1975. Gusenleitner and Schwarz (2002: 100) raised doubts that these two infraspecific taxa were conspecific with *A. allosa* and stated that "more taxa are certainly present in the close relatedness of *A. allosa*". *Andrena montana* is slightly better known and Amiet et al. (2010) indicated that this species flies from late June to mid-August, suggesting a single generation per year. Observations on the floral associations of these two taxa, however, are completely lacking. In contrast, the biology of *A. bicolor* is well-known. This species is bivoltine (e.g., Westrich 2006, 2018), at least at low elevations (Amiet et al. 2010), and broadly polylectic (Stöckhert in Schmiedeknecht 1930, Peeters et al. 2012, Scheuchl and Willner 2016). The cuckoo bee *Nomada fabriciana* (Linnaeus, 1767), similarly bivoltine, is a cleptoparasite of *A. bicolor* (e.g., Westrich 2006).

In the present study, we investigate the systematics of the Alpine taxa of the *bicolor*-group using DNA sequences of a mitochondrial and a nuclear gene. The nuclear gene was used in addition to the mitochondrial gene given the limitations of relying on a single DNA marker for species delimitation, for example because of incomplete lineage sorting, mitochondrial introgression or deep mitochondrial genetic divergence not accompanied by nuclear differentiation (e.g. Nicholls et al. 2012, Andriollo et al. 2015, Klopfstein et al. 2016). Based on combined genetic and morphological results, we demonstrate the presence of four well-separated species in the Alps, one of which is new to science. We also examine the status of some southern European taxa of the *bicolor*-group; this taxonomic treatment does not seek to resolve the taxonomy of this group outside the Alps but simply to ensure that the new species that we describe is not conspecific with a named taxon in southern Europe. Lastly, we revise the available material to determine the distribution of the Alpine taxa and to examine their phenology, study their host plant preferences based on analyses of pollen loads and report on field observations on habitat selection and floral preferences.

Methods

Specimen selection for molecular analyses

The selection of specimens for molecular analyses was performed iteratively. During an initial phase of this project, 14 specimens representing the observed morphological variation in the *bicolor*-group were sequenced, including 11 Alpine specimens as well as three specimens from the Apennines. Based on genetics and subsequent morphological examination of these specimens, we were able to recognize four well-separated species in the Alps. For simplicity, these species are named hereafter in a way that anticipates the species delimitation and the description presented below: *A. allosa*, *A. amieti* sp. n., *A. bicolor* and *A. montana*. Subsequently, 35 additional specimens originating from the Alps were identified using morphology prior to genetic analyses and added to the molecular dataset. Whenever possible, for all Alpine localities where *A. amieti* sp. n. and *A. bicolor* were found in sympatry we sequenced at least one specimen of each species. One specimen of *A. montana* from Greece was sampled, and we included one unclear specimen from the northern Pyrenees that showed morphological affinities with *A. allosa*.

Morphological examinations of further specimens of the *bicolor*-group revealed several additional taxa in southeastern Europe, some of which were very similar to *A. amieti* sp. n. Since at least one species-group name is available for this group of taxa (*A. allosa pileata*), we expanded our sampling to include six specimens of the *bicolor*-group from southeastern Europe. These six specimens include three unclear taxa of the *bicolor*-group, referred to as *Andrena* sp1, sp2 and sp3. Lastly, we sequenced three specimens of *A. rufula* Schmiedeknecht, 1883 to generate reference material for this species since females have so far been misidentified in Switzerland (Artmann-Graf 2017).

Details on locality information and BOLD and Genbank accession numbers, as well as GenSeq categories following Chakrabarty et al. (2013) are given in Table 1. All available sequences for the *bicolor*-group (Schmidt et al. 2015) were downloaded from the BOLD platform (www.boldsystems.org), as well as a selection of European species from the subgenus *Euandrena* Hedicke, 1933 and representatives of the subgenera *Larandrena* LaBerge, 1964, *Andrena* s. str. Fabricius, 1775, *Leucandrena* Hedicke, 1933, *Micrandrena* Ashmead, 1899, *Melandrena* Pérez, 1890 and *Ptilandrena* Robertson, 1902.

Lab protocols

We first amplified the 658-bp "DNA barcode" fragment of the mitochondrial gene cytochrome oxidase I (hereafter COI) using the LepF and LepR primers (Hebert et al. 2004) with the PCR conditions given therein; if no amplification was obtained, we used the alternate forward primer UAE3 (TAT AGC ATT CCC ACG AAT AAA TAA; Lunt et al. 1996) together with LepR to amplify a 409-bp fragment of the same gene applying the same PCR conditions. If the obtained chromatograms were not clean, possibly because of nuclear pseudogenes, contamination or co-amplification of *Wolbachia* sequences, the PCR was repeated with the following specific primers designed for the *bicolor*-group: bicolor_COX1_F: RGC AGG AAT RRT TGG WGC AT and bicolor_COX_R: CTC CVC CYA TWG GRT CAA A, with the following PCR conditions: 4' 94°; 35 × 45'' 94°, 45'' 55°, 45'' 72°; 7' 72°. These primers amplified a 563-bp fragment nested within the 658-bp barcoding fragment with a high success rate.

For 22 specimens of the *bicolor*-group as well as for *A. chrysopus* Pérez, 1903, *A. fulvata* Stöckhert, 1930 and *A. rufula*, we additionally sequenced an approximately 400-bp fragment of the single-copy nuclear gene LW-rhodopsin (hereafter opsin; Danforth et al. 2004) using the following primers specific to the genus *Andrena*: OpsFor3_Andrena: TTC GAC AGA TAC AAC GTR ATY GTM AAR GG and OpsRev3_Andrena: GCY ARC TTK GCC TCY GCG CT, with the following PCR conditions: 4' 94°; 35× 45'' 94°, 45'' 56°, 45'' 72°; 7' 72°.

Lab protocols follow Trunz et al. (2016). DNA was extracted from a single leg using DNA extraction kits (Nucleospin tissue, Macherey-Nagel). PCR-reactions were performed with Hotstart GoTaq polymerase (Promega) with a blank sample as a negative control. PCR products were examined visually using agarose gel electrophoresis and purified enzymatically with a mix of exonuclease and FastAP thermosensitive alkaline phosphatase (Fermentas). Purified PCR products were sequenced bidirectionally with the primers used in the PCR using BigDye Terminator v3.1 technology (Applied Biosystems).

Phylogenetic analyses

Chromatograms were trimmed and assembled in Geneious 6.0.6 (Kearse et al. 2012) and exported consensus were aligned using MAFFT (Katoh and Standley 2013). The resulting matrices were examined and edited in Mesquite (Maddison and Maddison 2018) and converted to amino acid sequences to verify that no stop codon was present. Maximum likelihood analyses were performed in RAxML 8.2.10 (Stamatakis 2014) on the CIPRES server (Miller et al. 2010), performing 1000 bootstrap replicates and applying a GTR + G model to each partition. COI was partitioned into three partitions corresponding to the three nucleotide positions, while opsin was partitioned into four partitions corresponding to the three nucleotide positions and the intron. Trees were rooted at the base of the subgenus *Euandrena*. Uncorrected p-distances were computed in a test version of Paup 4.0 (Swofford 2002) kindly provided by D. Swofford.

Morphology

Terminology follows Michener (2007); when numbered, metasomal terga and sterna are abbreviated by T and S (e.g., T2 for metasomal tergum 2). When describing vestiture colour in the descriptions and the identification key, "brown" means yellowish-brown, orange-brown or grey-brown and is opposed to "dark brown", which means dark brown to black. The length of the mouthparts, especially of the maxillary and labial palps, is an important criterion for separating some species of *Euandrena*. The palps are not cylindrical; instead, several segments are rather flattened and triangular. For estimating the length-to-width ratio of the segments, the width was measured on the flattened side, at the widest part, near the apex, perpendicular to the longitudinal axis of the segment. Measurements were made with ImageJ 1.48 (Abràmoff, Magalhães and Ram 2004) on pictures taken with a Keyence digital microscope VHX 1000 with the stacking option turned off. All pictures of specimens presented here were taken with the same digital microscope with the stacking option turned on.

Databasing

The material of the *bicolor*-group deposited in the main entomological collections in Switzerland (Table 2) has been revised. In addition, the material deposited in the Warncke collection (OLML) as well as in some additional collections in Europe (Table 2) has been examined. For *A. amieti* sp. n., every type specimen deposited in a public collection in Switzerland has been provided with a label bearing a unique identifier. Swiss data have been submitted to the Swiss Zoological Records Center (InfoFauna; www.cscf.ch) and data from other countries to GBIF (www.gbif.org) if the specimens are deposited in a public collection in Switzerland. To compare the phenology and altitudinal distribution of the examined species, records from the Alps were filtered to keep only one record per day and locality (regardless of the number of individuals collected). The distribution map was produced with ArcGIS using the "Digital Elevation Model over Europe, EU-DEM" data for relief (available at https://www.eea.europa.eu/data-and-maps/data/eu-dem).

Table 1. Locality data (including coordinates), BOLD (for the mitochondrial gene cytochrome oxidase, or COI) or Genbank (LW rhodopsin, or opsin) accession numbers and GenSeq category (after Chakrabarty et al. 2013; 1 = holotype; 2 = paratype; 3 = topotype; 4 = vouchered specimens) for sequences produced in this study.

Voucher	Name	Sex	Country	Locality	Genseq category	Coord N	Coord E	COI	Opsin
833	*A. chrysopus*	♂	CH	Leuk (S. Gerber)	4	46.303	7.678	NA	MK157241
483	*A. fulvata*	♀	CH	Orvin (C. Praz)	4	47.163	7.213	NA	MK157240
873	*A. rufula*	♀	FR	St-Guilhem-Le-Désert (34) (J. Litman/C. Praz)	4	43.738	3.542	HYMAA032-18	MK157242
874	*A. rufula*	♂	FR	Blandas (30) (J. Litman/C. Praz)	4	43.912	3.513	HYMAA033-18	NA
1146	*A. rufula*	♂	CH	Laupersdorf (SO) (G. Artmann-Graf)	4	47.332	7.645	HYMAA021-18	NA
558	*A. montana*	♂	CH	Zermatt, Gornergrat (VS) (J. Litman/C. Praz)	4	45.980	7.790	HYMAA049-18	NA
559	*A. montana*	♀	CH	Zermatt, Gornergrat (VS) (J. Litman/C. Praz)	4	45.980	7.790	HYMAA050-18	MK157255
800	*A. montana*	♂	IT	Maiella (Abruzzo) (J. Litman/C. Praz)	4	42.144	14.112	HYMAA053-18	MK157256
801	*A. montana*	♀	CH	Fully, Sorniot (VS) (D. Bénon)	4	46.177	7.089	HYMAA054-18	MK157257
962	*A. montana*	♀	GR	Mt Olympus (Piera) (K. Minachilis)	4	40.105	22.390	HYMAA044-18	MK157258
1201	*A. montana*	♀	CH	Visperterminen (CH) (D. Bénon)	4	46.257	7.944	HYMAA025-18	NA
1204	*A. montana*	♂	CH	Glarus Süd, Linthal (GL) (R. Neumeyer)	4	46.841	8.932	HYMAA004-18	NA
961	*A.* sp1	♀	GR	Mt Olympus (Piera) (K. Minachilis)	4	40.095	22.369	HYMAA043-18	MK157259
1252	*A.* sp1	♀	GR	Chelmos mountains (Archaea) (A.W Ebmer)	4	38.002	22.195	HYMAA037-18	NA
1254	*A.* sp2	♀	GR	Lesbos, Agiassos (North Aegean) (A.W Ebmer)	4	39.054	26.401	HYMAA038-18	NA
928	*A.* sp3	♀	GR	Kosmas (Arcadia) (J. Litman/C. Praz)	4	37.107	22.728	HYMAA036-18	NA
842	*A. allosa*	♀	FR	Moulinet, Mille Fourches (06) (E. Dufrêne)	4	43.992	7.435	HYMAA059-18	NA
848	*A. allosa*	♀	CH	Gündlischwand (BE) (F. Amiet)	4	46.649	7.928	HYMAA060-18	NA
1265	*A. allosa*	♀	CH	St-Martin, Lovégno (VS) (C. Praz/J. Litman)	4	46.175	7.470	HYMAA020-18	NA
1271	*A. allosa*	♀	CH	Leuk (VS) (S. Giriens)	4	46.335	7.657	HYMAA022-18	MK157244
1285	*A. allosa*	♀	FR	Allos, La Foux d'Allos (04) (C. Praz)	3	44.300	6.566	HYMAA039-18	MK157243
1293	*A. aff allosa*	♀	FR	Larrau (64) (D. Genoud)	4	43.035	-1.023	HYMAA045-18	NA
798	*A. amieti* group 1	♀	IT	Monte Pollino (Basilicata) (J. Litman/C. Praz)	2	39.904	16.181	HYMAA051-18	NA
799	*A. amieti* group 1	♂	IT	Monte Pollino (Basilicata) (J. Litman/C. Praz)	2	39.904	16.181	HYMAA052-18	MK157260
1202	*A. amieti* group 1	♀	CH	Kandersteg, Oeschinensee (BE) (C. Praz)	2	46.503	7.707	HYMAA006-18	NA
802	*A. amieti* group 2	♀	CH	Fully, Sorniot (VS) (D. Bénon)	2	46.167	7.108	HYMAA055-18	MK157261
804	*A. amieti* group 2	♀	CH	Orsières (VS) (D. Bénon)	2	46.060	7.091	HYMAA057-18	MK157262
805	*A. amieti* group 2	♀	CH	Fully, Sorniot (VS) (D. Bénon)	2	46.167	7.108	HYMAA058-18	NA
875	*A. amieti* group 2	♀	CH	Bagnes (VS) (D. Bénon)	2	46.008	7.346	HYMAA023-18	MK157263
1028	*A. amieti* group 2	♂	CH	Domleschg (GR) (H. Martz)	2	46.785	9.453	HYMAA031-18	NA
1029	*A. amieti* group 2	♂	CH	Grindelwald (BE) (M. Haider)	2	46.649	8.077	HYMAA029-18	NA
1031	*A. amieti* group 2	♀	CH	Grindelwald (BE) (M. Haider)	2	46.649	8.077	HYMAA028-18	NA
1159	*A. amieti* group 2	♀	FR	Le Bourg d'Oisan, Lauvitel (38) (M. Aubert)	2	44.954	6.060	HYMAA046-18	NA
1193	*A. amieti* group 2	♂	CH	Ennenda (GL) (A. Müller)	2	47.028	9.105	HYMAA010-18	NA
1197	*A. amieti* group 2	♀	CH	St-Martin, Lovégno (VS) (C. Praz)	2	46.169	7.472	HYMAA007-18	NA
1203	*A. amieti* group 2	♀	CH	Glarus Süd, Linthal (GL) (R. Neumeyer)	2	46.839	8.922	HYMAA005-18	NA
1207	*A. amieti* group 2	♀	CH	Kandersteg, Oeschinensee (BE) (J. Litman)	2	46.501	7.712	HYMAA002-18	NA
1268	*A. amieti* group 2	♂	CH	St-Martin, Lovégno (VS) (C. Praz/J. Litman)	2	46.175	7.470	HYMAA024-18	MK157264
1284	*A. amieti* group 2	♀	CH	Kandersteg, Oeschinensee (BE) (J. Litman) (HT)	1	46.501	7.712	HYMAA001-18	NA
1286	*A. amieti* group 2	♀	FR	Allos, La Foux d'Allos (04) (C. Praz)	2	44.300	6.566	HYMAA040-18	MK157265
556	*A. bicolor* clade 1	♀	CH	Emdt, Schalb (VS) (J. Litman/C. Praz)	4	46.221	7.816	HYMAA047-18	MK157245
803	*A. bicolor* clade 1	♀	CH	Fully, Sorniot (VS) (D. Bénon)	4	46.172	7.123	HYMAA056-18	MK157246
871	*A. bicolor* clade 1	♀	GR	Kryoneri (East Attica) (J. Litman/C. Praz)	4	36.955	22.363	HYMAA034-18	NA
900	*A. bicolor* clade 1	♀	CH	Leuk (VS) (S. Gerber)	4	46.303	7.678	HYMAA011-18	NA
903	*A. bicolor* clade 1	♀	CH	Vex (VS) (S. Gerber)	4	46.208	7.411	HYMAA013-18	NA
904	*A. bicolor* clade 1	♀	CH	Vex (VS) (S. Gerber)	4	46.208	7.405	HYMAA014-18	NA
925	*A. bicolor* clade 1	♀	CH	Leuk (VS) (S. Gerber)	4	46.303	7.678	HYMAA016-18	MK157247
927	*A. bicolor* clade 1	♀	CH	Gampel-Bratsch (VS) (C. Praz)	4	46.329	7.720	HYMAA018-18	MK157248
1199	*A. bicolor* clade 1	♀	CH	St-Martin, Lovégno (VS) (C. Praz)	4	46.169	7.472	HYMAA008-18	NA
557	*A. bicolor* clade 2	♀	CH	St-Niklaus (VS) (J. Litman/C. Praz)	4	46.179	7.800	HYMAA048-18	MK157249
876	*A. bicolor* clade 2	♀	GR	Kosmas (Arcadia) (J. Litman/C. Praz)	4	37.107	22.728	HYMAA035-18	NA
902	*A. bicolor* clade 2	♀	CH	Naters (VS) (N. Evéquoz)	4	46.321	7.967	HYMAA012-18	MK157250
924	*A. bicolor* clade 2	♀	CH	Yvonnand (VD) (M. Khadraoui)	4	46.783	6.716	HYMAA015-18	NA
926	*A. bicolor* clade 2	♀	CH	Nods (BE) (J. Litman/C. Praz)	4	47.135	7.063	HYMAA017-18	MK157251
1030	*A. bicolor* clade 2	♀	CH	Vals (GR) (A. Müller)	4	46.621	9.199	HYMAA026-18	NA
1032	*A. bicolor* clade 2	♀	CH	Bonaduz (GR) (R. Neumeyer)	4	46.809	9.412	HYMAA019-18	NA
1033	*A. bicolor* clade 2	♀	CH	Domleschg (GR) (H. Martz)	4	46.782	9.453	HYMAA030-18	NA
1194	*A. bicolor* clade 2	♂	CH	Ennenda (GL) (A. Müller)	4	47.026	9.104	HYMAA009-18	NA
1195	*A. bicolor* clade 2	♂	CH	Vitznau (LU) (A. Müller)	4	47.024	8.502	HYMAA027-18	NA
1205	*A. bicolor* clade 2	♀	CH	Kandersteg, Oeschinensee (BE) (J. Litman)	4	46.507	7.722	HYMAA003-18	NA
1287	*A. bicolor* clade 2	♂	FR	Allos, La Foux d'Allos (04) (C. Praz)	4	44.293	6.596	HYMAA041-18	MK157253
1288	*A. bicolor* clade 2	♂	FR	Allos, La Foux d'Allos (04) (C. Praz)	4	44.300	6.566	HYMAA042-18	MK157254

Table 2. Collections examined with acronyms.

AEC	Private collection of P. Andreas Ebmer, Puchenau, Austria
AMC	Private collection of Andreas Müller, Wädenswil, Switzerland
BNM	Bündner Naturmuseum, Chur, Switzerland
CPC	Private collection of Christophe Praz, Neuchâtel, Switzerland
CSEC	Private collection of Christian Schmid-Egger, Berlin, Germany
DGC	Private collection of David Genoud, Arzens, France
ESC	Private collection of Erwin Scheuchl, Ergolding, Germany
ETHZ	Eidgenössische Technische Hochschule, Zürich, Switzerland
FAC	Private collection of Felix Amiet, Solothurn, Switzerland
GAC	Private collection of Georg Artmann-Graf, Olten, Switzerland
HSC	Private collection of Hans Schwenninger, Stuttgart, Germany
JVC	Private collection of Johannes Voith, Augsburg, Germany
KHC	Private collection of Karl Hirt, Menziken, Switzerland
MAC	Private collection of Matthieu Aubert, Saint-Jean-De-Buèges, France
MBC	Private collection of Markus Bur, Rechthalten, Switzerland
MHC	Private collection of Mike Herrmann, Konstanz, Germany
MHNN	Muséum d'histoire naturelle de la ville de Neuchâtel, Switzerland
MNHN	Muséum Nationale d'Histoire Naturelle, Paris, France
MZL	Musée cantonal de zoologie, Lausanne, Switzerland
NMBE	Naturhistorisches Museum der Burgergemeinde Bern, Switzerland
OLML	Oberösterreichisches Landesmuseum, Linz, Austria
POL-AEGIS	University of the Aegean Pollinator collection, Mytilene, Lesbos, Greece
PRUN	Research collection of Christophe Praz, University of Neuchâtel, Switzerland
RNC	Private collection of Rainer Neumeyer, Zürich, Switzerland
RNF	Collection of the Natural Reserves of France
SRLC	Collection of the Swiss Bee Red List project, Neuchâtel, Switzerland
ZMHB	Museum für Naturkunde, Berlin, Germany

Pollen host preferences

The pollen host preferences of *Andrena allosa*, *A. amieti* sp. n. and *A. montana* were assessed by microscopic analysis of the scopal pollen contents of 24, 50 and 16 female specimens, respectively. These females all originated from the Swiss, French and Italian Alps and were collected from 1921 to 2018. For the bivoltine *A. amieti* sp. n., the results of the pollen analysis were split between females of the first (or spring) generation (n = 22) and females of the second (or summer) generation (n = 28). The methodology for pollen removal, pollen identification and data evaluation follows Müller (2018).

Results

Genetic analyses

Phylogenetic analyses of COI revealed the presence of six taxonomic units (either monophyletic clades or non-monophyletic grades) for Alpine members of the *bicolor*-group (Fig. 1): 1. a clade comprising all specimens of *Andrena montana*. 2. a poorly resolved paraphyletic grade comprising two southern Italian specimens and one Alpine specimen of *A. amieti* sp. n.; this grade is referred to as "*A. amieti* group 1". 3. a clade comprising most Alpine specimens of *A. amieti* sp. n; this clade is referred to as "*A. amieti* group 2". 4. a poorly resolved grade comprising all specimens of *A. allosa*, rendered paraphyletic by an unclear taxon from Greece, *Andrena* sp1. 5 and 6. two monophyletic clades in *A. bicolor*, referred to as *A. bicolor* clades 1 and 2.

The two clades recovered within *A. bicolor* are those reported in Schmidt et al. (2015); specimens reported therein as *A. montana* in fact belong to *A. amieti* sp. n group 2; no specimens of *A. montana* were sequenced by Schmidt et al. (2015). For Alpine members of *A. allosa*, *A. amieti* sp. n., *A. bicolor* and *A. montana*, all COI analyses were in agreement with our morphological identifications.

Andrena montana was only distantly related to *A. bicolor, A. allosa* and *A. amieti* sp. n. (Fig. 1); genetic distances were on average 6.88% to *A. bicolor* and 9.48% to *A. amieti* sp. n., and maximal genetic distance within *A. montana* was 0.35%. Both groups of *A. amieti* sp. n. were separated by an average distance of 2.41% (range 1.85 - 3.01%), and maximal within-group distances were 0.93 and 0.26% for groups 1 and 2, respectively. These two groups together formed a paraphyletic unit with respect to a clade formed by *A. allosa* and the unclear taxon referred to as *Andrena* sp1 from Greece (bootstrap support 67%; Fig. 1). Maximal genetic distance within Alpine populations of *A. allosa* was 0.48%; the minimal distance between *A. allosa* and the divergent specimen tentatively attributed to *A. allosa* from the Pyrenees (number 1293 on Fig. 1) was 0.73%. Distances between *A. allosa* and *A. amieti* sp. n. ranged from 2.77 to 4.71% (average 3.33%). Maximal distance within *A. bicolor* clade 1 was 0.89%, that within *A. bicolor* clade 2 (with the exception of the divergent

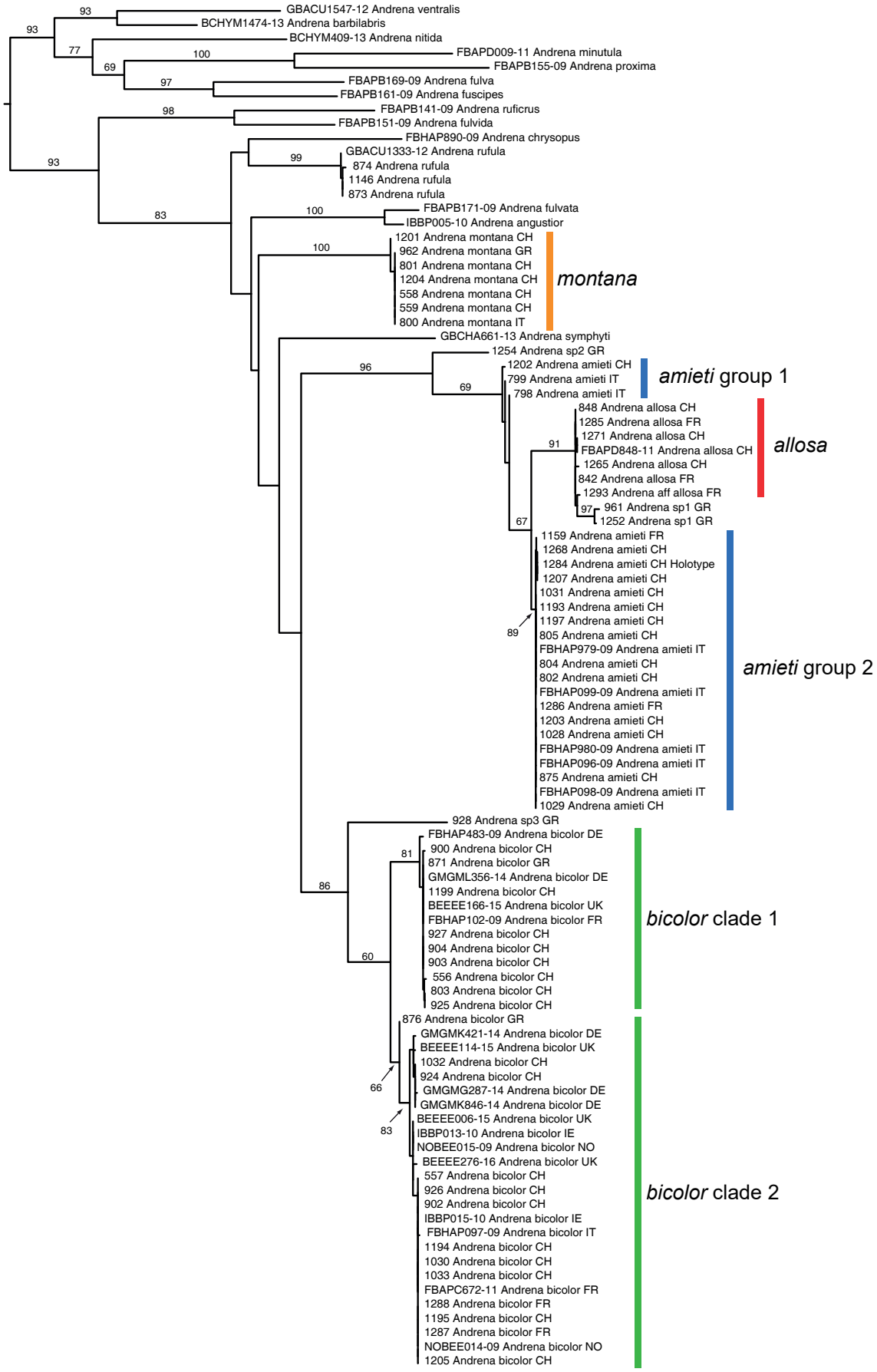


Figure 1. Phylogenetic tree based on maximum likelihood analyses of sequence data of the mitochondrial gene COI; numbers above branches indicate statistical support based on 1000 bootstrap replicates (values below 50 are omitted).

specimen 876 from Greece) 1.44%; the distances between the two clades of *A. bicolor* (except specimen 876) ranged from 3.13 to 4.40% (average 3.68%). Specimen 876 was separated by distances ranging from 1.04 to 1.46% from the rest of clade 2.

Three unclear taxa are additionally revealed in our analyses: *Andrena* sp1 represented by two females (specimens 961 from Mount Olympus, Greece, and 1252 from the Chelmos or Aroania Mountains, Greece) was separated by a minimum distance of 1.82% from *A. allosa* and 4.27% from *A. amieti* sp. n.; *Andrena* sp2, represented by a single female from Lesbos (specimen 1254), was separated by a minimum distance of 5.11% from *A. amieti* sp. n. group 1; and *Andrena* sp3 from the Peloponnese (specimen 928) separated by a distance of 5.71% from *A. bicolor* clade 1. Details on these unclear taxa are provided below.

In the ML analysis of COI, *A. (Ptilandrena) fulvata* and *A.* (*Ptilandrena*) *angustior* (Kirby, 1802) were nested within the subgenus *Euandrena*, with a clade composed of *A. ruficrus* Nylander, 1848 and *A. fulvida* Schenck, 1853 sister to a clade composed of these two species of *Ptilandrena* and the rest of *Euandrena* (Fig. 1); *A. amieti* sp. n., *A. allosa*, *Andrena* sp1 and *Andrena* sp2 formed a well-supported monophyletic group (bootstrap support 96%) that was sister to another well-supported clade (bootstrap support 86%) composed of both clades of *A. bicolor* and *Andrena* sp3 (Fig. 1).

Analyses of opsin (Fig. 2) indicated that all specimens of *A. montana* formed a well-supported clade (bootstrap support 95%). Specimens of *A. allosa*, of *A. amieti* sp. n. as well as *Andrena* sp1 formed another well-supported clade (bootstrap support 98%) separated from *A. bicolor*; *Andrena* sp1 was sister to an unresolved clade that contained all specimens of *A. allosa* and *A. amieti* sp. n., both of which were not recovered as reciprocally monophyletic clades. The two groups found within *A. amieti* sp. n. in analyses of COI were not recovered in analyses of opsin. All specimens of *A. bicolor* formed an unresolved assemblage; all four specimens representing *A. bicolor* clade 2 (specimens 557, 926, 1287 and 1288) formed a poorly-supported clade separated from clade 1 specimens. *Andrena amieti* sp. n. was separated from *A. bicolor* by distances ranging from 1.32% to 2.12%. Lastly, *A. (Ptilandrena) fulvata* was nested in the subgenus *Euandrena* as in COI analyses, with at

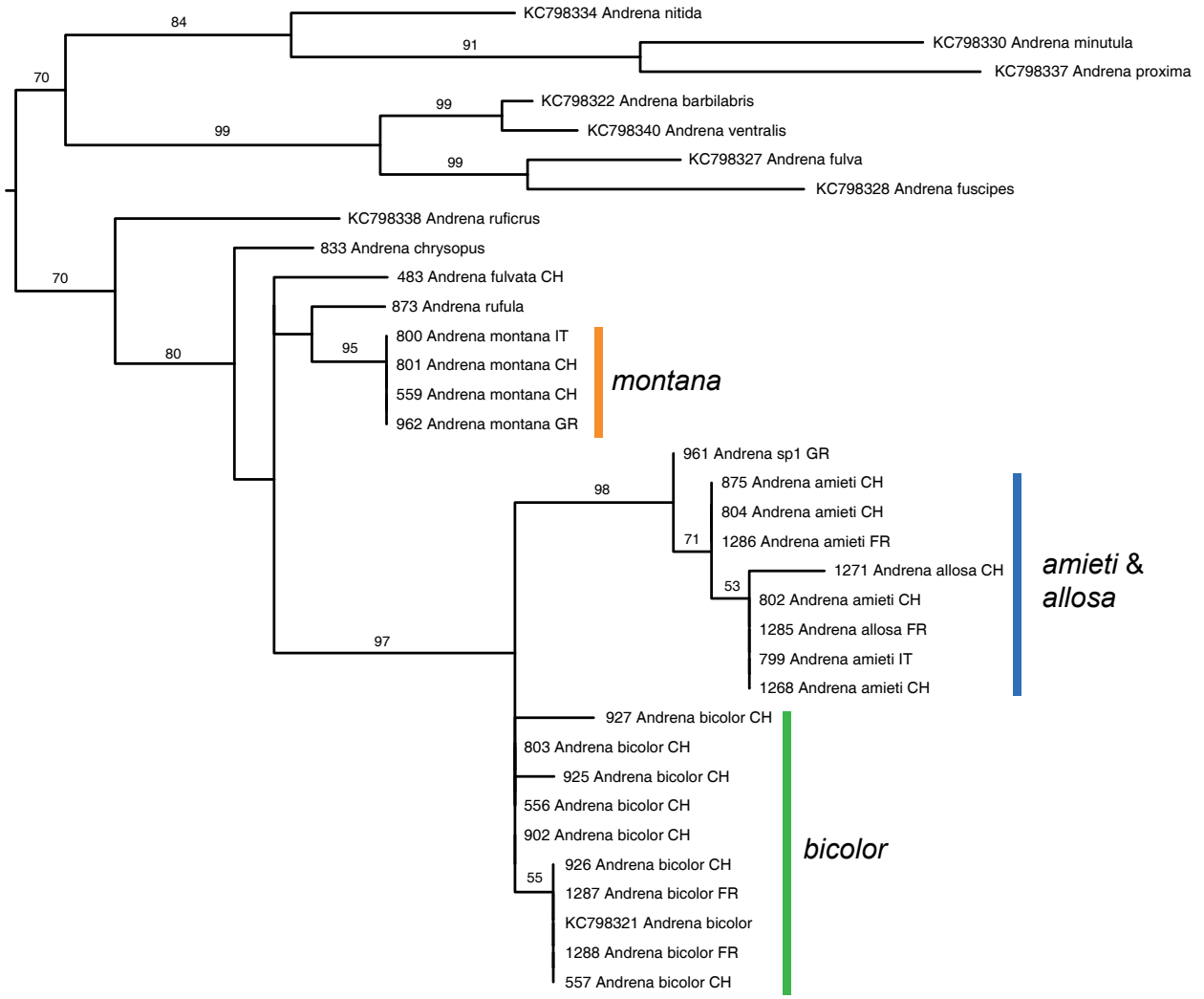


Figure 2. Phylogenetic tree based on maximum likelihood analyses of sequence data of the nuclear gene LW rhodopsin; numbers above branches indicate statistical support based on 1000 bootstrap replicates (values below 50 are omitted).

least *A. ruficrus* (no opsin sequence was available for *A. fulvida*) being sister to a clade including the other members of *Euandrena* and *A.* (*Ptilandrena*) *fulvata*.

Species delimitation

Both groups revealed in analyses of COI (Fig. 1) within *Andrena amieti* sp. n. included specimens of the spring and of the summer generations. The lone Alpine specimen of group 1 (specimen 1202) originates from the type locality of *A. amieti* sp. n., thus was found in sympatry with numerous specimens of group 2 and was morphologically not visibly divergent from group 2 specimens. The two southern Italian specimens of *A. amieti* sp. n., both of which were included in group 1, were morphologically slightly distinct from the Alpine specimens (including the lone specimens of group 1 and group 2 specimens). Differences were found in the colour of the vestiture but not in the sculpture. We thus tentatively consider these two groups to represent two mitochondrial lineages within the same biological species. Group 1 lineage appears to be present at low frequency in the Alps since it was represented by only one specimen in the 18 sequenced specimens of *A. amieti* sp. n.

We also consider the Alpine populations of *A. allosa* to constitute a distinct and well-separated species despite lack of monophyly (Fig. 1), lack of divergence with *A. amieti* sp. n. in the nuclear marker (Fig. 2), and the fact that *A. allosa* (and *Andrena* sp1) rendered *A. amieti* sp. n. paraphyletic in analyses of COI. Alpine populations of *A. allosa* are found in sympatry with *A. amieti* sp. n. but these two taxa are morphologically, phenologically and biologically well-differentiated from one another. In addition, in spite of non-monophyly in COI-based trees, COI sequences of *A. allosa* were unique and diagnostic for this species.

Alpine taxa of the *bicolor*-group

Andrena bicolor is not treated here since this species is widespread and well-known.

Andrena allosa Warncke, 1975

Figs 14, 18, 23, 25, 28, 32, 35, 43, 45, 49, 54.

Andrena allosa Warncke 1975a: 311, ♀, "Allos, Basses-Alpes" [France]. Holotype ♀, OLML, paratypes ♀♀.

Material examined. Type material: holotype female of *A. allosa* (Fig. 18); additional material: 57 females, 2 males from various localities in France and Switzerland (Suppl. material 1).

Distribution. Western Alps from "Alpes Maritimes" in Southeastern France to Western Switzerland (Fig. 3); possibly Northern Spain and Pyrenees (see note below). A mention from northeastern Italy on the map presented

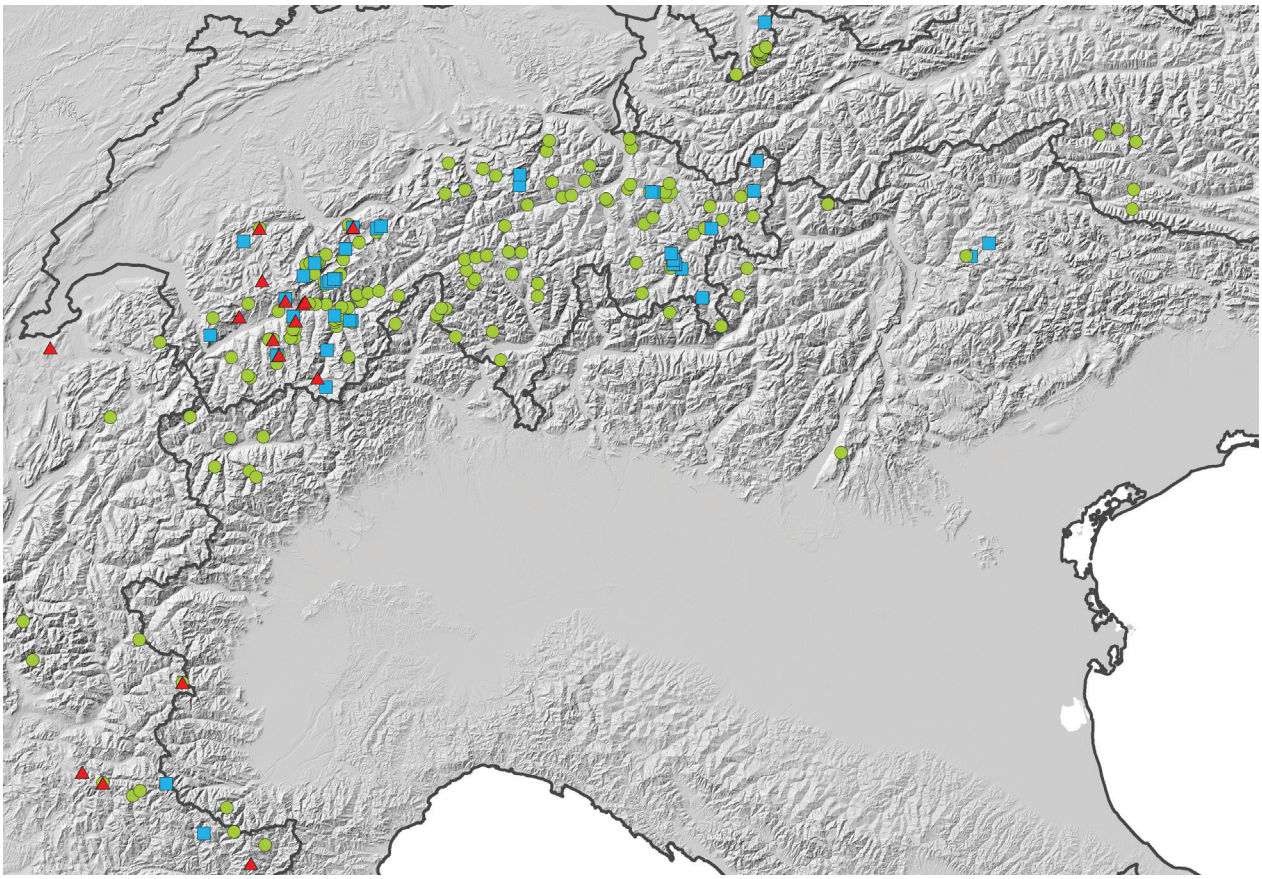


Figure 3. Distribution of *Andrena allosa* (red triangles), *A. amieti* sp. n. (green circles) and *A. montana* (blue squares) in the Alps.

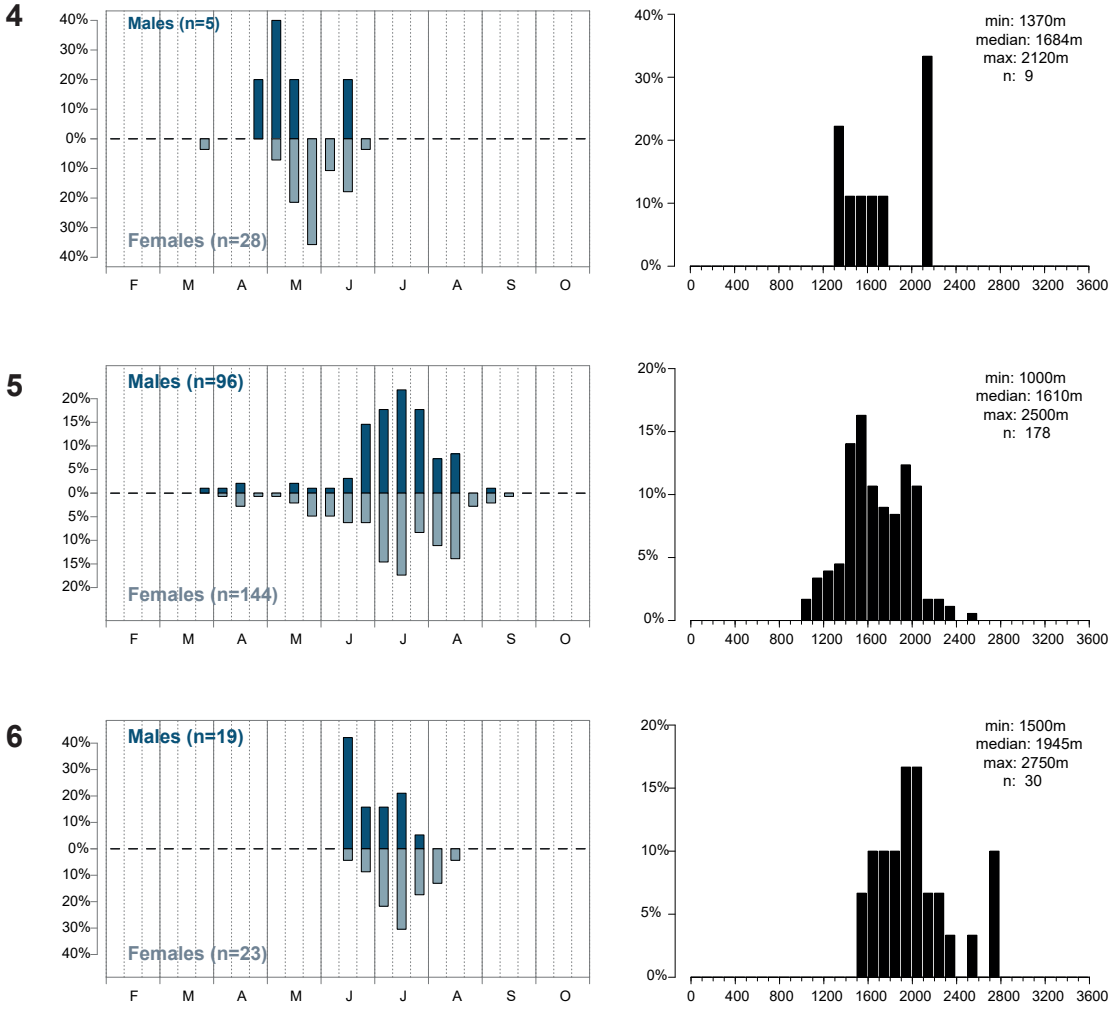
in Gusenleitner and Schwarz (2002: 967) was based on a misidentified specimen of *A. amieti* sp. n. from "Monte Baldo" (OLML).

Notes. We examined one specimen from Spain labelled as follows: "P. Leon Las Senales, 4,875 10.v-12.vi.1967 I & E Yarrow BM 1967-352" (OLML), which agrees with *A. allosa* in the sculpture of the terga and in its vestiture, but which has a shorter malar space, the clypeus that is not flattened apically as well as shorter mouthparts. This specimen appears to be superficially similar to the sequenced female collected at Larrau, in the "Pyrenées Atlantiques" department in France (number 1293; Fig. 1), which was 0.73% divergent from Alpine specimens of *A. allosa*. For now, we consider these two specimens to belong to *A. allosa* in spite of the lack of the most conspicuous diagnostic characters of this species, namely the long malar space and the flattened clypeus.

Phenology. *Andrena allosa* has only one generation per year from the end of March (one isolated record) to the end of June (Fig. 4).

Habitat. We found *Andrena allosa* in various subalpine and alpine grasslands from 1370 m to slightly above the tree line at around 2100 m (Fig. 4), often in close proximity to stands of *Crocus albiflorus* (Fig. 9). Nesting sites are unknown.

Pollen host preferences. *Andrena allosa* collected the pollen on eight plant families (Table 3) but had a pronounced affinity for the pollen of *Crocus* (Iridaceae), which contributed 62.4% to the total pollen grain volume and was recorded in 20 out of 24 scopal loads. This finding is supported by field observations at five different localities in the Swiss and French Alps, where several females of *A. allosa* simultaneously harvested pollen on *Crocus* (Fig. 14). Numerous females were observed to collect the pollen from *Crocus* flowers late in the season, at a time when blooming *Crocus* were restricted to small patches where snow had remained particularly long. Because of the particularly short blooming period of *Crocus*, this observation suggests that *A. allosa* females may locate short-lived stands of *Crocus* throughout their flying season.



Figures 4–6. Phenology (left diagram) and altitudinal distribution (right diagram) of the three Alpine taxa of the *bicolor*-group; only data originating from the Alps were used to produce these graphs. **4**, *Andrena allosa*. **5**, *A. amieti* sp. n. **6**, *A. montana*.

Table 3. Pollen host preferences of the three Alpine taxa of the *bicolor*-group. n = total number of pollen loads, N = number of pollen loads from different localities. Countries: CH = Switzerland, F = France, IT = Italy. Plant families: ACE = Aceraceae, AST = Asteraceae, BRA = Brassicaceae, CAM = Campanulaceae, CAR = Caryophyllaceae, CIS = Cistaceae, CLU = Clusiaceae, COL = Colchicaceae, CRA = Crassulaceae, ERI = Ericaceae, FAB = Fabaceae, GER = Geraniaceae, IRI = Iridaceae, LAM = Lamiaceae, LIL = Liliaceae, ORO = Orobanchaceae, PLA = Plantaginaceae, RAN = Ranunculaceae, ROS = Rosaceae, SAL = Salicaceae. Definitions of bee host ranges after Müller and Kuhlmann (2008).

Bee species	n	N	Origin (and number) of pollen loads	% pollen grain volume (number of loads)	Preferred host	% pollen grain volume of preferred host	% pure loads of preferred host	% loads with preferred host	Host range
Andrena allosa Warncke 1975	24	9	CH (20), F (4)	IRI (*Crocus*) 62.4% (20), AST (Cichorioideae) 7.2% (11), AST (Asteroideae) 2.7% (1), AST (Carduoideae) 1.1% (1), RAN 6.8% (7), BRA 6.2% (4), ROS (cf. *Potentilla*) 5.0% (5), ROS (*Geum*) 0.9% (2), CIS (*Helianthemum*) 4.9% (3), LIL (*Gagea*) 1.7% (2), FAB 0.1% (1), unknown 1.0% (1)	*Crocus*	62.4%	16.7%	83.3%	polylectic (8 plant families) with affinity for *Crocus* (Iridaceae)
Andrena amieti sp. n. (first generation)	22	9	CH (22)	AST (Cichorioideae) 28.9% (14), AST (Asteroideae) 5.3% (2), ROS (cf. *Potentilla*) 9.2% (6), ROS (*Geum*) 2.5% (2), ROS (other) 9.4% (4), SAL (*Salix*) 15.6% (7), BRA 7.5% (4), RAN 6.0% (3), GER (*Geranium*) 3.1% (1), ORO (cf. *Euphrasia*) 2.6% (1), IRI (*Crocus*) 2.6% (1), CAR 2.2% (3), ACE (*Acer*) 2.1% (1), CAM 1.8% (2), ERI 0.7% (1), unknown 0.5% (1)	·	·	·	·	polylectic (12 plant families)
Andrena amieti sp. n. (second generation)	28	26	CH (28)	CAM 79.9% (24), GER (*Geranium*) 7.1% (6), CAR 4.0% (2), BRA 3.7% (3), COL (*Colchicum*) 1.8% (1), CIS (*Helianthemum*) 1.5% (3), AST (Cichorioideae) 1.4% (6), RAN 0.3% (1), PLA (*Plantago*) 0.2% (1), unknown 0.1% (1)	Campanulaceae	79.9%	39.3%	85.7%	polylectic (9 plant families) with strong preference for Campanulaceae
Andrena montana, Warncke 1973	16	15	CH (14), F (1), IT (1)	CAM 27.1% (6), CIS (*Helianthemum*) 24.3% (6), CAR 22.0% (7), ORO (cf. *Euphrasia*) 7.8% (2), AST (Cichorioideae) 5.5% (6), AST (Asteroideae) 0.3% (1), RAN 4.0% (3), PLA (*Veronica*) 2.7% (1), GER (*Geranium*) 2.1% (2), CRA 1.5% (2), CLU (*Hypericum*) 1.1% (1), LAM (Nepetoideae) 1.0% (1), ROS 0.6% (2)	·	·	·	·	polylectic (12 plant families)

Andrena amieti Praz, Müller & Genoud, sp. n.

http://zoobank.org/6041B44B-3E38-42A4-8C46-7D8886920ECD

Figs 11, 12, 15–17, 20, 22, 24, 26, 27, 29–31, 33, 37, 39, 40, 42, 44, 46–48, 50, 52, Suppl. material 2: S1.

Type locality. Switzerland, Canton of Bern, Municipality of Kandersteg, Northern shore of Lake Oeschinen [Oeschinensee] 46.502N 7.723E, 1590m. This locality is located within the Unesco World Heritage site "Swiss Alps Jungfrau-Aletsch" (Fig. 7).

Holotype. Female of second generation, pinned (Figs 15–17, 26). Original labels: 1. "CH Oeschinensee, 621750/150000, 1640m, 6.vii.2014, leg. J. Litman 029472". 2. "ACU 29472, GBIFCH00103472" [unique identifier with a graphical barcode]. 3. "Voucher specimen for DNA extraction, Sample 1284, Christophe Praz, University of Neuchâtel" [yellow label, printed]. 4. Holotype female *Andrena amieti* sp. n. Praz, Müller & Genoud [red label, printed]. Deposited in MHNN.

Paratypes. 250 males and 237 females from various localities in France, Switzerland, Italy, Germany and Austria (Suppl. material 1).

Note. The description and diagnosis are based on Alpine populations of this species. Southern Italian specimens (Suppl. material 2: Fig. S1) are slightly divergent in the colour of the vestiture; this variation is presented at the end of the description.

Diagnosis. In the female sex, *Andrena amieti* sp. n. is highly similar to *A. bicolor* and *A. allosa*. All three species can easily be separated from *A. montana* by the dark prepygidial and pygidial fimbria (Fig. 37) (orange-brown in *A. montana*; Fig. 38) and by the presence of at least some dark hairs laterally on the mesosoma (Fig. 15) (hairs on lateral parts of mesosoma entirely brownish-grey in *A. montana*). The female differs from *A. bicolor* in the presence of comparatively long dark hairs on the mesonotum (Fig. 26), usually also on the scutellum; these dark hairs are intermixed with longer, orange brown or grey brown hairs, and many of them are longer than half the length of the light brown hairs. In *A. bicolor*, there are either no dark hairs on the mesonotum and scutellum, or only very short dark hairs on the mesonotum, their length being visibly smaller than half the length of the light brown hairs. In addition, there are in most cases numerous dark hairs on the propodeum in *A. amieti* sp. n. (all hairs usually



Figures 7–10. Habitats of *Andrena amieti* sp. n., *A. allosa* and *A. montana*. **7**, the lake of Oeschinen in the Bernese Alps in Switzerland, UNESCO world heritage site and type locality of *A. amieti* sp. n. (Picture J. Litman). **8**, nesting site of *A. amieti* sp. n. near Disentis in the Grisons, Switzerland (Picture A. Müller). **9**, habitat of *A. allosa* near Chandolin in the Valais, Switzerland, at a time where the females were already actively collecting pollen (Picture S. Giriens, www.swisswildbees.ch). **10**, habitat of *A. montana* near Zermatt in the Valais, Switzerland (Picture S. Giriens, www.swisswildbees.ch).



Figures 11–14. Habitus of *Andrena amieti* sp. n., *A. montana* and *A. allosa*. **11**, *A. amieti* sp. n. male, summer generation, on Caryophyllaceae spec. (Picture S. Giriens, www.swisswildbees.ch). **12**, *A. amieti* sp. n. female, summer generation, with Campanulaceae pollen load (Picture S. Giriens, www.swisswildbees.ch). **13**, *A. montana* female on Caryophyllaceae spec. (Picture D. Bénon, www.swisswildbees.ch). **14**, *A. allosa* female on *Crocus albiflorus* (Picture D. Genoud).

light in *A. bicolor*), the light hairs on T1–T4 are snow white (Fig. 33) (always yellowish-white in fresh specimens of *A. bicolor*; Fig. 34), and some hairs between the antenna are always grey-brown (Fig. 16) (hairs between the antennae commonly entirely dark in *A. bicolor*, although sometimes also grey-brown).

The female of *A. amieti* sp. n. differs from that of *A. allosa* by the shorter clypeus with convex preapical area (Fig. 17) (clypeus produced apically, preapical zone flattened medially in *A. allosa*; Fig. 18) and the short malar space (Fig. 22) (malar space as long as the basal width of antennal segment 3 in *A. allosa*; Fig. 23); in addition,

A. allosa has shagreened, more sparsely punctate tergal discs (especially medially on T2), the margin of T2 hardly impressed medially (Fig. 35), and comparatively longer mouthparts (compare Figs 24, 25).

The male of *A. amieti* sp. n. (Figs 39, 42) is similar to that of *A. bicolor*, *A. allosa* and *A. montana*, and superficially also to that of *A. ruficrus*. Separation from the male of *A. bicolor* may be difficult in worn specimens. In *A. amieti* sp. n., the light vestiture on mesosoma and metasoma is greyish-white without yellowish hue (Figs 39, 42, 50) (hairs on dorsal side of mesosoma and first terga with yellowish hue in fresh specimens of *A. bicolor*; Fig. 51). The vestiture is comparatively long on the terga (Fig. 50), in particular medially on T4, the apical fringe of hairs is longer than the tergal margin (in *A. bicolor* fringe of hairs as long as or shorter than tergal margin; Fig. 51). The disc of T4 has at most a few isolated, dark hairs (disc of T4 with numerous dark hairs in *A. bicolor*). Lastly, the facial vestiture (Figs 39, 42) is on average lighter than in *A. bicolor*, at least some grey hairs are found between and around the antennal sockets (in *A. bicolor* frequently entirely dark).

The male of *A. amieti* sp. n. is highly similar to that of *A. allosa*, especially in the first generation (*A. allosa* has only one generation). Differences are summarized in the key: the maxillary palps are comparatively slightly shorter in *A. amieti* sp. n. (Fig. 44) than in *A. allosa* (Fig. 45), and in *A. amieti* sp. n. the head is comparatively short and broad with little protruding clypeus (Fig. 42) (head comparatively long with protruding clypeus in *A. allosa*; Fig. 43). In addition, the first recurrent vein usually enters the second submarginal cell in or near its middle and the second submarginal cell is subquadrate or longer than broad (Fig. 48) (in *A. allosa*, the first recurrent vein enters the second submarginal cell in its basal half, second submarginal cell broader than long; Fig. 49).

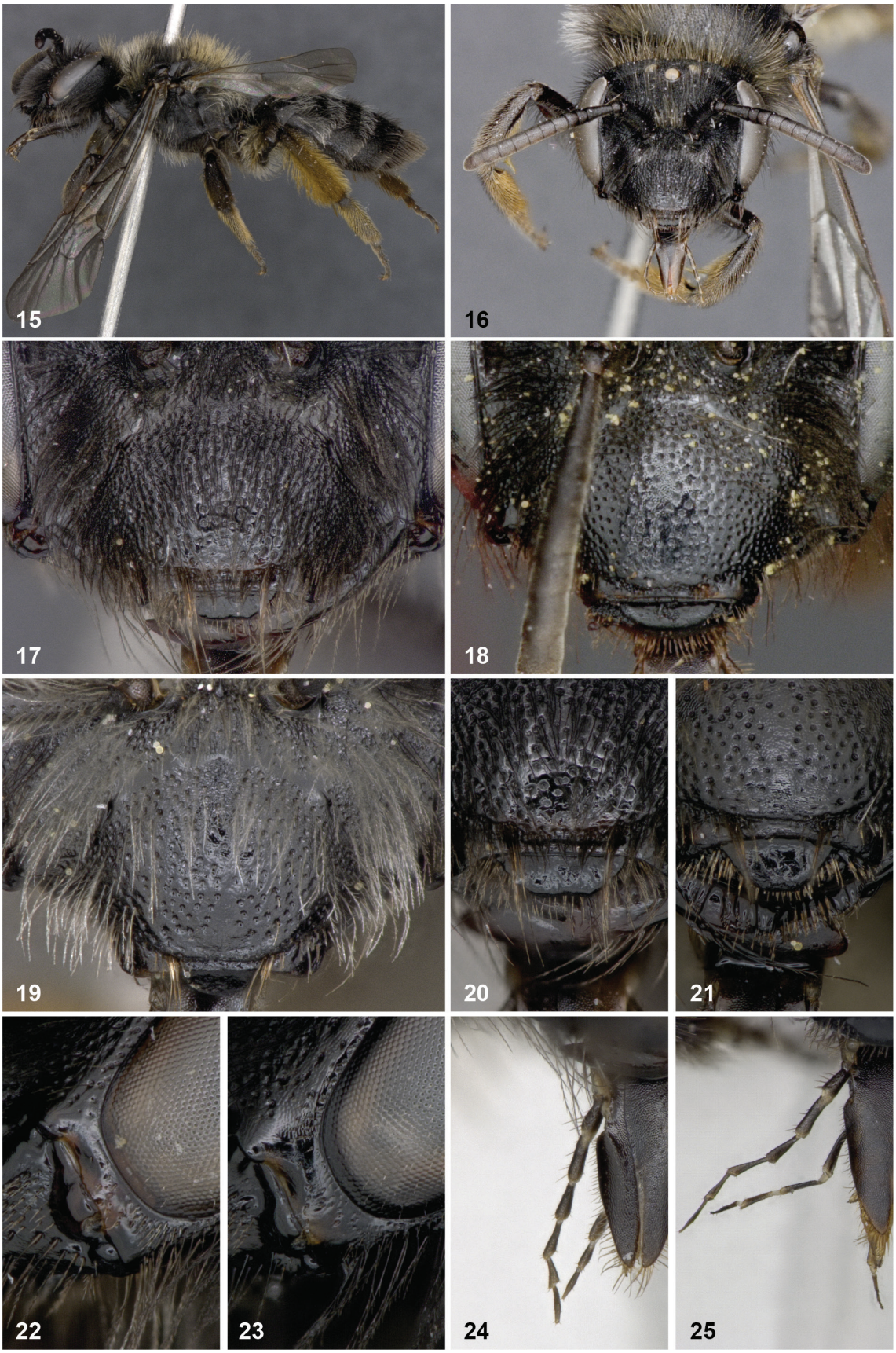
In its vestiture, the male of *A. amieti* sp. n. is similar to that of *A. montana*; the best diagnostic characters are the shape of the labral appendix, which is wider than long in *A. amieti* sp. n. (Fig. 40) and as long as apically wide in *A. montana* (Fig. 41), and the width of the penis valves and of the gonostylus: the gonostylus is more slender and the penis valves broader in *A. montana* (Fig. 61) than in *A. amieti* sp. n. (Fig. 52), although for these genitalic characters direct comparison with reference material is necessary. In addition, the mesonotum is nearly entirely shagreened in males of *A. montana*, while it is at least partly shiny in males of the second generation of *A. amieti* sp. n. (Fig. 47). Lastly, males of *A. amieti* sp. n. are also superficially similar to those of *A. ruficrus*, which usually have the apex of the hind tibia partly orange and the clypeal vestiture entirely show-white; in addition, the penis valves are broader basally in *A. ruficrus* (Fig. 60) than in *A. amieti* sp. n (Fig. 52).

Description. Female: **Body size and proportions**: Very similar to *A. bicolor*. Body length approximately 9mm, slightly smaller on average than *A. allosa* (body length approximately 9.5mm-10mm). Head slightly broader than long (Fig. 16), clypeus broader than long. Malar space short (Fig. 22), as in *A. bicolor*, shorter than in *A. allosa* (Fig. 23), length without impressed area at most equal to half the base of third antennal segment. Gena slightly broader than compound eye in lateral view. Interocellar distance approximately 2 times diameter of lateral ocellus. Ocelloccipital distance approximately 0.9 times diameter of lateral ocellus. Third antennal segment longer than fourth and fifth together, the latter two broader than long, segments 6–11 subquadrate, 12 longer than broad (Fig.16). Labral process trapezoidal, its apical width larger than its length (Fig. 20), comparatively broader than in *A. montana* (Fig. 21). Mouthparts (Fig. 24) as in *A. bicolor*, shorter than in *A. allosa* (Fig. 25), in particular segment 4 of maxillary palpus only three times as long as apically broad (in *A. allosa* at least four times as long as apically broad), and segment 2 of labial palpus hardly longer than broad (in *A. allosa* at least twice as long than broad).

Wing venation: As in *A. bicolor*; the first recurrent vein enters the second submarginal cell in its middle or nearly so, and second submarginal cell subquadrate or longer than broad (Fig. 27) (in *A. allosa*, the first recurrent vein usually enters the second submarginal cell in its basal half; second submarginal cell broader than long; Fig. 28).

Integument colour: As in *A. bicolor*, integument black or dark brown, including flagellum and tegulae, apical margin of T1–T4 slightly lighter, tarsal segments 2–4 dark orange-brown, tarsal claws weakly ferruginous, hind tibial spurs light brown. Wing venation (including stigma; Fig. 27) predominantly brown as in *A. bicolor*.

Vestiture: Entire body vestiture made of simple to weakly branched hairs, more strongly branched hairs are present between antennal sockets, plumose hairs in propodeal corbicula, floculus, and prepygidial and pygidial fimbria. Hairs on head predominantly dark brown (Fig. 16), always with grey-brown to greyish-white hairs between antennal sockets (sometimes also around antennal sockets) and medially on vertex (in *A. bicolor* hairs on head often entirely dark); extent of grey vestiture on face variable but vestiture on average lighter than in *A. bicolor*. Hairs on mesosoma predominantly grey-brown, including on lateral and ventral sides (Fig. 15); hairs never bright orange-brown as in fresh specimens of *A. bicolor*; mesonotum and usually also scutellum with intermixed long, grey-brown hairs and short, dark brown hairs (Fig. 26) (in *A. bicolor* either no dark hairs, or dark hairs shorter; see above); tegulae covered with short dark hairs (Fig. 26) (in *A. bicolor* light brown hairs); propodeum with intermixed grey and dark brown hairs (in *A. bicolor* usually without dark brown hairs); on lateral side of mesosoma, hairs on average lighter than in *A. bicolor*, sometimes entirely grey-brown (Fig. 15), dark hairs mostly with grey tips except sometimes under tegula, where hairs can be entirely



Figures 15–25. Structure of female of *Andrena amieti* sp. n., *A. allosa* and *A. montana*. **15**, holotype of *A. amieti* sp. n. in lateral view. **16**, holotype of *A. amieti* sp. n. in frontal view. **17**, clypeus of holotype of *A. amieti* sp. n. **18**, clypeus of holotype of *A. allosa*. **19**, clypeus of *A. montana*. **20**, labrum of *A. amieti* sp. n. **21**, labrum of *A. montana*. **22**, malar space of *A. amieti* sp. n. **23**, malar space of *A. allosa*. **24**, section of mouthparts of *A. amieti* sp. n. **25**, section of mouthparts of *A. allosa*.

dark; ventral part of mesosoma with grey-brown hairs becoming lighter apically. Leg vestiture nearly as in *A. bicolor*, flocculus grey-brown to whitish grey, on average lighter than in *A. bicolor*; scopa yellowish brown, hairs on basitarsi 2 and 3 usually yellowish brown (in *A. bicolor* usually dark brown). T1 mostly covered with snow-white hairs (in *A. bicolor* yellowish-white), only a few isolated, dark hairs on anterior part of disc and numerous dark hairs on vertical anterior part of tergum; T2 and T3 covered with long, snow white hairs (Fig. 33) (in *A. bicolor* hairs yellowish-white, Fig. 34 and usually slightly shorter medially) forming very loose apical fringes, not hiding cuticula, discs with short, erect dark hairs, more numerous on T3 than T2; T4 covered with long, dark hairs forming loose apical fringe and with short, erect dark hairs on disc; prepygidial and pygidial fimbriae dark brown (Fig. 37). Sterna covered with dark, erect hairs, apical margin with apical fringes of dark, plumose hairs. In first generation, vestiture on average longer than in second, especially on clypeus, mesosoma and basal terga.

Sculpture: The variation observed in the sculpture of *A. amieti* sp. n. represents the middle range of the much wider scuptural variation observed in *A. bicolor*. *Head:* Facial fovea narrow (Fig. 16), as in *A. bicolor*; clypeus (Fig. 17) densely punctured, more sparsely punctured laterally and basally than apically, there with shiny interspaces that are on average one puncture diameter wide, often with longitudinal irregularities (more so than in *A. bicolor*); apical part of clypeus without flat area as observed in *A. allosa*; frons unpunctured with numerous longitudinal ridges, as in *A. bicolor*. *Mesosoma*: mesonotum (Figs 29, 30) with well-visible punctures, interspaces nearly entirely dull and on average 3–4 puncture diameters in first generation (Fig. 29), shiny or silk-shiny and 2–3 puncture diameters in second generation (Fig. 30). Propodeum (Fig. 31) as in *A. bicolor*, propodeal triangle without punctures, dull, finely sculptured, anteriorly with a few longitudinal wrinkles, wrinkles less visible than in *A. allosa* (Fig. 32). *Metasoma*: terga sparsely punctured (Fig. 33), within variation observed in *A. bicolor* (Fig. 34), on average slightly more shagreened, especially apical tergal margin of T2 (compare specimens of same generation); first generation: disc of T1 very sparsely punctured, that of T2 sparsely punctured with interspaces equal to 4–5 puncture diameters; surface of tergal discs mostly shagreened to silk shiny, apical margins shagreened, mostly unpunctured, that of T2 weakly impressed medially, as in *A. bicolor* but more so than in *A. allosa*; second generation (Fig. 33): punctation on average denser (interspaces equal to 3–4 puncture diameters on disc of T1, and 2–3 puncture diameters on disc of T2; sculpture of surface on average shinier, although usually still weakly shagreened; apical margins as in first generation, usually at least slightly shagreened.

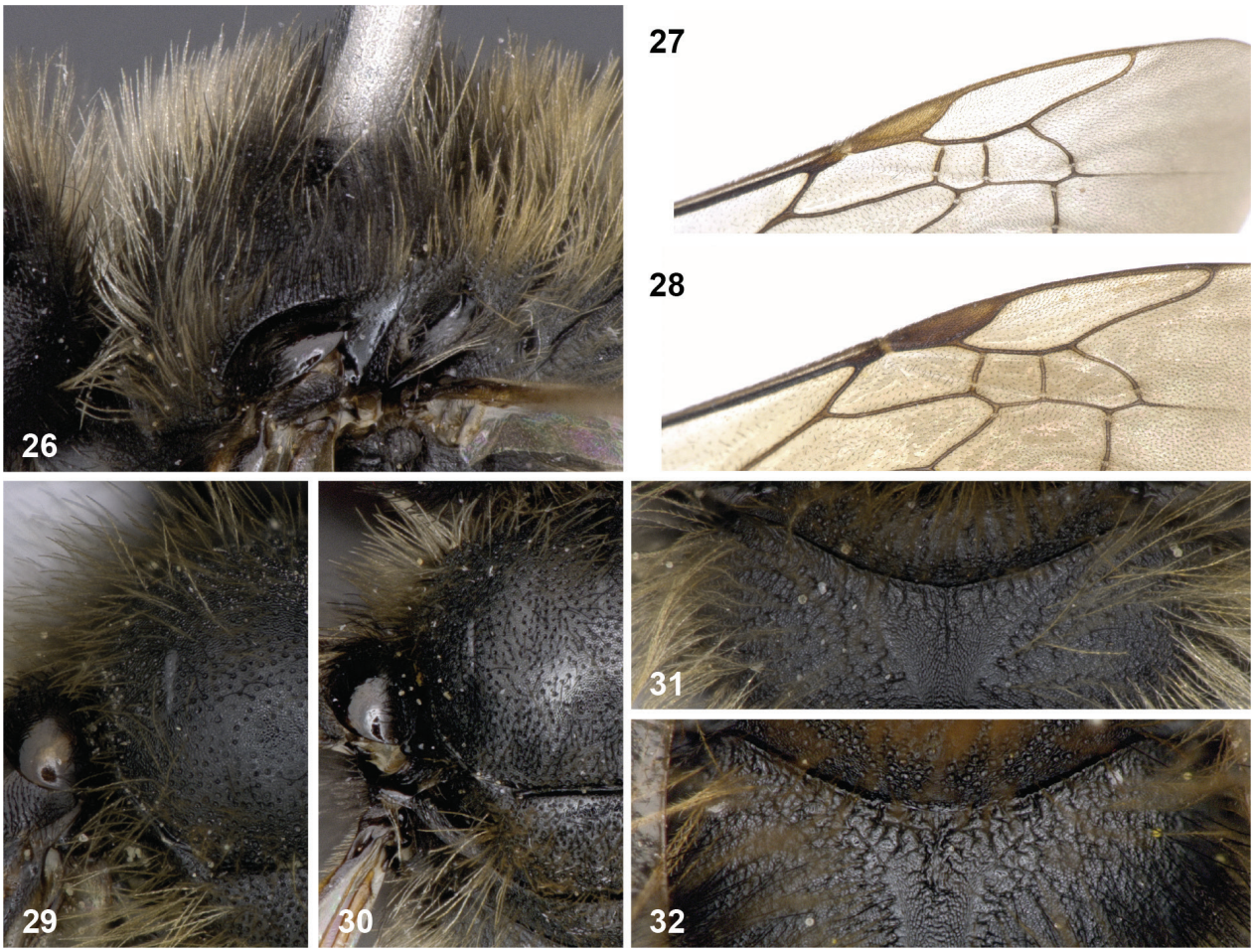
Male: **Body size and proportions**: Body length approximately 7–8mm, similar to *A. bicolor*; the two males of *A. allosa* examined were 8-8.5mm long. Head slightly broader than long, clypeus little protruding apically (Fig. 42) (in *A. allosa*, clypeus slightly more strongly protruding; Fig. 43); gena slightly broader than compound eye in lateral view; interocellar distance approximately 2.5–3 times diameter of lateral ocellus; ocelloccipital distance approximately equal to diameter of lateral ocellus; length of third antennal segment approximately 1.3 times length of fourth antennal segment (in *A. bicolor* third antennal segment often shorter, 1.1 times length of fourth segment), fourth slightly shorter than broad or subquadrate, segments 5–9 slightly longer than broad, 10–12 subquadrate, 13 longer than broad. Labral process trapezoidal, its apical margin slightly emarginate (Fig. 40) (in *A. montana*, process longer; Fig. 41). Mouthparts (Fig. 44) as in *A. bicolor*, slightly shorter than in *A. allosa* (Fig. 45) although differences not as striking as in female; segment 4 of maxillary palpus only three times as long as apically broad (in *A. allosa* approximately four times as long as apically broad).

Wing venation: As in female, the first recurrent vein usually enters the second submarginal cell in or near its middle; second submarginal cell subquadrate or longer than broad (Fig. 48) (in two examined specimens of *A. allosa*, the first recurrent vein enters the second submarginal cell in its basal half, second submarginal cell broader than long; Fig. 49).

Integument colour: As in female.

Vestiture: Entire body vestiture grey-white without yellowish hue (Figs 39, 42, 50) (light hairs always with yellowish hue in fresh specimens of *A. bicolor*; this yellowish hue is not apparent in worn specimens), except as follows: facial vestiture varying from predominantly dark (as on Fig. 42), with only a few grey hairs between and around antennal sockets, on scape and on vertex medially, to nearly predominantly grey-white, with dark hairs restricted to apical and lateral parts of clypeus (facial vestiture often entirely dark in *A. bicolor*; clypeus entirely covered by snow-white vestiture in *A. ruficrus*, and by light brownish-grey hairs and dark hairs laterally in *A. montana*), area along inner margin of compound eye, and lateral parts of head. Mesonotum with a few isolated dark hairs among longer, grey hairs (Figs 46, 47); lateral side of mesosoma with a few isolated dark hairs below tegula. Propodeum with intermixed dark and light grey hairs. Legs mostly covered with grey-white hairs, hairs on external surface of all tibiae yellowish and on ventral surface of all tarsal segments yellowish-white. Surface of T1 with a few isolated, dark hairs on anterior, vertical part. Vestiture of T2–T4 snow white (Fig. 50) without dark hairs or at most with a few isolated dark hairs basally on disc of T4 (in *A. bicolor*, vestiture of T1–T4 yellowish white in fresh specimens, Fig. 51; disc of T4 predominantly covered with dark hairs, and with numerous dark hairs basally on disc of T3; dark hairs may appear light grey in worn specimens).

Sculpture: As for female, the sculpture of the male of *A. amieti* sp. n. is similar to that of *A. bicolor*,



Figures 26–32. Structure of female of *Andrena amieti* sp. n. and *A. allosa*. **26**, vestiture of dorsal side of mesosoma of holotype of *A. amieti* sp. n. **27**, section of right forewing of *A. amieti* sp. n. **28**, section of right forewing of *A. allosa*. **29**, dorsal view of mesosoma of spring generation of *A. amieti* sp. n. **30**, dorsal view of mesosoma of summer generation of *A. amieti* sp. n. **31**, propodeum of *A. amieti* sp. n. **32**, propodeum of *A. allosa*.

which is particularly variable. *Head*: clypeus densely punctured, interspace shiny or weakly shagreened, mostly narrower than one puncture diameter (Fig. 42); frons nearly unpunctured with numerous longitudinal ridges. *Mesosoma*: mesonotum in first generation (Fig. 46) entirely shagreened with sparse and little visible punctures, interspaces equal to 4–5 puncture diameters (similar to *A. allosa* or to first generation of *A. bicolor*), in second generation (Fig. 47) nearly always with shiny area medially, punctation well-visible, on average slightly sparser than in second generation of *A. bicolor*, interspaces commonly over 3–4 puncture diameters (in *A. bicolor* rarely over 3 puncture diameters); propodeum as in female. *Mesosoma:* terga (Fig. 50) similar to *A. bicolor*, on average slightly more sparsely punctate and more shagreened, but within variation observed in *A. bicolor*; punctures fine (slightly coarser on T1), interspaces often more than 5 times puncture diameters. Tergal margins usually partly shagreened (Fig. 50) (in second generation of *A. bicolor* often entirely shiny). Structure of S8 not visibly different from *A. bicolor*.

Genitalia: As on Fig. 52, very similar to *Andrena bicolor* (Fig. 53), dorsal lobe of gonocoxite weakly developed, gonostylus simple, regularly spatulate, external margin regularly rounded, penis valves narrow, hardly broadened basally.

Geographic variation. In females from Southern Italy (Suppl. material 2: Fig. S1), the vestiture is nearly entirely grey-white, including on all parts of the mesosoma (isolated dark hairs on mesonotum and scutellum excepted), with no brownish hue, in contrast to Alpine specimens where the mesosonal vestiture is predominantly brown. No difference is found in vestiture colour in male specimens.

Etymology. This species is named in honor of Felix Amiet, who has greatly contributed to our understanding of Central European bees, including the four species presented here.

Additional comments. There are numerous species-group names currently treated as junior synonyms

of *A. bicolor* (Gusenleitner and Schwarz 2002). We carefully examined the description of each of these names if their type locality was located within the known range of *A. amieti* sp. n. The description of none of these species-group names points to *A. amieti* sp. n. (see also comments on *A. croatica* Friese, 1887 stat. rev., below). *A. gwynana* var. *testacea* Dalla Torre, 1877, described from Seefeld (Tyrol) and whose type material is presumably lost, originates from a region where *A. amieti* sp. n. might occur. The very brief original description merely mentions the "testaceous" hind tibia, which corresponds neither to *A. bicolor* nor to *A. amieti* sp. n., and which does not point to a differential character between these two species. For these reasons, we keep this taxon as a junior synonym of *A. bicolor*. Lastly, several taxa of *Euandrena* have been described from Ukraine, Central Asia or Russia (Gusenleitner and Schwarz 2002). Given that *A. amieti* sp. n. appears to be restricted to the Alps, the Apennines and the Pyrenees, we consider it unlikely that any of these taxa will turn out to be conspecific with *A. amieti* sp. n.

Distribution. Alps from Southern France to East Tyrol (Austria), including most of the Swiss Alps and the Allgäu Alps in Southern Germany, as well as the Italian Alps (Fig. 3); Monte Pollino in Southern Italy; one isolated record from the Pyrenees.

Phenology. According to our data and field observations, *Andrena amieti* sp. n. has two generations per year (Fig. 5). The earliest males of the first generation were collected at the end of March, and some worn females collected during the first half of June probably belonged to the first generation (thus some females collected in June and seemingly belonging to the second "peak" on Fig. 5 were in fact most likely of the first generation). The second generation is active from mid-June to the first half of September. While the first generation was underrepresented in the examined material, intensive surveys in three Swiss localities where the species was found to be abundant consistently revealed the presence of two generations, with several females observed from May to early June, then numerous fresh males and fresh females observed from the end of June to mid-August.

Habitat. *Andrena amieti* sp. n. has been found from an altitude of approximately 1000m up to slightly above the tree line at around 2300m in the Valais; one isolated record is from an elevation of 2500m (Fig. 5). Foraging females were observed in various habitats, often in clear forests but also in meadows, subalpine grasslands and scree slopes. Patrolling males, probably indicating the location of nesting aggregations, were regularly found on disturbed terrains with little vegetation, such as dry river beds, scree slopes or avalanche corridors (Fig. 8). In these presumed nesting sites, the soil was not particularly sandy, but rather consisting of gravel mixed with sand or clay.

Pollen host preferences. *Andrena amieti* sp. n. collected the pollen from flowers belonging to 15 plant families (Table 3). Females of the spring generation exploited a wide spectrum of pollen hosts, among which Asteraceae, Rosaceae and *Salix* (Salicaceae) predominated; pollen of these three plant taxa represented 70.9% of the total pollen grain volume. In striking contrast, females of the summer generation exhibited a strong preference for the pollen of Campanulaceae, which contributed 79.9% to the total pollen grain volume and was recorded in 24 out of 28 scopal loads (Fig. 12). Field observations revealed that flowers of both *Campanula* and *Phyteuma* serve as pollen hosts among the Campanulaceae.

Andrena montana Warncke 1973

Figs 13, 19, 21, 36, 38, 41, 61.

Andrena montana Warncke 1973: 33, ♀♂, "Bozen/Italien [Bolzano, Italy]" Holotype ♀, OLML, paratypes ♀♀♂♂.

Material examined. Holotype female (OLML); additional material: 31 males, 29 females originating from France, Switzerland, Germany, Italy, Greece and Macedonia (Suppl. material 1).

Distribution. Alps from "Alpes Maritimes" in Southeastern France to Switzerland, Northern Italy and southern Germany (Fig. 3); Apennines; Balkans (Greece, Macedonia). The species is expected to also occur in the western Austrian alps. One mention from Albania (Warncke 1973) in fact refers to *A. ruficrus*.

Phenology. *Andrena montana* has only one generation per year from mid-June to August (Fig. 6).

Habitat. *Andrena montana* has been found from 1500 m to 2750m (Fig. 6) and is more often observed above the tree line than any other Alpine species of the *bicolor*-group. Pollen-collecting females were observed in flower-rich alpine grasslands (Fig. 10). A few males were observed to patrol on areas with bare soil sparsely covered by vegetation; the soil was not particularly sandy but rather made of gravel mixed with sand and clay.

Pollen host preferences. *Andrena montana* collected the pollen on 12 plant families (Table 3). Flowers of the Campanulaceae, *Helianthemum* (Cistaceae) and Caryophyllaceae were the most important pollen hosts (Fig. 13); their pollen contributed 73.4% to the total pollen volume, whereas the pollen of all other taxa was represented by less than 10% each.

Identification key to Central European species of *Andrena* subgenus *Euandrena*

Unique characters in bold; non-unique characters in regular font; characters given in order of importance. This

key will work in most of Continental Europe except in the Pyrenees, in Spain and in the Balkans.

Females

***Euandrena*:** body-length 9–11mm. Fovea comparatively narrow, its broadest width less than 1.5 times broadest width of scape (slightly broader in *A. fulvida*). Third antennal segment longer than segments 4 and 5 together. Metasomal integument predominantly dark-brown. Mesonotal vestiture consisting of long, simple or shortly branched hairs. Flocculus neither particularly long nor bent apically. Propodeal triangle at most weakly wrinkled, coarsely wrinkled anteriorly in *A. fulvida* and in *A. allosa* (Fig. 32); propodeum laterally with little-developed corbicula. Hind femur without row of thorn-like projections. Dorsolateral angle of pronotum without elevated transverse carina.

1 **Head clearly longer than broad. T2-T4 with dense apical fringes of snow-white hairs, fringes continuous on T3 and T4 and hiding cuticula.** Head vestiture entirely light grey. Hind basitarsus ferruginous. Surface of metasomal terga smooth, not shagreened. Prepygidial and pygidial fimbria orange to brown-orange. ..... *Andrena chrysopus*

– Head at most as long as broad. If present on T2-T4, apical fringes of hairs not hiding cuticula or interrupted medially. Combination of other characters different. 2

2 **Hind basitarsus and hind tibia ferruginous.** Terga regularly finely shagreened, silk-shiny, with comparatively fine, little visible punctures. Fovea comparatively short and broad, little narrowed inferiorly, 1.5 times broader than broadest width of flagellum. Facial vestiture brown medially, dark brown laterally. ..... *Andrena ruficrus*

– Hind basitarsus and tibia dark brown. Terga shagreened or shiny with often distinct punctures. Fovea usually longer and often narrower (not clearly so in *A. fulvida*). Vestiture variable. 3

3 Clypeus shiny**, with particularly coarse punctures and slightly elevated, impunctate longitudinal line** (Fig. S2). Entire body vestiture brown, except dark on T6, sterna, tibia and tarsi, as well as a few isolated dark hairs on face along compound eye. Mesonotum and terga shagreened, the latter with isolated, little visible punctures..... *Andrena symphyti*

– Clypeus shiny or shagreened, without particularly coarse punctures, with or without impunctate longitudinal line, but longitudinal line never elevated. Mesosomal vestiture variable. Sculpture of mesonotum and terga variable. 4

4 **Facial vestiture nearly entirely brown, with at most a few isolated dark hairs along compound eye *and* vestiture on mesonotum brown intermixed with numerous, slightly shorter dark hairs. Anterior area of propodeum comparatively coarsely wrinkled** (as on Fig. 32). Surface of T1 shiny or only weakly shagreened, **medially between disc and depression with a few longitudinal irregularities [as in the distantly related *A.* (*Melandrena*) vaga]**. Vestiture on lateral side of mesosoma entirely brown, without black hairs. T2 and T3 fringed laterally with weak, brownish-white apical fasciae. Mesonotum and scutellum mat, the former comparatively densely punctate. Terga regularly, finely punctate, shiny or only slightly shagreened. ..... *Andrena fulvida*

– Vestiture of head and mesonotum different, never with the combination of predominantly brown facial hairs and intermixed brown and dark hairs on mesonotum. Propodeum more finely wrinkled (except in *A. allosa*). Surface of T1 shagreened or shiny, without longitudinal irregularities. Vestiture and sculpture variable. 5

5 **Integument of apical margin of T1–T4 ivory-colored** (Figs S3, S4), basal part of tergal margins weakly translucid. Entire body vestiture brown, except facial vestiture, which is predominantly dark with more or less brown hairs medially, a few isolated, dark hairs on mesonotum and some dark hairs on T5 and T6 6

– **Integument of apical margin of T1–T4 not ivory-colored,** at most narrowly light brown apically; basal part of tergal margins not translucid; vestiture variable. 7

6 Tergal discs on average more coarsely and densely punctate, interspaces on disc of T2 equal to 1.5-2 puncture diameters (Fig. S3). Surface of tergal discs strongly convex, apical margin strongly impressed. Fovea comparatively long, starting below middle of antennal sockets. ..... *Andrena granulosa*

– Tergal discs on average more finely and sparsely punctate, interspaces on disc of T2 equal to 3-4 puncture diameters or more (Fig. S4). Surface of tergal discs nearly flat, apical margins less strongly impressed. Fovea comparatively short, starting well-above middle of antennal sockets. ..... *Andrena vulpecula*

7 **Vestiture of mesosoma entirely brown-orange** (quickly fading to grey brown), **including on lateral and ventral sides**, mesonotum without intermixed long or short dark hairs. **Facial vestiture predominantly brown orange**, only a few dark hairs along compound eyes and sometimes on clypeus (Fig. S5). Scopa orange. Prepygidial and pygidial fimbria dark brown. Facial fovea comparatively little narrowed ventrally (Fig. S5). Inferior part of clypeus shiny, sparsely and coarsely punctate (Fig. S5). Mesonotum strongly shagreened, with shallow punctures. Tergal discs superficially shagreened, silk-shiny, sparsely punctate, interspaces 4-5 puncture diameters medially on disc of T3. Apical margins of T2 and T3 slightly depressed, shagreened, with few, shallow punctures, often light-brown apically. [Females of *A. rufula* are often confused with those of *A.* (*Ptilandrena*) *fulvata*, which can be recognized by the less shiny clypeus with a weak, longitudinal impression medially (sometimes not clearly visible!), by the strongly shagreened and very sparsely punctate terga, and by the medially not depressed apical margins of T2 and T3]. ..... *Andrena rufula*

– Lateral and ventral parts of mesosoma either with at least some dark hairs, or entirely grey-brown, but then mesonotum with some intermixed dark hairs; other characters variables. 8

8 **Prepygidial and pygidial fimbria yellowish-orange** (Fig. 38), at most with a few brown hairs next to pygidial plate. **Hairs on face nearly entirely grey-white**, only a few dark hairs laterally and on vertex (Fig. 19). **Hairs on lateral and ventral parts of mesosoma light grey**, at most with isolated dark hairs. **Labral appendix long, approximately as long as wide apically** (Fig. 21). **Hairs on T1-T4 entirely grey-white, without erect, dark hairs** (Fig. 36). Fovea comparatively broad, broadest width wider than broadest width of flagellum and little narrowed ventrally. Tergal discs entirely finely shagreened (Fig. 36), silk-shiny, regularly sparsely punctate, punctures fine, interspaces 3-4 puncture diameters. Margins of T2-T4 hardly depressed, shagreened..... *Andrena montana*

– Prepygidial and pygidial fimbria dark brown (Fig. 37), never orange (but whitish brown in old specimens). Hairs on face predominantly dark, light brown or grey only between and around antennae. Lateral and ventral sides of mesosoma with extended areas covered with dark hairs. Labral appendix wider than long (Fig. 20). Sculpture variable..... 9

9 **Smallest length of malar space** (without impressed margin close to mandible) **comparatively long, approximately as long as basal width of antennal segment 3** (Fig. 23). **Clypeus laterally convex, medially nearly flat**, densely and coarsely punctate, interspaces conspicuously shiny at least apically (Fig. 18). **Terga entirely shagreened, disc of T2-T4 very sparsely punctate, nearly impunctate medially** (Fig. 35)**; T2 and T3 with apical margin weakly impressed medially** (Fig. 35) [sculpture nearly as in *A.* (*Ptilandrena*) *fulvata*]. **Anterior part of propodeum with comparatively strong wrinkles** (Fig. 32). First recurrent vein enters second submarginal cell in basal half, second submarginal cell usually longer than broad (Fig. 28). Vestiture dark on head (except for some brown hairs on vertex), lateral and ventral sides of mesosoma, and T4-T6. Mesonotum with brown hairs intermixed with some dark hairs that are 2/3 as long as the brown hairs..... *Andrena allosa*

– Malar space shorter (Fig. 22) (in some rare females with particularly long head, malar space nearly as long as in *A. allosa*). Clypeus regularly convex medially (Fig. 17), shiny or shagreened. Sculpture of terga variable, but disc of T2-T4 comparatively more densely punctate (Figs 33, 34); apical margin of T2 and T3 visibly impressed medially (Figs 33, 34). Anterior part of propodeum at most with only fine wrinkles (Fig. 31). First recurrent vein usually enters second submarginal cell in its middle, second submarginal cell usually quadrate (Fig. 27). Mesonotal vestiture variable..... 10

10 **Brown vestiture of mesonotum and usually also of scutellum intermixed with numerous, comparatively long dark brown hairs; dark hairs on average at least half as long as light hairs** (Fig. 26)**. Light hairs on T1-T4 snow white without yellowish hue** (Fig. 33). Hairs on mesonotum greyish brown (Figs 15, 26), never bright orange brown. Hairs laterally and ventrally on mesosoma dark grey to dark brown (Figs 15, 26), but dark hairs often with greyish tips. Propodeum with numerous dark hairs. Hairs on face predominantly dark but always grey between or around antennal sockets (Fig. 16). Sculpture variable, mesonotum sparsely punctate, medially with interspaces up to 3 puncture diameters, punctures well visible (Figs 29, 30), interspaces often silk-shiny medially, never entirely smooth with no sculpture. Tergal discs shagreened and comparatively sparsely punctate (Fig. 33)..... *Andrena amieti* sp. n.

– **Mesonotum either without intermixed dark brown hairs, or with very short dark hairs, then dark hairs on average less than half the length of light hairs** (very rarely longer). **Scutellum without intermixed dark hairs**. **Light hairs on T1-T4 yellowish-brown** (Fig. 34) **in fresh specimens** (but grey-white in worn specimens). Hairs on mesonotum orange-brown in fresh specimens. Hairs laterally and ventrally on mesosoma mostly dark, dark hairs without grey tips, except in second generation, especially in the southern and western Alps; propodeum usually without dark hairs. Hairs on face usually entirely dark, although in the southern and western Alps often with numerous grey-brown hairs in second generation. Sculpture of mesonotum and of terga variable and encompassing variation seen in previous species..... ***A. bicolor***

Males

***Euandrena*:** The delineation of the subgenus *Euandrena* is challenging in males and it is thus advised to use available keys to the genus *Andrena* (e.g., Schmid-Egger and Scheuchl 1997; Amiet et al. 2010) in addition to this diagnosis. Body-length 7–11mm. Integument of clypeus and of terga dark brown. Propodeal triangle at most weakly wrinkled (coarsely wrinkled anteriorly in *A. fulvida*). Third antennal segment usually clearly longer than fourth (except in *A. rufula*). Labral appendix not projecting anteriorly. Apical margin of clypeus regularly rounded, not curved anteriorly. Male genitalia usually simple (Figs 52–61), dorsal gonocoxite lobes short and rounded, penis valves usually narrow basally, their maximal width subequal to apical width of gonostylus (except in *A. fulvida*, Fig. 57 and *A. chrysopus,* Fig. 55), gonostylus not enlarged apically (except in *A. fulvida*, Fig. 57).

1 **Antennal segment 3 as long as segments 4 and 5 together, segment 4 clearly wider than long, segment 5 wider than long to approximately as long as wide**. Entire vestiture brown or grey, especially facial vestiture nearly entirely grey, at most with a few isolated dark hairs laterally..... 2

– Antennal segment 3 shorter than segments 4 and 5 together, segment 4 as long as wide or longer, segment 5 longer than wide. Vestiture variable..... 3

2 Terga shiny and densely punctate, interspaces approximately 1-2 puncture diameters on terga 2-4. Hind basitarsus and usually also hind tibia ferruginous. **Penis valves basally broadened with lateral, angular extension** (Fig. 55)..... ..... *Andrena chrysopus*

– Terga dull with little visible and sparse punctation. Hind basitarsus dark. Penis valves basally without lateral extension (Fig. 56), although broader than in *A. bicolor.* ..... *Andrena symphyti*

3 **Penis valves basally broad, broader than gonostylus apically** (Fig. 57)**. Gonostylus apically broad, spatulate, inner angle nearly quadrate** (Fig. 57). Propodeum anteriorly coarsely wrinkled. Entire body vestiture brown, except a few isolated dark hairs laterally on face. ..... *Andrena fulvida*

– Penis valves basally narrow, subequal to apical width of gonostylus (Figs 52-54, 58-61). Gonostylus apically not broadened (Figs 52-54, 58-61). Propodeum comparatively finely wrinkled anteriorly. Vestiture variable. 4

4 **Apical margin of terga 1-5 ivory coloured** (Figs S6, S7). **Terga impressed basally and apically, thus tergal discs comparatively strongly convex.** Penis valves basally slightly broader than in *A. bicolor*, approximately as broad as apical width of gonostylus (Fig. 58). 5

– **Apical margin of terga 1-5 not ivory-coloured**, at most T3-5 with a narrow, yellowish brown margin. Terga little impressed basally, disc comparatively flat. Width of penis valves variable 6

5 Tergal discs coarsely and densely punctate, on T2 interspaces equal to 2 puncture diameters (Fig. S6). Surface of tergal discs strongly convex, apical margin strongly impressed, separated from disc by an abrupt step even medially (Fig. S6). ..... *Andrena granulosa*

– Tergal discs finely and sparsely punctate, on T2 interspaces equal to 3-4 puncture diameters (Fig. S7). Surface of tergal discs not strongly convex (similar to *A. bicolor*), apical margin weakly impressed, separated from disc medially by a gradual step (Fig. S7). ..... *Andrena vulpecula*

6 **Apex of gonostylus triangular, external angle acute** (Fig. 59). Third antennal segment subequal to or only slightly longer than fourth. Vestiture entirely brown, except a few dark hairs laterally on face. Penis valves slightly broadened basally (Fig. 59). Mesonotum shagreened with little visible punctures. ..... *Andrena rufula*

– Apex of gonostylus rounded, without acute angle (Figs 52-54, 60, 61). Third antennal segment visibly longer than fourth. Vestiture, basal width of penis valves and sculpture of mesonotum and terga variable. 7

7 **Hind tibia usually more or less ferruginous near apex, hind basitarsus sometimes ferruginous** (hind leg rarely entirely dark). **Clypeal vestiture predominantly snow white *and* propodeum laterally with numerous dark hairs.** Clypeus densely and finely punctate, interspaces very narrow, mat. **Sterna with dense apical fringes of snow-white hairs.** Vestiture laterally on mesosoma and on terga predominantly snow white, on mesonotum grey-brown. Terga silk-shiny, punctation very fine, little visible. Penis valves slightly broadened basally (Fig. 60). ..... *Andrena ruficrus*

– Hind tibia and basitarsus dark. Clypeal vestiture dark or light, but *if* light grey-brown (fading to grey-white), *then* propodeum without dark hairs. Clypeus more coarsely punctate, interspaces wider and at least partly shiny (Figs 40-42). Vestiture and basal width of penis valves variable. 8

8 **Facial hairs predominantly grey-white, especially on clypeus, including hairs along apical clypeal margin; dark hairs restricted to area along compound eyes and on frons. Labral appendix longer than apically wide** (Fig. 41). Mesonotum with grey-brown hairs with a yellowish hue in fresh specimens and with isolated, comparatively long intermixed dark hairs. Propodeum and lateral parts of mesosoma without dark hairs. **Penis valves basally slightly enlarged** (difference with the following species only visible in direct comparison!), **its maximal width approximately equal to the width of the gonostylus; apex of gonostylus comparatively narrow, parallel-sided, exterior margin straight or very slightly concave** (Fig. 61). Discs of T2-T5 finely shagreened, silk-shiny, never entirely smooth, finely and regularly punctate, punctures comparatively small. ..... *Andrena montana*

– Facial hairs usually predominantly dark, grey hairs, if present, restricted to area around antennal sockets or to base of clypeus (Figs. 39, 42), hairs along apical clypeal margin predominantly dark. Labral appendix wider than long (Fig. 40). Vestiture on mesosoma variable, at least some dark hairs present laterally. Penis valves narrow basally, not broadened and clearly narrower than apical width of gonostylus; gonostylus apex regularly rounded, external margin convex (Figs 52-54). Sculpture of tergal discs variable, often with smooth and shiny area, or punctation coarser. 9

9 **Light hairs on dorsal parts of mesosoma, terga** (Fig. 51) **and sterna yellowish white in fresh specimens** (although snow white in worn specimens). T2-T4 with comparatively short apical fringes of hairs, long only laterally, fringes medially not longer than apical tergal margin. **Erect hairs on disc of T4 usually predominantly dark** (lighter in worn specimens). Facial vestiture often entirely dark (but frequently light medially in second generation, especially in southern and western parts of the Alps) ..... *Andrena bicolor*

– Light hairs on dorsal parts of mesosoma, terga and sterna snow white, **without yellowish hue even in very fresh specimens** (Figs 39, 50). T2-T4 with comparatively long, snow white apical fringes of hairs, fringes medially clearly longer than apical tergal margin (Fig. 50). **Disc of T4 at most with a few isolated, erect dark hairs**. Face always with some grey-white hairs medially, at least between and around antennal sockets (Figs 39, 42). 10

10 Maxillary palps comparatively longer, segments 4 and 5 at least four times as long as maximal apical width (Fig. 45). Body length 8.5mm. First recurrent vein entering second submarginal cell comparatively closer to first submarginal crossvein (Fig. 49), second submarginal cell broader than long. Head comparatively long with protruding clypeus (Fig. 43). Mesonotum matt, without extended silk-shiny area medially (as on Fig. 46). ..... *Andrena allosa*

– Maxillary palps comparatively shorter, segments 4 and 5 at most three times as long as maximal apical width (Fig. 44). Slightly smaller, body length on average 7-8mm. First recurrent vein entering second submarginal cell comparatively

closer to middle of cell, second submarginal cell often subquadrate (Fig. 48). Head comparatively short with little protruding clypeus (Fig. 42). Sculpture of mesonotum variable, in first generation matt (Fig. 46), in second generation with extended silk-shiny area medially (Fig. 47)..... *Andrena amieti* **sp. n.**

(Only two males of *A. allosa* were examined and the characters mentioned to distinguish *A. allosa* from *A. amieti* sp. n. are tentative.)

Additional taxonomic notes on selected *Andrena (Euandrena)* species

Andrena croatica Friese, 1887, stat. rev.

Suppl. material 3: Figs S8, S9

Andrena croatica Friese 1887: 85, ♀, ♂, "Prope Orechovicam non procul ab urbe St. Veithii, mense Martio" [Near Orehovica (nowadays a district of Rijeka), not far from the city of St. Veith (Rijeka, Croatia) month of March]. Syntypes ♀♀♂♂ (NMBE, OLML, ZMHB).

Notes. We examined two possible syntype females of *Andrena croatica*, which perfectly agree with the original description. No specimen was available for genetic study. These two females are markedly divergent from *A. bicolor*, and thus *A. croatica*, which is currently considered as a synonym of *A. bicolor* (Gusenleitner and Schwarz 2002), probably represents a valid species (stat. rev.). Striking divergent features in the female sex include the white scopa, the fine, regular punctation of the terga (Suppl. material 3: Fig. S9), the mesonotal vestiture comprising intermixed grey-brown hairs and numerous, comparatively long, dark hairs, and the numerous dark hairs on the propodeum. This species also has long mouthparts approaching the condition observed in *A. allosa* (Suppl. material 3: Fig. S8). The male is unknown to us.

Examined material. 2 possible syntype females from Fiume [Croatia, Rijeka] and an additional female from Croatia (Suppl. material 1).

Andrena pileata Warncke, 1975, stat. n.

Suppl. material 3: Figs S10–S12

Andrena allosa pileata Warncke 1975b: 85, ♀ nec ♂, "Chelmos, Peloponnes" [Chelmos mountains, Greece]. Holotype ♀, OLML.

Notes. Warncke (1975b) described *Andrena allosa pileata* from the Chelmos mountains in Greece. The type series of *A. allosa pileata* is mixed and includes two distinct species. The first species, represented by the holotype, is briefly redescribed here. No specimen was available for genetic study. This first species appears clearly distinct from *A. allosa* and *A. amieti* sp. n., and we treat it as a valid species, *A. pileata* Warncke stat. n.

Description. Female: Body length 9mm. Clypeus shorter than in *A. allosa*, as in *A. bicolor*, without flattened apical area, regularly convex, densely punctate, interspaces weakly shagreened even apically (Suppl. material 3: Fig. S10). Malar space as in *A. bicolor*, shorter than in *A. allosa*. Fovea as in *A. bicolor* or *A. allosa*, markedly narrower inferiorly than superiorly. Mesonotum nearly entirely matt, silk-shiny only medially, comparatively densely punctate, except medially (there interspaces up to 3–4 puncture diameters). Terga entirely shagreened, finely, regularly punctate even medially on discs, interspaces 3 puncture diameters (Suppl. material 3: Fig. S12). Apical tergal margins weakly impressed apically, more so than in *A. allosa*. The sculpture of the terga is similar to that of *A. ruficrus* and unlike *A. amieti* sp. n. or *A. allosa*. Vestiture predominantly brown (both specimens are not fresh), medially on face grey-brown, laterally dark; vestiture on mesonotum orange-brown, made of comparatively short, strongly plumose hairs, with only few, very short dark hairs (Suppl. material 3: Fig. S11). Hairs on lateral and ventral sides of mesosoma grey-brown. Scopa brown-orange. Hairs on metasoma comparatively short, metasomal terga without loose apical fringes of white hairs, at most with isolated, short hairs (Suppl. material 3: Fig. S12).

Male: unknown; the male paratype is likely not conspecific and probably belong to *Andrena* sp1.

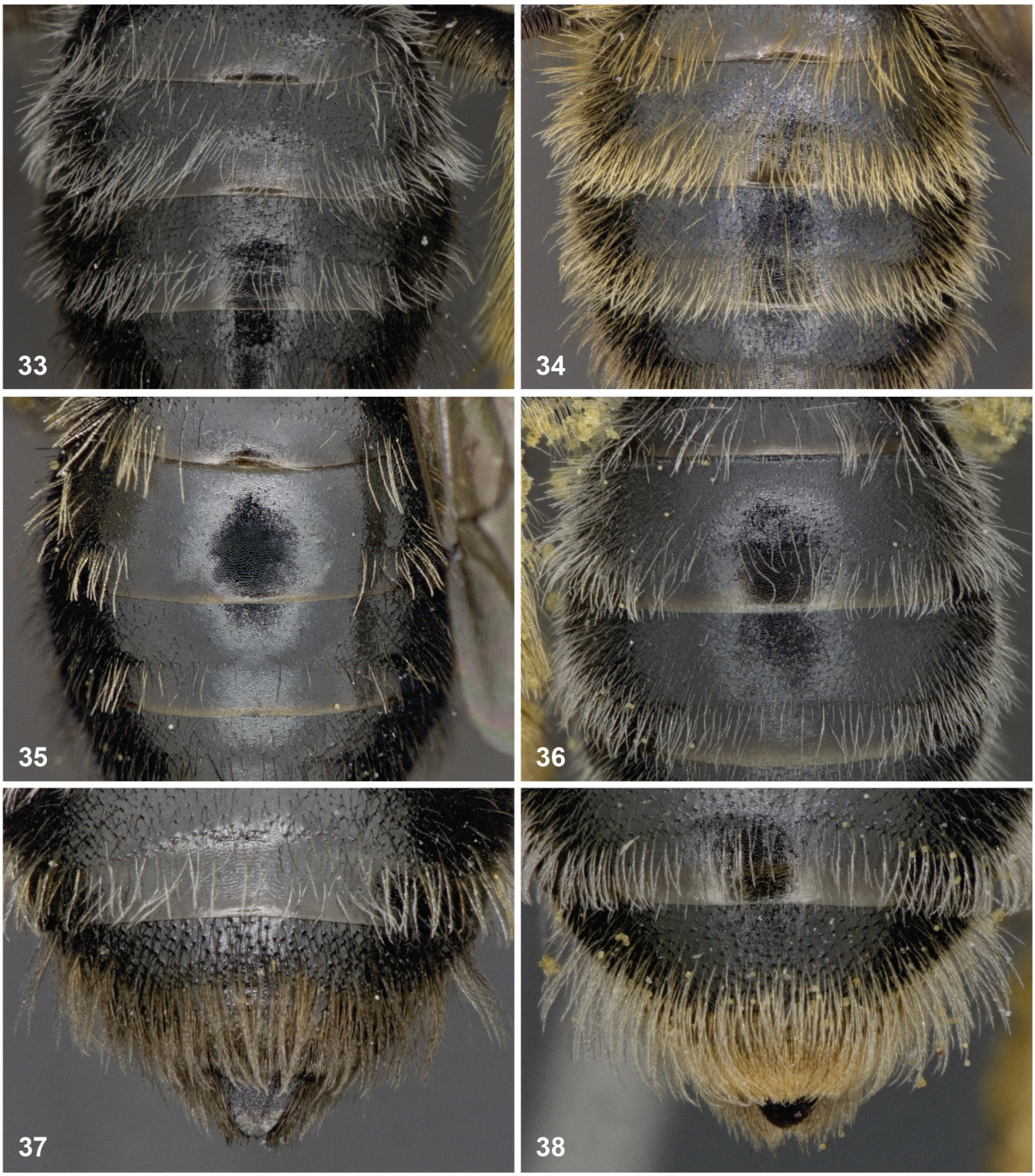
Examined material. Holotype female of *A. pileata*; one additional female from the Chelmos mountains, Greece (Suppl. material 1).

Andrena sp1

Suppl. material 3: Figs S13–S15

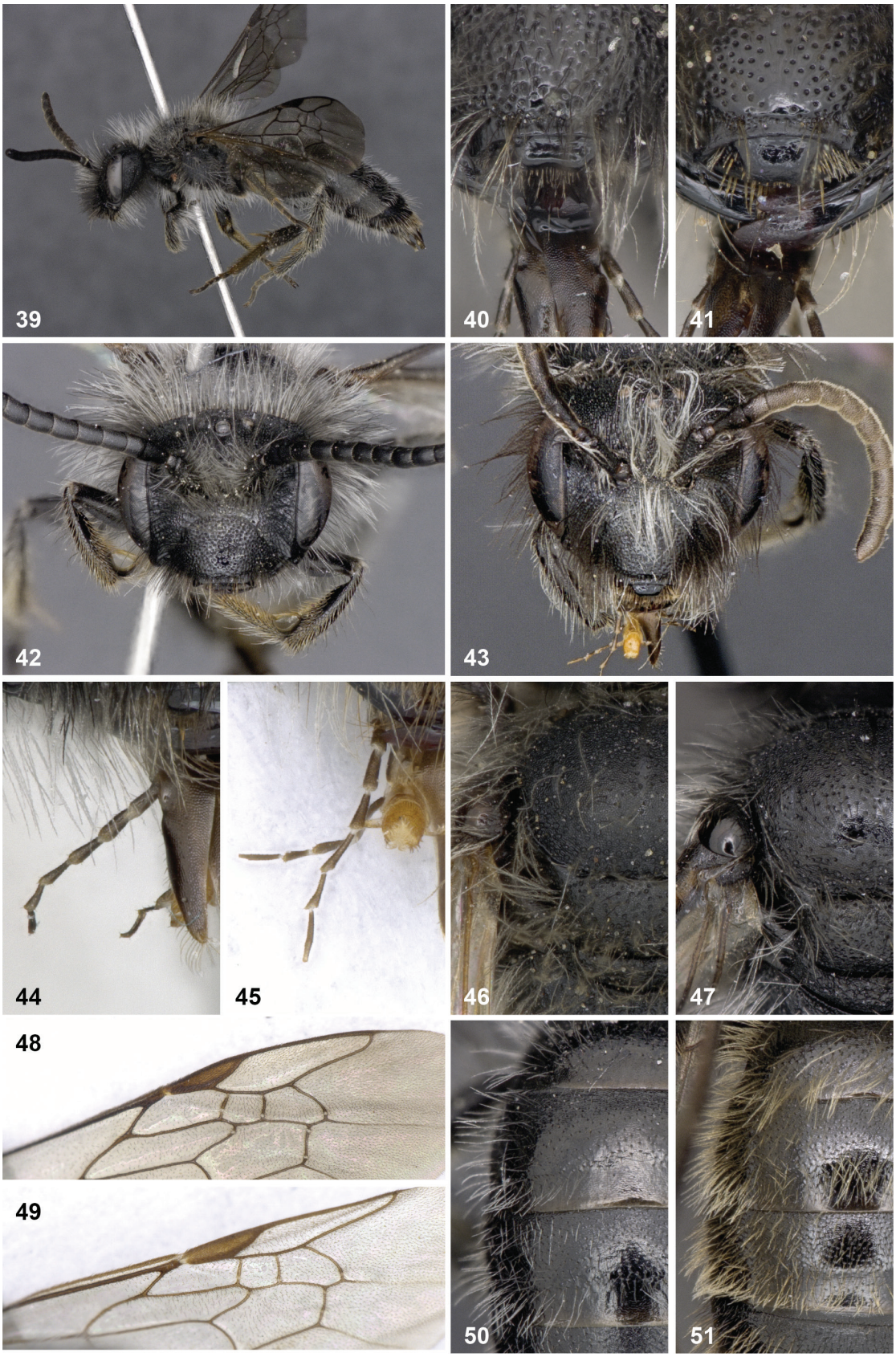
Andrena allosa pileata Warncke, 1975b, *partim*

Notes. The second species included in the type series of *Andrena allosa pileata* is referred to as *Andrena* sp1. This species shares similarities with both *A. amieti* sp. n. and *A. allosa*. It is superficially similar to specimens of *A. amieti* sp. n. from Southern Italy (Suppl. material 2: Fig. S1), which have entirely grey vestiture even in the female sex. Two specimens were available for genetic study (specimens 961 and 1252; Figs 1, 2). These two specimens were closely related to *A. allosa* and separated from that species by a genetic distance of 1.82%. We do not consider this species to be conspecific with *A. amieti* sp. n. for three reasons: first, genetic distances to *A. amieti* sp. n. (4.27%) were higher than to *A. allosa*; second, based on the available material, this species appears to have only one generation per year unlike *A. amieti* sp. n.; third, there are slight, but consistent morphological differences compared to *A. amieti* sp. n. *Andrena* sp1 is characterized as follows:



Figures 33–38. Structure of female of *Andrena amieti* sp. n., *A. bicolor*, *A. allosa* and *A. montana*. **33**, T1–T4 of *A. amieti* sp. n. **34**, T1–T4 of *A. bicolor*. **35**, T1–T4 of *A. allosa*. **36**, T1–T4 of *A. montana*. **37**, prepygidial and pygidial fimbria of *A. amieti* sp. n. **38**, prepygidial and pygidial fimbria of *A. montana*.

Description. Female: Body size, 7–8mm. Clypeus shorter than in *A. allosa*, as in *A. bicolor*, without flattened apical area, in most specimens, apical area with irregular, longitudinal concavity (not clearly visible on Suppl. material 3: Fig. S15). Clypeus less densely punctate than in *A. pileata* stat. n., interspaces shinier, very weakly shagreened or completely shiny medially (Suppl. material 3: Fig. S15). Malar space as in *A. bicolor*, shorter than in *A. allosa*. Fovea as in *A. bicolor* or *A. allosa*, markedly narrower inferiorly than superiorly. Mesonotum nearly entirely matt, finely sculptured, silk-shiny medially, comparatively sparsely punctate, interspaces medially up to 5 puncture diameters. Terga weakly shagreened, entirely silk-shiny, shinier than in *A. allosa*, irregularly, very sparsely punctate to nearly impunctate, apical margin weakly impressed apically (Suppl. material 3: Fig. S14)



Figures 39–51. Structure of male of *Andrena amieti* sp. n., *A. montana*, *A. allosa* and *A. bicolor*. **39**, male of *A. amieti* sp. n. in lateral view. **40**, labrum of *A. amieti* sp. n. **41**, labrum of *A. montana*. **42**, male of *A. amieti* sp. n. in frontal view. **43**, male of *A. allosa* in frontal view. **44**, section of mouthparts of *A. amieti* sp. n. **45**, section of mouthparts of *A. allosa*. **46**, dorsal view of mesosoma of spring generation of *A. amieti* sp. n. **47**, dorsal view of mesosoma of summer generation of *A. amieti* sp. n. **48**, section of right forewing of *A. amieti* sp. n. **49**, section of right forewing of *A. allosa*. **50**, T1–T4 of *A. amieti* sp. n. **51**, T1–T4 of *A. bicolor*.



Figures 52–61. Male genitalia of species of *Euandrena*. **52**, *Andrena amieti* sp. n. **53**, *A. bicolor*. **54**, *A. allosa*. **55**, *A. chrysopus*. **56**. *A. symphyti*. **57**, *A. fulvida*. **58**, *A. vulpecula*. **59**, *A. rufula*. **60**, *A. ruficrus*. **61**, *A. montana*.

although more so than in *A. allosa*. Vestiture predominantly white-grey, without yellowish or orange hue (Suppl. material 3: Figs S13, S14). Face darker than in *A. pileata* stat. n., grey only around antennal sockets. Vestiture on mesonotum predominantly grey, made of comparatively long, weakly plumose grey hairs and numerous, comparatively long dark hairs (Suppl. material 3: Fig. S13) (as in *A. amieti* sp. n. but unlike *A. pileata* stat. n.). Hairs on lateral side of mesosoma dark, on ventral side grey. Scopa white. Hairs on metasoma comparatively long, nearly entirely whitish grey, except dark on disc of T4, and on T5 and T6. The most distinctive features are the white scopa, the grey mesonotal vestiture with long, dark hairs, and the nearly impunctate terga.

Male: No difference was found between the three males examined and the first generation of *A. amieti* sp. n.

Examined material. 3 males and 10 females from the Chelmos Mountains, the Mount Olympus and the Mount Tymfristos, Greece (Suppl. material 1).

Andrena sp2

Suppl. material 4: Figs S16, S17

Notes. One female specimen from Lesbos included in our genetic study (specimen 1254) is morphologically distinct from both *A. pileata* stat. n. and *Andrena* sp1 and is referred to as *Andrena* sp2. In the female sex, it is similar to *Andrena* sp1, except that the clypeus lacks the longitudinal impression (Suppl. material 4: Fig. S17) observed in *Andrena* sp1, the mesonotum is more densely punctate, the terga are more shiny (disc of T1 and T2 nearly completely shiny; Suppl. material 4: Fig. S16) and more clearly punctate. The mesonotum has grey-brown vestiture, the hairs are weakly plumose, there are a few long dark hairs on the mesonotum and numerous dark hairs on the propodeum. The scopa is yellowish white, in contrast to *Andrena* sp1. Male unknown.

Examined material. 2 females from two localities on the Island of Lesbos, Greece (Suppl. material 1).

Andrena sp3

Suppl. material 4: Figs S18, S19

Notes. Specimen 928 in our genetic dataset, a female collected in Greece, appears to be morphologically distinct from *A. bicolor* and from any taxa mentioned above. In addition, we have examined a series of females from the Island of Lesbos, as well as one female from Northern Italy, all of which putatively belong to *Andrena* sp3. This species is presumably widely distributed in southeastern Europe. In the female sex, *Andrena* sp3 is similar to some forms of *A. bicolor*. The vestiture is nearly entirely brown-orange, including on all sides of the mesosoma, with only a few dark hairs laterally on face (Suppl. material 4: Fig. S19), on the disc of T4, as well as numerous dark hairs on T5 and T6. The mesonotum

is conspicuously shiny with coarse and dense punctation (Suppl. material 4: Fig. S18). In its vestiture this species is highly similar to *A. rufula*, from which it can easily be separated by the shiny sculpture of the mesonotum. Male unknown to us.

Examined material. 5 females from the Island of Lesbos, Greece; 1 female from the Peloponnese, Greece; one female from northwestern Italy (Suppl. material 1).

Discussion

Species delimitation in the *bicolor*-group

The taxonomy of the *bicolor*-group in the Alps has long remained controversial. In light of our results, there appears to be little doubt that four well-separated biological species co-occur in the Alps, for the following reasons. First, DNA barcodes are diagnostic for each of these species in spite of the observed paraphyly in *Andrena amieti* sp. n. in mitochondrial trees (Fig. 1); these distinct barcodes were concordant with morphology in all cases, suggesting no mitochondrial introgression. Second, all four species occur in sympatry and maintain distinct morphology. *Andrena montana* differs from the other three species in numerous sculptural characters in addition to conspicuous characters in vestiture colour; similarly, this species was only distantly related to the other three species (Figs 1, 2). *Andrena allosa* differs from *A. bicolor* and *A. amieti* sp. n. in subtle but constant sculptural characters in the female, while *A. amieti* sp. n. and *A. bicolor* can be distinguished by constant differences in vestiture colour. Third, *A. allosa* and *A. montana* have a single generation per year while *A. bicolor* and *A. amieti* sp. n. have two generations per year. Fourth, *A. allosa* differs from *A. bicolor* and *A. amieti* sp. n. in its pollen host choice: the second generation of the latter two species have a pronounced affinity for Campanulaceae, a pollen type that is completely absent from the pollen diet of *A. allosa*.

These clear differences in morphology and life-history traits are in contradiction with the results of our analyses of the nuclear gene, where one specimen of *A. allosa* (1285; Fig. 2) was not separated from some specimens of *A. amieti* sp. n. *A. amieti* sp. n. and *A. allosa* have probably diverged recently, and the observed pattern in the nuclear gene sequences is likely due to either lack of variation in the selected marker, incomplete lineage sorting or rare instances of horizontal gene flow, all of which are expected to occur in complexes of closely related species.

While our study solves a long controversy in the systematics of central European bees, it also raises additional questions that will require future work. In both *A. bicolor* and *A. amieti* sp. n., two distinct clusters of sequences were found in phylogenetic analyses of COI. In both cases these two clusters were found in sympatry and they conflict with current species concepts. The same two clades occurring in sympatry within *A. bicolor* were previously reported (Schmidt et al. 2015). Based on available sequences on BOLD these two clades appear to be widespread in Europe. In contrast to the situation in *A. bicolor* where both clades are sister groups, the two clusters found in *A. amieti* sp. n. form a paraphyletic unit with respect to a distinct biological species occurring in sympatry, *A. allosa*.

Two hypotheses can be formulated to explain these discrepancies between mitochondrial gene trees and species trees (Mutanen et al. 2016). First, these clusters may point to additional cryptic diversity. For example, species paraphyly in the pierid butterfly *Leptidea reali* Reissinger, 1989 has recently been demonstrated to be due to the presence of an additional cryptic species, *L. juvernica* Williams, 1946 (Dincă et al. 2011). Second, these clusters may merely represent deep intraspecific divergences within one biological species, without reproductive isolation between mitochondrial lineages. Such a situation has been suggested for two divergent clades within the Common Redstart *Phoenicurus phoenicurus* (Linnaeus, 1758) (Hogner et al. 2012) and for the paper wasp *Polistes dominula* (Christ, 1791) (Neumeyer et al. 2014, Schmid-Egger et al. 2017). To discriminate between these two alternative hypotheses for the *bicolor*-group, future research is needed, ideally using genomic-scale, nuclear markers.

Our study reveals that there are probably five additional species in the *bicolor*-group in southeastern Europe: *A. croatica* stat. rev., *A. pileata* stat. n., *Andrena* sp1, *Andrena* sp2 and *Andrena* sp3. How these species relate to *A. allosa*, *A. amieti* sp. n., or to additional species from Eastern Europe (*A. asperula* Osytshnjuk, 1977 from Ukraine) or from the East Palearctic (e.g., *A. capilosella* Osytshnjuk, 1986, *A. khosrovi* Osytshnjuk, 1993), remains unclear and requires future investigation. We strongly recommend the use of genetic analyses to clarify the taxonomy of these challenging taxa.

Delimitation of *Euandrena* and *Ptilandrena*

Our study suggests that *Andrena fulvata* and the closely related *A. angustior*, currently placed in the subgenus *Ptilandrena*, may in fact belong to the subgenus *Euandrena*. These two species differ from other species of *Euandrena* in the long mandibles of the male and the presence of an elevated carina on the pronotum in both sexes. They differ from other members of *Ptilandrena* such as *A. vetula* Lepeletier, 1841, in the narrow facial fovea of the female, a character shared with species of *Euandrena*. Future studies should examine the phylogenetic placement of other members of the morphologically heterogeneous subgenus *Ptilandrena*.

Pollen host preferences

The high proportion of *Crocus* pollen in the larval diet of *Andrena allosa* was unexpected. *Crocus albiflorus*, which is the only native *Crocus* species in the Central

Alps, starts to bloom immediately after the snowmelt (Fig. 9). The early flight period of *A. allosa* in combination with its restricted host plant choice might explain why this bee species has so rarely been found in the past. We hypothesize that *A. allosa* will turn out to be more common than hitherto assumed when flowering *Crocus* stands will be systematically checked for the presence of this species.

Surprisingly, the spring and summer generations of the bivoltine *A. amieti* sp. n. distinctly differ in their pollen host selection in that the females of the latter exhibit a strong preference for the pollen of Campanulaceae. This preference is also suggested by our observations that males of the summer generation patrolled *Campanula* flowers in their search for females and that summer generation males and females visited *Geranium sylvaticum* (Geraniaceae). The latter observation is in agreement with the finding that *Geranium* was the second most important pollen host of the summer generation (Tab. 3). *Geranium* flowers often serve as a source of nectar or a "rendezvous" point for oligolectic bees specialized on *Campanula*, such as *Andrena curvungula* Thomson, 1870, *A. pandellei* Pérez, 1895 or *Chelostoma rapunculi* (Lepeletier, 1841), which might possibly be due to similar colour or olfactory cues exerted by the flowers of the two unrelated taxa. Attraction to similar cues might also explain why *Geranium* is regularly visited by *A. amieti* sp. n. Interestingly, a preference for Campanulaceae was also reported for the summer generation of the bivoltine *A. bicolor*, which is closely related to *A. amieti* sp. n. (Stöckhert in Schmiedeknecht 1930, Müller et al. 1997, Peeters et al. 2012, Scheuchl and Willner 2016). Differing pollen host choice by spring and summer generations of the same species as in *A. amieti* sp. n. and *A. bicolor* suggest that the two generations have evolved their own phenotypes as a result of different selection regimes in spring and summer (Simpson et al. 2011). In a recent study, however, Milet-Pinheiro et al. (2016) did not detect seasonal polyphenism in *A. bicolor* and found instead that females of the first and the second generation have the same innate flower search image in spite of the different spectrum of pollen hosts they exploit.

Conclusion

Genetic analyses, in combination with morphological analysis, were decisive in solving an important controversy in the taxonomy of European wild bees. However, our study also raised new questions, in particular the intriguing case of paraphyly observed in mitochondrial gene trees in *Andrena amieti* sp. n. This new species appears to be the tip of the iceberg of cryptic diversity in southern Europe. Time and funds should be dedicated to taxonomic research on wild bees in species-rich Mediterranean ecosystems.

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References

Abràmoff MD, Magalhães PJ, Ram SJ (2004) Image Processing with ImageJ. Biophotonics International 11: 36–42.

Amiet F, Hermann M, Müller A, Neumeyer R (2010) Apidae 6, *Andrena*, *Melliturga*, *Panurginus*, *Panurgus*. Fauna Helvetica 26, CSCF & SEG, Neuchâtel, 316 pp.

Andriollo T, Naciri Y, Ruedi M (2015) Two Mitochondrial Barcodes for one Biological Species: The Case of European Kuhl's Pipistrelles

(Chiroptera). Plos One 10: e0134881. https://doi.org/10.1371/journal.pone.0134881

Artmann-Graf G (2017) Zwei Erstfunde von *Andrena rufula* Schmiedeknecht, 1883 in der Schweiz (Hymenoptera, Apoidea). Ampulex 9: 40–41.

Chakrabarty P, Warren M, Page L, Baldwin C (2013) GenSeq: An updated nomenclature and ranking for genetic sequences from type and non-type sources. ZooKeys 346: 29–41. https://doi.org/10.3897/zookeys.346.5753

Danforth BN, Brady SG, Sipes SD, Pearson A (2004) Single-copy nuclear genes recover cretaceous-age divergences in bees. Systematic Biology 53: 309–326. https://doi.org/10.1080/10635150490423737

Dincă V, Lukhtanov VA, Talavera G, Vila R (2011) Unexpected layers of cryptic diversity in wood white *Leptidea* butterflies. Nature Communications 2: 324. https://doi.org/10.1038/ncomms1329

Else GR, Edwards M (2018) Handbook of the Bees of the British Isles. Ray Society Monographs, The Ray Society, c/o The Natural History Museum, London, 775 pp.

Friese H (1887) Species aliquot novae generis *Andrena* FABR. Természetrajzi Füzetek 11: 21–26.

Gusenleitner F, Schwarz M (2002) Weltweite Checkliste der Bienengattung *Andrena* mit Bemerkungen und Ergänzungen zu paläarktischen Arten (Hymenoptera, Apidae, Andreninae, *Andrena*). Entomofauna, Supplement 10, 1280 pp.

Hebert PDN, Penton EH, Burns JM, Janzen DH, Hallwachs W (2004) Ten species in one: DNA barcoding reveals cryptic species in the neotropical skipper butterfly *Astraptes fulgerator*. Proceedings of the National Academy of Sciences 101: 14812–14817. https://doi.org/10.1073/pnas.0406166101

Hogner S, Laskemoen T, Lifjeld JT, Porkert J, Kleven O, Albayrak T, Kabasakal B, Johnsen A (2012) Deep sympatric mitochondrial divergence without reproductive isolation in the common redstart *Phoenicurus phoenicurus*. Ecology and Evolution 2: 2974–2988. https://doi.org/10.1002/ece3.398

Katoh K, Standley DM (2013) MAFFT multiple sequence alignment software version 7: improvements in performance and usability. Molecular Biology and Evolution 30: 772–780. https://doi.org/10.1093/molbev/mst010

Kearse M, Moir R, Wilson A, Stones-Havas S, Cheung M, Sturrock S, Buxton S, Cooper A, Markowitz S, Duran C, Thierer T, Ashton B, Meintjes P, Drummond A (2012) Geneious Basic: an integrated and extendable desktop software platform for the organization and analysis of sequence data. Bioinformatics 28: 1647–1649. https://doi.org/10.1093/bioinformatics/bts199

Klopfstein S, Kropf C, Baur H (2016) *Wolbachia* endosymbionts distort DNA barcoding in the parasitoid wasp genus *Diplazon* (Hymenoptera: Ichneumonidae). Zoological Journal of the Linnean Society 177: 541–557. https://doi.org/10.1111/zoj.12380

Lunt DH, Zhang DX, Szymura JM, Hewitt GM (1996) The insect cytochrome oxidase I gene: evolutionary patterns and conserved primers for phylogenetic studies. Insect Molecular Biology 5: 153–165. https://doi.org/10.1111/j.1365-2583.1996.tb00049.x

Maddison WP, Maddison DR (2018) Mesquite: a modular system for evolutionary analysis. Version 3.51. http://www.mesquiteproject.org

Michener CD (2007) The Bees of the World, second edition. Johns Hopkins University Press, Baltimore, Maryland, 953 pp.

Milet-Pinheiro P, Herz K, Dötterl S, Ayasse M (2016) Host choice in a bivoltine bee: how sensory constraints shape innate foraging behaviors. BMC Ecology 16: 20. https://doi.org/10.1186/s12898-016-0074-z

Miller MA, Pfeiffer W, Schwartz T (2010) Creating the CIPRES science gateway for inference of large phylogenetic trees. Proceedings of the Gateway Computing Environments Workshop (GCE), New Orleans LA, USA.

Müller A (2018) Pollen host selection by predominantly alpine bee species of the genera *Andrena*, *Panurginus*, *Dufourea*, *Megachile*, *Hoplitis* and *Osmia* (Hymenoptera, Apoidea). Alpine Entomology 2: 101–113. https://doi.org/10.3897/alpento.2.29250

Müller A, Krebs A, Amiet F (1997) Bienen - Mitteleuropäische Gattungen, Lebensweise, Beobachtung. Naturbuch Verlag, Augsburg. 384 pp.

Müller A, Kuhlmann M (2008) Pollen hosts of western palaearctic bees of the genus *Colletes* (Colletidae) – the Asteraceae paradox. Biological Journal of the Linnean Society: 95, 719–733. https://doi.org/10.1111/j.1095-8312.2008.01113.x

Mutanen M, Kivelä SM, Vos RA, Doorenweerd C, Ratnasingham S, Hausmann A, Huemer P, Dincă V, van Nieukerken EJ, Lopez-Vaamonde C, Vila R, Aarvik L, Decaëns T, Efetov KA, Hebert PD, Johnsen A, Karsholt O, Pentinsaari M, Rougerie R, Segerer A, Tarmann G, Zahiri R, Godfray HC (2016) Species-Level Para- and Polyphyly in DNA Barcode Gene Trees: Strong Operational Bias in European Lepidoptera. Systematic Biology 65: 1024–1040. https://doi.org/10.1093/sysbio/syw044

Neumeyer R, Baur H, Guex GD, Praz C (2014) A new species of the paper wasp genus *Polistes* (Hymenoptera, Vespidae, Polistinae) in Europe revealed by morphometrics and molecular analyses. ZooKeys (400): 67–118. https://doi.org/10.3897/zookeys.400.6611

Nicholls JA, Challis RJ, Mutun S, Stone GN (2012) Mitochondrial barcodes are diagnostic of shared refugia but not species in hybridizing oak gallwasps. Molecular Ecology 21: 4051–4062. https://doi.org/10.1111/j.1365-294X.2012.05683.x

Peeters TMJ, Nieuwenhuijsen H, Smit J, van der Meer F, Raemakers IP, Heitmans WRB van Achterberg C, Kwak M, Loonstra AJ, de Rond J, Roos M, Reemer M (2012) De Nederlandse Bijen (Hymenoptera: Apidae s.l.). Natuur van Nederland 11, Naturalis Biodiversity Center and European Invertebrate Survey, Leiden, 544 pp.

Scheuchl E, Willner W (2016) Taschenlexikon der Wildbienen Mitteleuropas. Quelle & Meyer, Wiebelsheim, 920 pp.

Schmid-Egger C (2012) Die taxonomischen Situation der Gattung *Andrena* (Apidae) in Mitteleuropa – Kommentar zu: Amiet et al. (2010): Fauna Helvetica, Apidae 6. Ampulex 4: 55–60.

Schmid-Egger C, Scheuchl E (1997) Illustrierte Bestimmungstabellen der Wildbienen Deutschlands und Österreichs unter Berücksichtigung der Arten der Schweiz, Band III, Andrenidae. Eigenverlag, Velden/Vils, 180 pp.

Schmid-Egger C, van Achterberg K, Neumeyer R, Morinière J, Schmidt S (2017) Revision of the West Palaearctic *Polistes* Latreille, with the descriptions of two species - an integrative approach using morphology and DNA barcodes (Hymenoptera, Vespidae). ZooKeys (713): 53–112. https://doi.org/10.3897/zookeys.713.11335

Schmidt S, Schmid-Egger C, Morinière J, Haszprunar G, Hebert PD (2015) DNA barcoding largely supports 250 years of classical taxonomy: identifications for Central European bees (Hymenoptera, Apoidea partim). Molecular Ecology Resources 15: 985–1000. https://doi.org/10.1111/1755-0998.12363

Schmiedeknecht O (1930) Die Hymenopteren Nord- und Mitteleuropas. Gustav Fischer, Jena. 1062 pp.

Simpson SJ, Sword GA, Lo N (2011) Polyphenism in Insects. Current Biology 21: 738–49. https://doi.org/10.1016/j.cub.2011.06.006

Stamatakis A (2014) RAxML version 8: a tool for phylogenetic analysis and post-analysis of large phylogenies. Bioinformatics 30: 1312–1313. https://doi.org/10.1093/bioinformatics/btu033

Swofford DL (2002) PAUP 4.0 Phylogenetic Analysis using Parsimony (and other Methods). Version 4. Sinauer Associates, Sunderland.

Trunz V, Packer L, Vieu J, Arrigo N, Praz CJ (2016) Comprehensive phylogeny, biogeography and new classification of the diverse bee tribe Megachilini: Can we use DNA barcodes in phylogenies of large genera? Molecular Phylogenetics and Evolution 103: 245–259. https://doi.org/10.1016/j.ympev.2016.07.004

Warncke K (1973) Beitrag zur Bienenfauna Mazedoniens (Colletidae, Andrenidae und Melittidae/Apoidea). Mitteilungen aus dem Zoologischen Museum in Berlin 49: 13–36.

Warncke K (1975a) Die Bienengattung *Andrena* F., in Iberien (Hym. Apidae). Teil A. Eos 49: 293–314.

Warncke K (1975b) Die Sandbienen der Türkei (Hymenoptera. Apoidea, Andrena). Mitteilungen der Münchner Entomologischen Gesellschaft 65: 29–102

Westrich P (2006) Ein weiterer Beleg für den Bivoltinismus und das Wirt-Parasit-Verhältnis von *Andrena bicolor* (FABRICIUS 1804) und *Nomada fabriciana* (KIRBY 1802) (Hym. Apidae). Linzer biologische Beiträge 38: 919–923.

Westrich P (2018) Die Wildbienen Deutschlands. Ulmer, Stuttgart, 824 pp.

Supplementary material 1

Database for all specimens examined in this study (Occurences)

Authors: Christophe Praz, Andreas Müller, David Genoud
Data type: specimens data
Explanation note: Complete database including all examined specimens of *Andrena allosa*, *A. amieti* sp. n. (including holotype and paratypes), *A. croatica* stat. rev., *A. montana*, *A. pileata* stat. n., and the three unclear taxa referred to as *Andrena* sp1, sp2 and sp3.
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Link: https://doi.org/10.3897/alpento.3.29675.suppl1

Supplementary material 2

Supplementary figures S1-S7

Authors: Christophe Praz, Andreas Müller, David Genoud
Data type: multimedia
Explanation note: Fig. S1, female paratype of *Andrena amieti* sp. n. from Southern Italy, lateral view. Fig. S2, clypeus of *A. symphyti* female. Fig. S3, T1–T3 of *A. granulosa* female. Fig. S4, T1–T4 of *A. vulpecula* female. Fig. S5, head of *A. rufula* female in frontal view. Fig. S6, T1–T3 of *A. granulosa* male. Fig. S7, T1–T3 of *A. vulpecula* male.
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Link: https://doi.org/10.3897/alpento.3.29675.suppl2

Supplementary material 3

Supplementary figures S8-S15

Authors: Christophe Praz, Andreas Müller, David Genoud
Data type: multimedia
Explanation note: Fig. S8, mouthparts of *Andrena croatica* stat. rev. female. Fig. S9, T1–T3 of *A. croatica* stat. rev. female. Fig. S10, head in frontal view of *A. pileata* stat. n. female. Fig. S11, vestiture on mesonotum and scutellum of *A. pileata* stat. n. female. Fig. S12, T1–T3 of *A. pileata* stat. n. female. Fig. S13, vestiture on mesonotum and scutellum of *Andrena* sp1 female. Fig. S14, T1–T4 of *Andrena* sp1 female. Fig. S15, head in frontal view of *Andrena* sp1 female.
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Supplementary material 4

Supplementary figures S16-S19

Authors: Christophe Praz, Andreas Müller, David Genoud
Data type: multimedia
Explanation note: Fig. S16, T1–T4 of *Andrena* sp2 female. Fig. S17, head in frontal view of *Andrena* sp2 female. Fig. S18, mesosoma in dorsal view of *Andrena* sp3 female. Fig. S19, head in frontal view of *Andrena* sp3 female.
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Fire and windthrow in forests: Winners and losers in Neuropterida and Mecoptera

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Abstract

The mid-term impact of forest fires and windthrows on species compositions in the insect orders Neuroptera, Raphidioptera, and Mecoptera was assessed in Swiss forests using standardized flight interception traps. For 50 species the abundances in intact control plots were compared to those in moderately or strongly disturbed forest stands. The catches were combined over four forest disturbance projects, ranging from windthrows in alpine spruce forests and lowland deciduous forests to winter forest fires in Southern Switzerland and a large summer fire in southwestern Switzerland. As a result, 82% of the 50 species benefited from the disturbance and became more abundant in the years after the fire or windthrow. More species (19) had their maximum abundance in intermediately disturbed plots than in heavily disturbed forests (17). Only 11 species, mainly Hemerobiidae and Coniopterygidae, peaked in the undisturbed forest stands. The species are listed per impact and ranked as winners (more than 66% specimens per treatment collected in disturbed forest plots), losers (more than 66% specimens per treatment in undisturbed forest plots), and indifferent species. An additional 29 species that were too scarce for an assessment are listed in Appendix 1. We conclude that for Neuropterida and Mecoptera catastrophic incidences are natural ecological events which create new habitats and by this foster their occurrence and abundance.

Introduction

Natural disturbances such as strong storms causing windthrow in forests or wildfires destroying the vegetation have a drastic impact on the survival of plants and animals (Schelhaas et al. 2003). While a catastrophe for forestry, such stochastic or recurring disturbances are natural phenomena that have led to well-adapted communities of plants and animals. After Bond and Keeley (2005), fire in natural ecosystems is a significant evolutionary force. Research after forest fires and windthrows have shown that many species are benefiting from natural disturbances (Wermelinger et al. 1995, 2002, 2017, Moretti et al. 2002, 2006, 2010, Bouget and Duelli 2004), or even depend on them for their long-term survival (e.g. Ressl 1969, Bond and Keeley 2005).

Apart from earlier more general assessments of Neuropterida survival in three of the four projects presented here (Duelli et al. 2002a, Moretti et al. 2006, 2010, Wermelinger et al. 2017), we were not able to find published information on natural disturbances such as forest fire or windthrow affecting populations of Neuropterida or Mecoptera. While a broad range of arthropod orders and families have been sampled in the projects described here, the present paper is limited to the insect orders Neuroptera, Raphidioptera, and Mecoptera (Megaloptera were absent). These small orders (Aspöck et al. 1980, Willmann 1989) are very ancient clades. The species are mainly predaceous both as adults and larvae and preferentially feed on soft-bodied arthropods. The aim here is to present a detailed assessment of natural disturbances on populations of abundant species of Neuroptera, Raphidioptera, and Mecoptera.

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Materials and methods

Collecting method

Two similar types of trap stations were used for sampling Neuroptera, Raphidioptera, and Mecoptera. In the windthrow project in Alpine spruce forests each trap station consisted of a window trap and a yellow bucket trap (Fig. 1). The window trap intercepted flying insects with a vertical glass screen (80 cm × 50 cm) mounted 150 cm above ground with two lateral water troughs 80 cm long (Duelli et al. 1999). Some detergent was added to the water to make the insects drown quickly, and 2% Rocima GT (Acima, Buchs, Switzerland) was also added to prevent mold. The yellow bucket traps, 20 cm in diameter, attracted flower-visiting insects. They were also filled with water containing some traces of detergent and Rocima. For the three other projects a newer type of combined trap (further as combi-trap, Fig. 2) was used (Duelli et al. 1999). The combi-traps consisted of two sheets of Plexiglas (50 cm × 43 cm) crossed at right angles to provide independence of wind direction. To collect the insects, a yellow plastic funnel (43 cm diameter) was mounted below the screens, again at a height of 150 cm and filled with water and the same additives as above. A comparison between the performance of one window trap plus one yellow bucket vs. one combi-trap showed no statistically significant differences in species composition, richness and abundance (Gygax 1999).

Trap numbers and sampling periods varied between projects, but were always identical among the three treatments within one project (see below). The traps were emptied weekly. The sampled material was stored in vials with 70% EtOH and sorted to taxonomic groups. The specimens of Neuropterida and Mecoptera were identified by the first author using the nomenclature of the lacewing digital library (Oswald 2017) and for Mecoptera Klausnitzer (2002).

Experimental design

Two projects investigated the impact of windthrow on the insect fauna: in the Northern Pre-Alps (Windthrow I), and on the Swiss Plateau (Windthrow II). Two other projects analyzed the impact of forest fire: one encompassed multiple fire on the southern slope of the Alps in Ticino (Forest Fire I), the other was a large wildfire in the inner-Alpine valley Valais (Forest Fire II). Table 1 shows the location of the different projects and trap sites.

Each of the four projects included three different treatments. Intact, undisturbed forests (FO) served as controls, heavily disturbed (HD) plots were plots with maximum disturbance, and intermediately disturbed (ID) plots were less severely disturbed. More detailed descriptions of the treatments are given below.

Windthrow I (Vivian)

In early 1990 storm Vivian devastated mainly subalpine spruce forests in the Swiss Alps (Fig. 3). Near the village Schwanden at elevations around 1000 m three forest



Figure 1. Window interception trap and yellow bucket trap in an uncleared windthrow plot (Windthrow I) above Schwanden after storm Vivian. Photo: WSL.



Figure 2. Combi trap (a combination of a flight interception trap and a yellow funnel trap) in an uncleared windthrow plot (Windthrow II) near Habsburg after storm Lothar. Photo: WSL.

Table 1. Trap location and site numbers of the four projects.

Project	Canton	Community	Locality	Treatment	Latitude	Longitude	m above sea	N sites
Forest Fire I	TI	Brissago	Boscopiano	control	46.133936	8.712697	560	3
			Ciossa	control	46.105821	8.692639	460	3
		Gordola	Falò	control	46.191353	8.840348	590	3
			Monti di Ditto	control	46.184869	8.890699	730	3
		Locarno	Canegg	control	46.175529	8.772595	460	3
		Minusio	Ronco di Bosco	control	46.184160	8.803246	660	3
		Gordola	Sassone	repeated fires	46.192194	8.863041	845	6
		Locarno	Ai Sassi	repeated fires	46.176832	8.776513	575	6
			Monte Bré	repeated fires	46.181748	8.779224	890	3
		Ronco sopra Ascona	Buffaga	repeated fires	46.142842	8.720671	520	3
		Brissago	Sciresa	single fires	46.113481	8.691522	680	3
		Gordola	Selvacce	single fires	46.195802	8.844349	580	3
		Locarno	Piodelle	single fires	46.183951	8.783164	920	3
		Minusio	Ronco di Bosco	single fires	46.185028	8.805859	670	3
		Orselina	Gaggio	single fires	46.182509	8.790900	660	3
		Ronco sopra Ascona	Fontana Martina	single fires	46.138382	8.717330	480	3
Forest Fire II	VS	Leuk	Höhwald	Forest Fire Edge	46.329863	7.649166	1427	6
				Forest Fire Center	46.330463	7.650454	1433	6
				Forest	46.330736	7.650295	1442	6
Windthrow I	GL	Schwanden (GL)	Schwanden, GL (Niederntal)	Uncleared	46.980930	9.094159	1000	5
				Cleared	46.983742	9.095598	1000	5
				Forest	46.981916	9.090925	1000	5
Windthrow II	AG	Habsburg	Habsburg	Uncleared	47.469381	8.204498	420	3
				Cleared	47.457359	8.196624	430	3
		Brugg	Habsburg	Forest	47.495900	8.203981	440	3
	SO	Messen	Messen	Uncleared	47.086577	7.464313	535	3
				Cleared	47.088782	7.461421	530	3
				Forest	47.084293	7.459738	545	3
	AG	Sarmenstorf	Sarmenstorf	Uncleared	47.318269	8.257562	580	3
				Cleared	47.318752	8.255356	590	3
				Forest	47.281080	8.288693	715	3



Figure 3. Large windthrow of storm Vivian in spruce forest in the Canton Glarus. Photo: WSL.



Figure 4. Cleared windthrow plot above Schwanden three years after storm Vivian (Windthrow I). Photo: WSL.

plots were used for a long-term investigation of different disturbance effects on biodiversity between cleared and uncleared windthrows. Like the disturbed plots, the control forest plot (FO) consisted of intact spruce forest with some scattered deciduous trees. The HD and ID plots had been equally affected by the storm but HD was cleared of all stems, suffering a double disturbance: windthrow and timber harvest (Fig. 4). In the ID plot the fallen trees remained untouched by harvest (Fig. 1). In the disturbed plots of 1–2 ha the vegetation cover developed slowly because of the high elevation. While in the cleared plot (HD) flowering herbs attracted pollinators and pollen feeders, the uncleared plot (ID) developed a brush vegetation of deciduous plants and young trees. The plots were sampled in 1992 (two years after the storm), 1993, 1994, 1996, 2000 and 2009. Three window traps and five yellow bucket traps were placed in each of the three plots (FO, ID, HD) at distances of at least 30 m between trap stations. The sampling periods lasted from mid May to end of September.

Windthrow II (Lothar)

Ten years after storm Vivian, storm Lothar (late 1999) devastated even larger forest areas all over Europe. This time mainly deciduous forests in the Swiss Central Plateau were affected. Three areas, each with the three types of treatments (intact forest FO, cleared HD, and unsalvaged ID) were secured for long-term investigation. The plots in the region of Sarmenstorf (Fig. 2) represented beech forest (*Fagus sylvatica* L.), those at Messen were spruce forests (*Picea abies* (L.)), and those at Habsburg were mixed forest with half coniferous (mainly spruce) and half broad-leaved trees (Fig. 5). Within a region, the three treatments were located at distances from 100 m to three km apart to keep site conditions similar. In each of the nine plots three combi-traps were placed at distances of about 100 m from each other. A total of 27 combi-traps were operated between mid March to end of September in the years 2001, 2004, and 2010.

Forest fire I (Ticino)

The study area stretched over 15 km along a south-facing slope of the Swiss Alps at elevations between 450 m and 850 m a.s.l. in the region of Locarno. The former coppice stands of chestnut forest (*Castanea sativa* L.) on acidic soil is prone to forest fire, mainly fast spreading surface fires in late winter. Detailed records of the incidence of fires in that region (Conedera et al. 1996) allowed for a sampling design based on "space for time substitution" (Pickett 1989). Instead of sampling in different years after a fire, plots with different fire histories were sampled within one year (Moretti et al. 2006). In six sectors, 18 trap sites were chosen, each with a plot of only one fire for the previous 40 years (intermediately disturbed; ID), another with two to four fires in the previous 40 years (heavily disturbed; HD), and the third with no fire in at least 40 years (undisturbed



Figure 5. Cleared windthrow plot in mixed forest near Messen, two years after storm Lothar (Windthrow II). Photo: WSL.

forest; FO). All plots had similar site conditions. The same combi-traps (Fig. 6) as in windthrow project II (Lothar) were used (Moretti et al. 2006). Three traps were placed in each of the 54 plots. The minimum distance between traps at each site was ten m, while the average distance between the sites was around 300 m. The traps were emptied weekly from March to September 1997.

Forest fire II (Leuk)

On 13 August 2003, 300 ha of south-exposed forest at Leuk in the dry Central Alpine valley of the Valais fell victim to a large forest fire caused by intentional arson (Wohlgemuth et al. 2005). The burned area consisted of different forest types at elevations from 800m to 2100 m a.s.l. Three horizontal transects of six combi-traps were installed at elevations of 1200 m (mainly *Pinus sylvestris* L.), 1450 m (mixed forest with *Picea abies* and *Pinus sylvestris*), and 1700 m (mixed forest with *Larix decidua* Miller and *Picea abies*), ranging on both sides of the burned area from intact forest (FO) into the center of the burned area (HD, Fig. 7). The traps in the intermediately disturbed areas (ID) were installed on burned ground, but close (20–50 m) to the remaining forest edges. The 18 combi-traps (six at three altitudes) were emptied weekly from April to early September, starting in 2004 (first year after the fire) and continuing in 2005, 2006, 2008, and 2013. Details on regrowth of the vegetation at different locations and altitudes (Fig. 8) are given in Moser and Wohlgemuth (2006).

Data processing

Natural impacts such as wildfires or windthrows cannot be planned or organized in space and time, because they happen sporadically and accidentally. Scientific investigations are therefore case studies rather than experiments with true replicates for statistical treatment. Replicates of either windthrow or forest fires take place in different years, show different coverage, or even occupy different regions. Since the projects were located at different elevations and in different regions of Switzerland, several species occurred only in a subsample of the projects. This heterogeneity prevented us from averaging numbers of specimens per treatment and from calculating variance. Also, the abundance of species changed with time after the impact, which cannot be considered as a variable in the present analysis because of the low numbers of specimens collected for most species. Furthermore, spatial autocorrelation of the trap sites (or plots) is a critical issue in unique events, but in the case of repeated space for time substitution (fire in Ticino) we accounted for it and minimized its effect by avoiding spatially structured sampling design (Moretti et al. 2010).

For each of the four projects, species lists were established. For each species the numbers of specimens collected per treatment (FO, ID, HD) were combined for all years. A species had to be caught at least five times in all four projects to be included in the analyses. Species collected in smaller numbers are listed in Appendix 1 for faunistic considerations only.



Figure 6. Combi trap in an intensely disturbed forest plot in Ticino (Forest fire I) after several forest fires within the previous 40 years. In spring the chestnut regrowth (here without old trees) is still without leaves. Photo: WSL.



Figure 7. Combi trap in the center of the large burned area above Leuk, a few months after the fire (Forest fire II). Photo: WSL.



Figure 8. Two years after the massive fire above Leuk the whole area was covered with a carpet of colorful vegetation. Photo: WSL.

To quantify the positive or negative impact of disturbance on a species, the numbers were combined separately for the three treatments FO, ID, and HD for all four projects. The number of trap sites per treatment was balanced. As an indicator for the effect of disturbance in general, the following formula was used for each species: mean (HD+ID) / (mean (HD+ID) +FO). Species with more than 66% are considered winners, those with less than 33% losers.

Species rating in between are considered indifferent to the midterm effects of storms or fires.

Results

In total, 8345 individuals from 79 species were collected. Among the 8285 specimens of the 50 more common species, the most species-rich order was the Neuroptera, numbering 42 species, whereas the most abundant order was the Mecoptera where only five species included a total of 4291 specimens (Table 2). Raphidioptera numbered only three species, but were represented by a total of 1037 individuals. The most species-rich projects were the forest fire projects in Leuk (56 species) and in Ticino (37 species). Only nine species were collected in all four projects, six were found only in Leuk, and two only in Ticino. Among the 29 scarcely collected species (Appendix 1), 16 belong to the Hemerobiidae, five to Chrysopidae, four to Coniopterygidae, two to Raphidioptera, and one each to Myrmeleontidae and Osmylidae.

A majority of 20 species were most abundant in the intermediately disturbed plots (ID) (bold print in Table 2). Fewer species (17) were most abundant in the highly disturbed (HD) plots, and only 11 species in the undisturbed (FO) forest sites. Two species were equally abundant with their maxima in the two disturbed plots (ID and HD). In the Vivian windthrow project the HD plots yielded the highest species numbers, while in the Lothar windthrow project the two disturbance treatments yielded equal numbers. In the forest fire project above Leuk the highest number of species was captured in the ID plots, and in Ticino all three treatments yielded about the same number of species. Of the total of 8285 individuals, 42% were caught in the ID plots, 37% in the HD plots, and 21% in the FO plots.

For each species the sum (N) of all specimens collected per treatment (FO, ID, HD) is shown in Table 2 for each of the four projects. Not all species were consistent

Table 2a. List of species of families Chrysopidae and Hemerobiidae with five or more specimens collected in the three treatments (FO: intact forest; ID: intermediately disturbed plots; HD: heavily disturbed plots) of the four projects. The grand total gives the sum for all projects. The treatment with the highest number of individuals is highlighted in bold. Two equally high numbers are also highlighted. Single specimens in one or two treatments are not highlighted. Calculation of % in disturbed plots: mean(HD+ID)/(mean(HD+ID)+FO). Values for the Grand Total are considered. Species above 66% are considered winners, those below 33% losers.

Order	Family	Species	% in disturbed plots	Winners / Losers	All Disturbances				Forest Fire								Windthrow							
					Grand Total				I. Ticino				II. Leuk				I. Vivian				II. Lothar			
					N	FO	ID	HD	N	FO	ID	HD	N	FO	ID	HD	N	FO	ID	HD	N	FO	ID	HD
Neuroptera	Chrysopidae	*Chrysopa formosa* Brauer	100%	W	25		**17**	8					25		**17**	8								
		Chrysopa pallens Rambur	100%	W	7		2	**5**					7		2	**5**								
		Nineta flava (Scopoli)	100%	W	5		**5**						5		**5**									
		Pseudomallada prasinus (Burmeister)	100%	W	145		**76**	69	1			1	144		**76**	68								
		Pseudomallada ventralis (Curtis)	100%	W	24		**16**	8					20		**14**	6	3		**2**	1	1			1
		Chrysopa perla (L.)	97%	W	229	4	101	**124**	5		2	**3**	130	3	52	**75**	74	1	**38**	35	20		9	**11**
		Chrysoperla lucasina (Lacroix)	96%	W	267	6	124	**137**	3		1	**2**	215	3	**109**	103	8			**8**	41	3	14	**24**
		Pseudomallada abdominalis (Brauer)	85%	W	12	1	3	**8**					4		1	**3**	4	1		**3**	4		**2**	**2**
		Pseudomallada flavifrons (Brauer)	83%	W	53	5	**38**	10	5		**4**	1	43	5	**32**	6					5		2	**3**
		Cunctochrysa albolineata (Killington)	78%	W	8	1	**4**	3					4		**2**	**2**	4	1	**2**	1				
		Chrysoperla carnea (Stephens)	65%	–	537	113	196	**228**	204	69	65	**70**	110		**66**	44	2			**2**	221	44	65	**112**
		Hypochrysa elegans (Burmeister)	58%	–	26	7	**10**	9	2	1	1										24	6	**9**	**9**
		Nothochrysa fulviceps (Stephens)	43%	–	5	**2**	1	**2**					2		1	1	1	1			2	1		1
		Chrysoperla pallida Henry, Brooks, Duelli & Johnson	40%	–	139	**59**	39	41	22	**13**	5	4	16	2	**7**	**7**					101	**44**	27	30
		Chrysotropia ciliata (Wesmael)	23%	L	86	**54**	16	16	1	1											85	**53**	16	16
		Peyerimhoffina gracilis (Schneider)	13%	L	13	**10**	1	2					5	**5**			1	1			7	**4**	1	2
		N individuals			1581	262	649	670	243	84	78	81	730	18	384	328	97	5	42	50	511	155	145	211
		N species; with ≥ 5 inds.			16	11	16	15	8	4	6	6	14	5	13	12	8	5	3	6	11	7	9	11
	Hemerobiidae	*Megalomus tortricoides* Rambur	100%	W	5		2	**3**					2			**2**	3		**2**	1				
		Wesmaelius subnebulosus (Stephens)	83%	W	142	13	41	**88**	25	3	5	**17**	115	10	36	**69**	1			1	1			1
		Wesmaelius malladai (Navas)	81%	W	85	9	34	**42**					85	9	34	**42**								
		Micromus paganus (L.)	81%	W	47	5	16	**26**	1	1			11	3	7	1	35	1	9	**25**				
		Megalomus hirtus (L.)	80%	W	9	1	4	**4**					5		2	**3**	4	1	2	1				
		Micromus angulatus (Stephens)	80%	W	9	1	5	3	2	1		1	2		1	1					5		4	1
		Micromus variegatus (Fabricius)	78%	W	73	9	**29**	**35**	39	6	11	**22**	21	2	**10**	9	3		2	1	10	1	6	3
		Hemerobius lutescens Fabricius	74%	W	40	6	15	**19**	8	**4**	3	1	28	2	12	**14**	4			**4**				
		Hemerobius humulinus L.	70%	W	124	22	28	**74**	98	18	16	**64**	11	1	4	**6**	8	**3**	3	2	7		**5**	2
		Drepanepteryx phalaenoides (L.)	70%	W	10	3		**7**	9	2		**7**					1	1						
		Hemerobius micans Olivier	48%	–	235	82	**100**	53	159	53	**62**	44	4	1	**3**		38	**20**	17	1	34	8	**18**	8
		Sympherobius klapaleki Zeleny	18%	L	23	**16**	6	1	22	**15**	6	1									1	1		
		Hemerobius pini Stephens	13%	L	16	**14**	2						10	**9**	1		4	**4**			2	1	1	
		Sympherobius fuscescens (Wallengren)	13%	L	8	**7**		1					4	**3**		1	2	**2**			2	**2**		
		Sympherobius pellucidus (Walker)	0%	L	12	**12**							8	**8**			3	**3**			1	1		
		N individuals			838	200	282	356	363	103	103	157	306	48	110	148	106	35	35	36	63	14	34	15
		N species; with ≥ 5 inds.			15	14	12	13	9	9	6	8	13	10	10	10	12	8	6	8	9	6	5	5

regarding their total maxima. The most consistent group of species was that of the intact forest dwellers (maximum of specimens in FO). Four species were consistent only because they were restricted to one project.

The impact strength of disturbance is expressed as the percentage of population gain or loss after the fire or windthrow (left column in Table 2). With no specimens caught in the intact forest plots, the positive impact on a species

Table 2b. List of species of Coniopterygidae, Myrmeleontidae, Raphidiidae, and Panorpidae. Further explanations as in Table 2a.

Order	Family	Species	% in disturbed plots	Winners / Losers	All Disturbances				Forest Fire								Windthrow							
					Grand Total				i. Ticino				ii. Leuk				i. Vivian				ii. Lothar			
					N	FO	ID	HD	N	FO	ID	HD	N	FO	ID	HD	N	FO	ID	HD	N	FO	ID	HD
Neuroptera	Coniopterygidae	*Coniopteryx esbenpeterseni* Tjeder	91%	W	22	1	10	**11**	12	1	2	**9**					10		**8**	2				
		Parasemidalis fuscipennis (Reuter)	90%	W	20	1	**16**	3	2		**2**		1	1			17		**14**	3				
		Coniopteryx borealis Tjeder	67%	W	5	1	**3**	1	4	1	**2**	1					1		1					
		Coniopteryx tineiformis Curtis	57%	–	66	18	**30**	18	54	17	**21**	16					11	1	**8**	2	1		1	
		Coniopteryx haematica McLachlan	50%	–	6	2	**3**	1	6	2	**3**	1												
		Coniopteryx drammonti Rousset	33%	–	10	**5**	4	1	10	**5**	4	1												
		Semidalis aleyrodiformis (Stephens)	31%	L	305	**161**	105	39	304	**160**	105	39	1	1										
		Coniopteryx pygmaea Enderlein	24%	L	54	**33**	10	11	12	4	**5**	3	33	**23**	5	5	8	**6**		2	1			1
		*Conwentzia psociformis (*Curtis)	0%	L	6	**6**			3	**3**			3	**3**										
		N individuals			494	228	181	85	407	193	144	70	38	28	5	5	47	7	31	9	2	0	1	1
		N species; with ≥ 5 inds.			9	9	8	8	9	8	8	7	4	4	1	1	5	2	4	4	2	0	1	1
	Myrmeleontidae	*Distoleon tetragrammicus* (Fabricius)	94%	W	32	1	**19**	12					32	1	**19**	12								
		Myrmeleon formicarius L.	75%	W	12	3	**9**						12	3	**9**									
		N individuals			44	4	28	12					44	4	28	12								
		N species; with ≥ 5 inds.			2	2	2	1					2	2	2	1								
Raphidioptera	Raphidiidae	*Phaeostigma notata* (Fabricius)	91%	W	311	14	**164**	133					242	7	**130**	105	40	6	11	**23**	29	1	**23**	5
		Dichrostigma flavipes (Stein)	88%	W	710	46	**419**	245					710	46	**419**	245								
		Puncha ratzeburgi (Brauer)	60%	–	16	4	**6**	**6**					6	**3**	2	1	10	1	4	**5**				
		N individuals			1037	64	589	384					958	56	551	351	50	7	15	28	29	1	23	5
		N species; with ≥ 5 inds.			3	3	3	3					3	3	3	3	2	2	2	2	1	1	1	1
Mecoptera	Panorpidae	*Panorpa cognata* L.	87%	W	28	2	9	**17**	27	2	8	**17**									1		1	
		Panorpa alpina Rambur	74%	W	425	64	174	**187**									59	**27**	24	8	366	37	150	**179**
		Panorpa vulgaris Imhoff & Labram	67%	W	5	1	**3**	1					4	1	**2**	1					1		1	
		Panorpa communis L.	61%	–	1904	462	673	**769**	730	240	**279**	211	128	21	**55**	52	511	103	189	**219**	535	98	150	**287**
		Panorpa germanica L.	55%	–	1929	555	**792**	582					136	26	**56**	54	1209	332	**537**	340	584	197	**199**	188
		N individuals			4291	1084	1651	1556	757	242	287	228	268	48	113	107	1779	462	750	567	1487	332	501	654
		N species; with ≥ 5 inds.			5	5	5	5	2	2	2	2	3	3	3	3	3	3	3	3	5	3	5	3
All taxa		N individuals			8285	1842	3380	3063	1770	622	612	536	2344	202	1191	951	2079	516	873	690	2092	502	704	886
		N species; with ≥ 5 inds.			50	44	46	45	28	23	22	23	39	27	32	30	30	20	18	23	28	17	21	21
		N species; incl. «rare» species			79	59	60	58	37	26	25	29	56	35	40	35	36	22	21	25	33	19	24	22

amounts to 100% (see e.g. five top species of Chrysopidae in Table 2). A maximum negative impact is indicated with 0% specimens caught in the disturbed plots ID and HD, as shown in *Sympherobius pellucidus* and *Conwentzia psociformis*. 28 species above 66% are considered to have been winners in the years after the impacts, and 9 are losers in the sense that their abundance was less than 33% in the disturbed areas. 11 species were ranking between 33% and 66%. Two species of both the orders Raphidioptera and Mecoptera, as well as of the neuropteran family Myrmeleontidae, benefited from the disturbances. In the neuropteran family Chrysopidae 10 of 16 species benefited from the disturbances and in the Hemerobiidae 9 of 15 species, whereas in the Coniopterygidae 4 of the 9 species ranked as losers.

Discussion

For most Neuropterida and Mecoptera in Central Europe the basic ecological requirements for larval development and habitat of adults are well known. A majority of species in Switzerland are considered to depend on trees and bushes for development (Aspöck et al. 1980). In particular, the edges of forests are hotspots for neuropteran diversity (Duelli et al. 2002b). In earlier assessments of windthrow effects on Neuropterida after storm Vivian (Duelli et al. 2002b), a significant increase in numbers of species and a highly significant increase in abundances were observed. The same effect was seen after forest fires in Ticino (Moretti et al. 2006). A large majority (74%) of species treated here became more frequent after windthrow and forest fires, basically independent of the type of disturbance. The two forest fire projects show that there is a positive effect on most neuropteran species both when the fire acted during the dormancy period in winter (Forest fire I, Ticino) and during the flight period in summer (Forest fire II, Leuk).

The two windthrow projects show that in both coniferous and deciduous forests and both at higher and lower elevations storms enhanced neuropteran diversity and abundance.

While this might be obvious for species living in open natural or rural landscapes, most of the species found in this study are known to be forest dwellers (Aspöck et al 1980). Why should a forest dweller profit from disturbances destroying the forest? The insects do not profit from the event itself, but from the modified forest structure and abiotic condition, which in turn become similar to the conditions at forest edges (Duelli et al 2002a). In destroyed forests, more sunlight reaches the floor and allows regrowth of herbs, bushes and young trees, which are attractive for plant lice and other soft-bodied arthropods. These in turn are prey to Neuroptera and Raphidioptera, and when injured or dead also for Mecoptera. The sunlight in open gaps favors their reproduction and larval development on herbs and bushes, as well as on the newly created inner forest edges.

Analyzing the neuropteran species composition in different types of forest edges along the vertical vegetation gradient (Duelli et al. 2002a) showed that only 5% of the species living in forest habitats were more abundant within the forest than at the forest edges or in the canopy. In that study, most of the species (29%) reached their maxima in the forest mantle (10–30 m high), 18% in the shrub belt (2–10 m) and 18% in the herbaceous fringe (0–2 m) bordering the forest edges. Three species were only collected in the canopy, whereas seven species were collected in the contact zones between forest and open space from the shrub belt to the canopy. Thus, most of the neuropteran species were in fact forest edge species (Duelli et al. 2002a).

In the four projects presented here, the top winners after fire and windthrow (Table 1) were the species with all specimens collected exclusively in the disturbed plots. The highest number of species (46) was found in the intermediately disturbed (ID) plots, closely followed by the 45 species with maxima in the heavily disturbed (HD) plots. Looking at the different taxonomic groups, however, reveals clear differences.

Neuroptera: Chrysopidae

Among the six top winners with 100% in disturbed plots were five green lacewing species. Two of these, *Chrysopa formosa* and *C. pallens*, are known to live in open habitats, on herbs or bushes (Aspöck et al. 1980). The three others, *Nineta flava, Pseudomallada prasinus* and *P. ventralis,* like almost all other winners among the Chrysopidae, are well-known forest edge species (Duelli et al. 2002a) or ubiquists (exemplified by *Chrysoperla lucasina* or *C. carnea*). *Hypochrysa elegans*, a pollen feeder in the adult stage, requires flowering plants for egg production. The arboreal *Chrysoperla pallida* and *Nothochrysa fulviceps* showed no clear preferences for disturbed habitats. Clear losers among the Chrysopidae were *Peyerimhoffina gracilis*, restricted to shady conifer forests, and *Chrysotropia ciliata*, mainly found in the Windthrow I project Lothar, which is known to live in moist forest habitats.

Neuroptera: Hemerobiidae

It was a surprise to see so many hemerobiid species ranking high up as winners after disturbances, because hemerobiids are known among neuropterologists to live mainly in the forest interior. However, *Wesmaelius malladai, Micromus paganus, Megalomus hirtus* and *M. tortricoides*, as well as the abundant *Wesmaelius subnebulosus,* can also be found in open habitats (Aspöck et al. 1980), and *Micromus variegatus* is even common in crop fields (McEwen et al. 2001). In forest edges, the *Micromus* species were labeled "herbaceous fringe" species (Duelli et al. 2002a), which is the lowest layer between forest edge and open habitat. *Hemerobius lutescens* and *Drepanepteryx phalaenoides* were considered "mantle-species." Among the losers, the genus *Sympherobius*, represented by three small species, was dominant. A clear loser also was *Hemerobius pini*, again a specialist on conifers (Aspöck et al. 1980). More than half of the species of Hemerobiidae were not abundant enough to be treated here (see Appendix 1).

Neuroptera: Coniopterygidae

These tiny insects fly only within a small range when disturbed, but sometimes can swarm and move to other habitats in the morning. *Parasemidalis fuscipennis*, *Coniopteryx esbenpeterseni, C. borealis,* and *C. tineiformis* were found mostly in disturbed plots. The rather rare *C. haematica and C. drammonti* (both only Ticino), as well as the abundant *Semidalis aleyrodiformis*, showed no clear preferences for disturbed habitats. Losers were *C. pygmaea*, and especially *Conwentzia psociformis.*

Neuroptera: Myrmeleontidae

Only two species of antlions were collected in sufficient numbers to be treated here, and both were favored by the

effects of fire. *Distoleon tetragrammicus*, recorded only in the forest fire project II above Leuk, clearly favored ID plots. The species is known to develop in detritus between tree roots in warm forests (Aspöck et al. 1980). *Myrmeleon formicarius*, the most common antlion in Switzerland, was also collected only at Leuk, with nine specimens in the ID plots and three in the FO plots.

Raphidioptera

The two most abundant snake fly species were winners. The most positive impact of disturbance was shown in *Phaeostigma notata*, a "mantle species" in forest edges (Duelli et al 2002a). The larvae live under bark, where they feed on other arthropods, such as the larvae of bark beetles (Kenis et al. 2004). The larvae are most frequent under loose bark of dead tree trunks, thus favored by both types of disturbance. In the Lothar windthrow II and Leuk forest fire II projects they were most abundant in ID plots, and in the Vivian windthrow I they were most abundant in the cleared (HD) plot. *Dichrostigma flavipes* was caught only in the Leuk project, but in large numbers, mainly in the ID plots. The species develops in the soil in coniferous as well as deciduous forests (Aspöck et al. 1980). *Puncha ratzeburgi*, also a "mantle species" in forest edges (Duelli et al. 2002a), develops under bark of conifers and was collected in all three disturbance conditions of the Vivian and Leuk projects.

Mecoptera

All four *Panorpa* species had more specimens in the disturbed plots, but only two were winners with more than 66%. *Panorpa cognata*, almost exclusively found in the Forest fire I project in Ticino, was about equally frequent in ID (24) and HD (22) plots, with only 2 specimens collected in the intact forest. Like all *Panorpa* species, *P. cognata* develops in the soil (Willmann 1989). *Panorpa alpina* was collected in surprisingly large numbers in the Lothar (Windthrow II) project, far from "alpine" regions. While most frequent in ID and HD plots in the Windthrow II project, the species was most frequent in the intact forest (FO) in the Windthrow I project. *Panorpa communis*, the most abundant species in this study, preferred ID plots after fire, whereas the numbers in the windthrow projects were highest in the HD plots. *Panorpa germanica*, not recorded in Ticino, benefitted least in overall numbers from the disturbances among the Mecoptera, but was consistently most abundant in the ID plots.

Conclusion

The combined results of our four independent projects suggest that strong natural disturbances such as windthrow or wildfire, which humans consider to be catastrophes, but which have proven to enhance biodiversity in various taxa, are positive also for most Neuroptera, Raphidioptera, and Mecoptera by increasing their abundance in the years after fires and windthrows.

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References

Aspöck H, Aspöck U, Hölzel H (1980) Die Neuropteren Europas. Eine zusammenfassende Darstellung der Systematik, Ökologie und Chorologie der Neuropteroidea (Megaloptera, Raphidioptera, Planipennia) Europas. Vols 1 & 2, Goecke and Evers, Krefeld, 495 & 455pp.

Aspöck H, Hölzel H, Aspöck U (2001) Kommentierter Katalog der Neuropterida (Insecta: Raphidioptera, Megaloptera, Neuroptera) der Westpaläarktis. Denisia 2: 1–606.

Bond WJ, Keeley JE (2005) Fire as a global 'herbivore:' the ecology and evolution of flammable ecosystems. Trends in Ecology and Evolution 20:387–394. https://doi.org/10.1016/j.tree.2005.04.025

Bouget C, Duelli P (2004) The effects of windthrow on forest insect communities: a literature review. Biological Conservation 118: 281–299. https://doi.org/10.1016/j.biocon.2003.09.009

Conedera M, Marcozzi M, Jud B, Mandallaz D, Chatelain F, Frank C, Kienast F, Ambrosetti P, Corti G (1996) *Incendi Boschivi Al Sud Delle Alpi: Passato, Presente E Possibili Sviluppi Futuri*. Rapporto di lavoro PNR 31. Hochschulverlag AG ETH, Zürich, Switzerland.

Duelli P, Obrist MK, Schmatz DR (1999) Biodiversity evaluation in agricultural landscapes: above-ground insects. In: M. Paoletti (Ed.) The role of biodiversity and bioindication in assessing sustainability in European landscapes. Agriculture, Ecosystems and Environment 74: 33–64. https://doi.org/10.1016/S0167-8809(99)00029-8

Duelli P, Obrist MK, Flückiger PF (2002a) Forest edges are biodiversity hotspots – also for Neuroptera! Acta zoologica hungarica 48 (Suppl.2): 75–87.

Duelli P, Obrist MK, Wermelinger B (2002b) Windthrow induces changes of faunistic biodiversity in alpine spruce forests. Forest Snow and Landscape Research 77(1/2): 117–131.

Gygax R (1999) Methodenoptimierung zur Schätzung der lokalen Biodiversität von Arthropoden. Diplomarbeit. Zoologisches Museum. Universität Zürich. 65 pp.

Kenis M, Wermelinger B, Grégoire JC (2004) Research on parasitoids and predators of Scolytidae – a review. In: Lieutier F, Day KR, Battisti A, Grégoire JC, Evans HFn (Eds) Bark and wood boring insects in living trees in Europe – a synthesis. Kluwer Academic Publishers, Dordrecht, 237–290. https://doi.org/10.1007/978-1-4020-2241-8_11

Klausnitzer B (Ed.) (2002) Stresemann Exkursionsfauna von Deutschland, Band 2: Wirbellose: Insekten (2002) Spektrum Akademischer Verlag: 976 pp

McEwen PK, New TR, Whittington AE (Eds) (2001) Lacewings in the crop environment. Cambridge University Press, Cambridge, 546 pp. https://doi.org/10.1017/CBO9780511666117

Moretti M, Conedera M, Duelli P, Edwards PJ (2002) The effects of wildfire on spiders (Arthropoda: Araneae) in deciduous forests on the southern slope of the Alps (Ticino, Switzerland). Journal of Applied Ecology 39: 321–336. https://doi.org/10.1046/j.1365-2664.2002.00701.x

Moretti M, Duelli P, Obrist, MK (2006) Biodiversity and Resilience of Arthropod Communities after Fire Disturbance in Temperate Forests. Oecologia 149(2): 312–327. https://doi.org/10.1007/s00442-006-0450-z

Moretti M, De Cáceres M, Pradella C, Obrist MK, Wermelinger B, Legendre P, Duelli P (2010) Fire-induced taxonomic and functional changes in saproxylic beetle communities in fire sensitive regions. Ecography 33(4): 760–771. https://doi.org/10.1111/j.1600-0587.2009.06172.x

Moser B, Wohlgemuth T (2006) Which plant species dominate early post-fire vegetation in the Central Alps, and why? In: Viegas DX (Ed) V International conference on forest fire research, Elsevier, 1–7. https://doi.org/10.1016/j.foreco.2006.08.225

Oswald JD (2017) Neuropterida Species of the World, Version 5.0. http://lacewing.tamu.edu/SpeciesCatalog/Main [Last accessed 5 September 2018]

Pickett STA (1989) Space-for-time substitution as an alternative to long-term studies.

Long Term Studies. Springer, New York, NY.

Ressl F (1969) Über einige auf Brandstellen lebende Käferarten. Entomologisches Nachrichtenblatt, Band 16: 55–56.

Schelhaas, MJ, Nabuurs GJ, Schuck A (2003) Natural disturbances in the European forests in the 19th and 20th centuries. Global Change Biology 9: 1620–1633. https://doi.org/10.1046/j.1365-2486.2003.00684.x

Wermelinger B, Duelli P, Obrist MK, Odermatt O, Seifert M (1995) Die Entwicklung der Fauna auf Windwurfflächen mit und ohne Holzräumung. Schweizerische Zeitschrift für Forstwesen 146(11): 913–928.

Wermelinger B, Duelli P, Obrist MK (2002) Dynamics of saproxylic beetles (Coleoptera) on windthrow areas in alpine spruce forests. Forest Snow and Landscape Research 77(1/2): 133–148.

Wermelinger B, Moretti M, Duelli P, Lachat T, Pezzatti GB, Obrist MK (2017) Impact of windthrow and salvage-logging on taxonomic and functional diversity of arthropods. Forest Ecology and Management 391: 9–18. https://doi.org/10.1016/j.foreco.2017.01.033

Willmann R (1989) Evolution und Phylogenetisches System der Mecoptera (Insecta: Holometabola). Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft 544: 1–153.

Wohlgemuth T, Duelli P, Ginzler C, Gödickemeier I, Hadorn S, Hagedorn F, Küttel P, Lüscher P, Moretti M, Schneiter G, Sciacca S, Wermelinger B (2005) Ökologische Resilienz nach Feuer: die Waldbrandfläche Leuk als Modellfall. Schweizerische Zeitschrift für Forstwesen 156:345–352. https://doi.org/10.3188/szf.2005.0345

Appendix 1

Species collected with less than 5 specimens. The Hemerobiidae dominated, whereas no rare Mecoptera were collected. Most scarcely collected species were caught in the forest fire II plots above Leuk, followed by the forest fire I plots in Ticino.

Order	Family	Species	Total	Forest Fire I	Forest Fire II	Windthrow I	Windthrow II
Neuroptera	Chrysopidae	*Chrysopa viridana* Schneider	1		1		
		Chrysoperla mediterranea (Hölzel)	1		1		
		Nineta inpunctata (Reuter)	1			1	
		Nineta pallida (Schneider)	4		3	1	
		Nineta vittata (Wesmael)	3			2	1
	Hemerobiidae	*Drepanepteryx algida* (Erichson)	1		1		
		Hemerobius contumax Tjeder	2	1	1		
		Hemerobius fenestratus Tjeder	2			1	1
		Hemerobius gilvus Stein	3	3			
		Hemerobius marginatus Stephens	3	2			1
		Hemerobius nitidulus Fabricius	2		2		
		Hemerobius stigma Stephens	4	1	3		
		Micromus lanosus (Zeleny)	1		1		
		Psectra diptera (Burmeister)	1			1	
		Sympherobius pygmaeus (Rambur)	1		1		
		Wesmaelius balticus (Tjeder)	1		1		
		Wesmaelius concinnus (Stephens)	2		2		
		Wesmaelius fassnidgei (Killington)	3		3		
		Wesmaelius mortoni (McLachlan)	1		1		
		Wesmaelius nervosus (Fabricius)	3	3			
		Wesmaelius quadrifasciatus (Reuter)	4		4		
	Coniopteryg-idae	*Coniopteryx arcuata* Kis	1	1			
		Coniopteryx lentiae Aspöck & Aspöck	2	2			
		Conwentzia pineticola Enderlein	2		1	1	
		Helicoconis pseudolutea Ohm	1	1			
	Myrmeleontidae	*Euroleon nostras* (Fourcroy)	2		2		
	Osmylidae	*Osmylus fulvicephalus* (Scopoli)	2				2
Raphidioptera	Inocelliidae	*Parainocellia bicolor* Costa	3	3			
	Raphidiidae	*Xanthostigma xanthostigma* Schummel	3		1		2

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PENSOFT

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Checklist of ichneumonid parasitoid wasps in Switzerland (Hymenoptera, Ichneumonidae): 470 species new for the country and an appraisal of the alpine diversity

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Abstract

We here present the first comprehensive and validated species list of the parasitoid wasp family Ichneumonidae in Switzerland. The list includes 1,878 species and is based on both an extensive literature research and a review of all reliably identified specimens present in the major Swiss collections. Because of the incomplete taxonomic treatment of this largest hymenopteran family, we adopted a conservative approach, accepting only species that have been published recently and/or were identified by recognized experts. The subfamilies Adelognathinae, Brachycyrtinae, Diacritinae and Lycorininae are reported for the first time for the country, as are 470 of the 1,878 species. The true number of species of ichneumonids in Switzerland is probably much higher, given the incomplete revision of Swiss specimens and the fact that large areas of the country were studied very sparsely or not at all. The subalpine and alpine areas deserve special attention, as they show a higher ratio between the number of species per collected specimen; these areas should be the focus of intensified collecting efforts in the future. The current list may serve as a starting point for more extensive taxonomic and faunistic work on Ichneumonidae in Switzerland.

Introduction

The Ichneumonidae are one of the largest families of insects and the largest in the order Hymenoptera, with more than 25,000 species described to date (Yu et al. 2016). According to a very conservative estimate (Townes 1969), the true diversity is more than two times larger; the family is thus considered one of the most understudied groups of organisms (Quicke 2012). The gaps in our knowledge of species richness, distribution, autecology, and life history of ichneumonids hamper attempts to use the group in biodiversity research, ecological studies, and as agents in biological control, despite the fact that their parasitoid lifestyle makes them especially well-suited in all these contexts.

In Switzerland, the ichneumonid fauna has received even less attention than in the surrounding countries, as evidenced by the comparatively low number of faunistic publications. The current edition of Taxapad (Yu et al. 2016), an online database covering taxonomy, biology, and faunistics of this group, lists only 1,551 species from Switzerland (for comparison: Germany – 4,121 species; Austria – 2,588; France – 3,016; Italy – 1,798). Taxapad reports all the species that have ever been mentioned in a publication for the country, including fossil species and very old and unconfirmed records. Given the taxonomic difficulty of the group, with many genera and sometimes entire subfamilies in need of systematic revision, these records have to be interpreted with caution; however, they clearly demonstrate that Switzerland has a lot of catching-up to do with respect to the knowledge of its ichneumonid fauna.

As is the case throughout most of entomological history, the work of just a handful of dedicated collectors and taxonomists has made a large impact on our knowledge of ichneumonids in Switzerland. Very early on, the German and French entomologists Arnold Förster (1871; 1876),

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Joseph Kriechbaumer (1869; 1872a; b; 1887; 1890a; b; 1893; 1896), and Victor Berthoumieu (1895; 1896; 1899; 1900) studied Swiss specimens and described several new species, especially from the alpine regions. The first more comprehensive faunistic study was conducted by Carl Blösch (1906), who collected insects in the surroundings of Laufenburg AG. Unfortunately, only very few Swiss hymenopterists followed his example, and ichneumonid faunistics remained neglected during the following decades. Charles Ferrière produced a list of Ichneumonidae collected in the Swiss National Park (Ferrière 1947). Theodor Steck, conservator at the Natural History Museum in Bern during the late 19th and early 20th century, assembled a large collection both from the surroundings of Bern and from alpine habitats, especially in the Valais. Only very few of his findings were published (Steck 1891), but the more than 13,000 ichneumonid specimens he collected still constitute the core of the ichneumonid collections at the museums in Bern and Basel. The sphecid specialist Jacques de Beaumont took the same role a few decades later as a curator at the Musée de Zoologie in Lausanne, where he identified and curated most of his almost 17,000 ichneumonid specimens himself. Later on, he worked with the renowned specialist Jacques F. Aubert, who published numerous taxonomic revisions, catalogues and faunistic studies (Aubert 1966c; 1968a; b; 1969a; 1970c; 1978; 2000), mostly based on specimens from France, but also from Switzerland and all of Europe and the Mediterranean. Aubert's private collection, including the name-bearing types of 501 species-level taxa that he described (Klopfstein and Baur 2011), was acquired by the Musée de Zoologie, which makes their collection in Lausanne the most important ichneumonid collection in Switzerland.

More recently, most of the additional records of ichneumonids from Switzerland were generated as a by-product of taxonomic revisions conducted at a European scale, with Swiss specimens studied rather irregularly (but see Horstmann 2008; Horstmann 2011; Jussila 2001; Klopfstein 2014; Riedel 2008; 2012; 2015; 2017; Schwarz 1998; 2002a; 2007; 2015; 2016). Faunistic work was conducted almost exclusively by Georg Artmann-Graf (2012; 2014; 2015; 2016; 2017; Artmann-Graf et al. 2009), who published a series of papers on ichneumonids he collected, mostly in the surroundings of Olten, including some very rare species such as *Hellwigia obscura* (see Artmann-Graf 2012).

We here aim to summarize the available knowledge of Ichneumonidae in Switzerland in the form of a checklist, considering both species that are reported in the literature and those evidenced in the form of specimens identified by specialists in Swiss collections. Because of the many remaining taxonomic problems in the group, including a lack of reliable identification keys in many of the subfamilies, we applied rather stringent criteria with respect to which names made it on the list (for details, see Materials and Methods section); it thus represents a first but incomplete appraisal of their true diversity in this country. It will hopefully act as a starting point for more extensive ichneumonological coverage of Switzerland, which holds the potential for numerous new discoveries, especially in its poorly studied alpine habitats (Schwarz 2002b).

Materials and methods

Classification

The nomenclature for this checklist is based on the newest version of the online world catalogue "Taxapad" (Yu et al. 2016), with very few modifications based on phylogenetic studies which were published later (see comments section). We did not adopt the changes to the subfamily classification of Cryptinae that were suggested in Santos (2017), but rather await for a more stable phylogeny of the concerned taxa. Taxapad also lists the genus *Eusterinx* under the subfamily Microleptinae, but this is based on an erroneous interpretation of a table in a paper on fossil ichneumonids (Antropov et al. 2014); the genus clearly belongs in Orthocentrinae (Klopfstein et al. 2018). As for lower taxonomic levels, in the few cases where a genus/species-name combination is not in accordance with the catalogue, the respective publication is indicated in the comments section. Ichneumonids have a history of widespread homonymy, with some species-level names being very commonly employed across the group (e.g., Jacques Aubert alone described 60 taxa under the species or subspecies name "*meridionator*", see Klopfstein and Baur 2011). Consultation of the catalogue is thus vital for correct interpretation of the names used here. In cases of current or only recently resolved homonymy (Kittel 2016), we refer to the author and year of the original description in the comments section.

Materials

We have recorded the label data of more than 75,000 specimens of ichneumonids at all major collections in Switzerland in the course of two GBIF.ch projects from 2005 to 2007. Many of these specimens were re-identified by specialists (see below under "Criteria for inclusion"). The examined collections are as follows:

BNM	Bündner Naturmuseum, Chur
ETHZ	Collection of the ETH, Zürich
MHNG	Muséum d'histoire naturelle, Genève
MZL	Musée cantonal de zoologie, Lausanne
NatAar	Naturama Aargau, Aarau
NMBE	Naturhistorisches Museum Bern
NMB	Naturhistorisches Museum Basel
RIE	private collection of Matthias Riedel, Bad Fallingbostel, Germany
ZSM	Zoologische Staatssammlung München

In addition, we studied some specimens from Georg Artmann-Graf's private collection, which we abbreviate as 'ART'. These data provided the basis for the checklist, together with the literature listed in the ichneumonid world catalogue for Switzerland (Yu et al. 2016). We

also examined publications from between 2015 and today, which have not been covered in the world catalogue. Most of the literature records that we deemed reliable are taxonomic treatments of particular groups that included specimens from Switzerland. Reports in ecological or biocontrol studies were only included if co-authored by a specialist, or if a specialist was specifically acknowledged for the identifications.

Criteria for inclusion

Given the taxonomic difficulties in this family, we only included species in the list that have been identified in the last 50 years by renowned specialists, i.e., researchers that can be considered specialists of subgroups of this large family, as they have published taxonomic or at least extensive faunistic treatments on ichneumonids. These specialists were Jacques F. Aubert (collection at MZL: Banchinae, Ctenopelmatinae, Pimplinae, Tryphoninae, various subfamilies), Gavin R. Broad (Natural History Museum, London: Ophioninae, Orthocentrinae), Erich Diller (ZSM: Diplazontinae, Ichneumoninae: Phaeogenini), Mike Fitton (Natural History Museum, London: Banchinae: *Banchus*), Klaus Horstmann (Universität Würzburg and ZSM: Campopleginae, Tersilochinae, various subfamilies), Rolf Hinz (Einbeck: Campopleginae, Ichneumoninae), Seraina Klopfstein (NMBE: Diplazontinae, Pimplinae, various subfamilies), Matthias Riedel (Bad Fallingbostel, Germany: Ichneumoninae), Heinz Schnee (Anomaloninae), and Martin Schwarz (Kirchschlag, Austria: Cryptinae). In the case of Aubert's work with Ctenopelmatinae, which represents his last taxonomic endeavour, we took a compromise, including only those species from his list (Aubert 2000) for which we could find identified specimens at MZL. We took the same approache for some genera of Banchinae which we considered as insufficiently revised at the time of publication (*Apophua*, *Cryptopimpla*, *Exetastes*, *Glypta*, *Lissonota*; Aubert 1978).

Another publication of somewhat uncertain reliability is the revision of the European Mesochorinae by Schwenke (1999). Many of the characters that he used for species delimitation, especially in the genus *Mesochorus*, might not be very reliable (Matthias Riedel, Andrew Bennett, pers. comm.). We nevertheless decided to include this work here, given that it is the only modern treatment of the subfamily. However, a revision of the type material and the study of large series is certainly warranted.

Identifications that go back more than 50 years, e.g., by Charles Ferriere in the collections in Geneva (MHNG) and Chur (BNM), were checked and found too unreliable. These records are thus only included here if they could be backed up by more recently identified specimens in collections or in the literature. For confirmed records, we nevertheless mention the first report for Switzerland in the literature list, in some cases complemented by a more recent reference. We also did not include species described from Switzerland in the 18th and 19th century that cannot be interpreted anymore today because the types were lost and the species have never been revised (e.g., *Ichneumon bicinctus* Fuesslin, 1775; *Mesoleptus biguttulus* Gravenhorst, 1820; *Netelia alpina* Rudow, 1886). For every species of which we have seen recently identified material, we give one of the collections where recently identified specimens are deposited.

On the other hand, we did include species that were collected on the Col de Bretolet, a mountain pass between Champéry in Valais, Switzerland and the Haute Savoie in France. Jacques F. Aubert described numerous new species from this locality, but reported them from France instead of Switzerland and labelled the specimens accordingly in his collection (Klopfstein and Baur 2011). However, most of the areas around the pass that are accessible for collecting insects are on the Swiss side, and we thus included the specimens from this locality in our list.

Analysis of altitudinal patterns

Distribution records for ichneumonid wasps from all major collections in Switzerland were obtained from GBIF.ch. Of the nearly 75'000 specimens recorded, almost 61'000 were from Switzerland and had sufficiently accurate location data to be included in an analysis of altitudinal patterns. Using a custom R script (R Core Team 2014), we extracted the number of individuals and the number of species collected in each of the 100 m altitudinal range steps, from 100 m to 2900 m above sea level. For the species but not the individual counts, we excluded specimens only identified to genus. The relationship between the number of species per collected specimen and altitude was plotted as a scatter plot and complemented by a smoothing curve fitted using the Loess algorithm as implemented in the 'scatter.smooth' function in the 'stats' package in R.

Results

Overview and altitudinal patterns

We here report 1,878 species for Switzerland, 470 of which are reported for the first time. For 1,529 of them (81%), we have examined recently identified specimens, mostly at the MZL, NMBE, NMB, and MHNG. The remaining records (349 species, 19%) stem from publications that were deemed reliable. For most of the latter, identified specimens are also present in Swiss collections, but their identification has not been reviewed recently by a specialist. 143 of the species that are listed for Switzerland in the world catalogue (Yu et al. 2016) and thus also in Fauna Europaea (which adopted its distribution records) have not been accepted for our list, because they go back to literature records that have not been confirmed by a specialist. Most of these concern records from before 1910 (such as Blösch 1906; Dalla Torre 1902; Fuesslin 1775) or by Ferrière (1947), and are often from groups that have received insufficient taxonomic and/or faunistic research. Many of these names might be added to the list again once the taxa are better studied.

Figure 1a shows the low coverage and patchiness of sampling of the family Ichneumonidae in Switzerland, especially in comparison with the very well-researched butterflies and zygaenid moths (Fig. 1b), according to data obtained from the Centre Suisse de Carthographie de la Faune. Large areas remain blank, and from most of the covered 5 km x 5 km squares used as a grid in these maps, less than 10 specimens were reported. Better-sampled localities are rare, and there are only five localities where more than 1,000 ichneumonid specimens were collected. This is despite the fact that ichneumonids potentially occur in all habitat types found in Switzerland and can often be collected in large numbers. The map thus rather reflects the places where hymenopterists were collecting than actual distributional patterns. In contrast, butterflies and zygaenid moths have been very well researched, both by private collectors and the national butterfly monitoring project.

Analysing the altitudinal records in the ichneumonid data on GBIF, we found an interesting pattern (Fig. 2). While

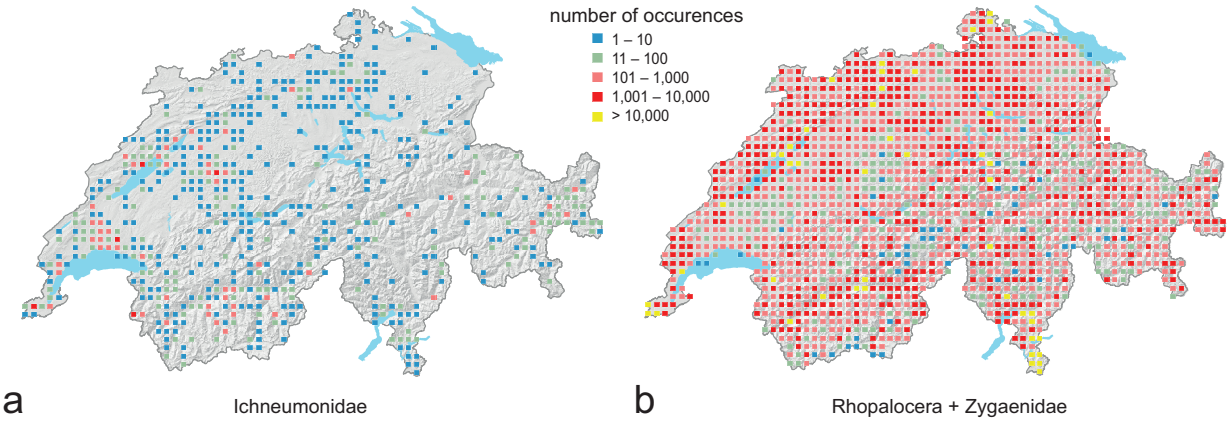


Figure 1. Occurrence data of the family Ichneumonidae (1,878 species recorded from Switzerland) and butterflies and zygaenid moths (226 species). The better-covered areas on the left map mostly reflect the main excursion areas of different hymenopterists, which might or might not correspond to centres of ichneumonid diversity. Note that the scale of the colour code is exponential.

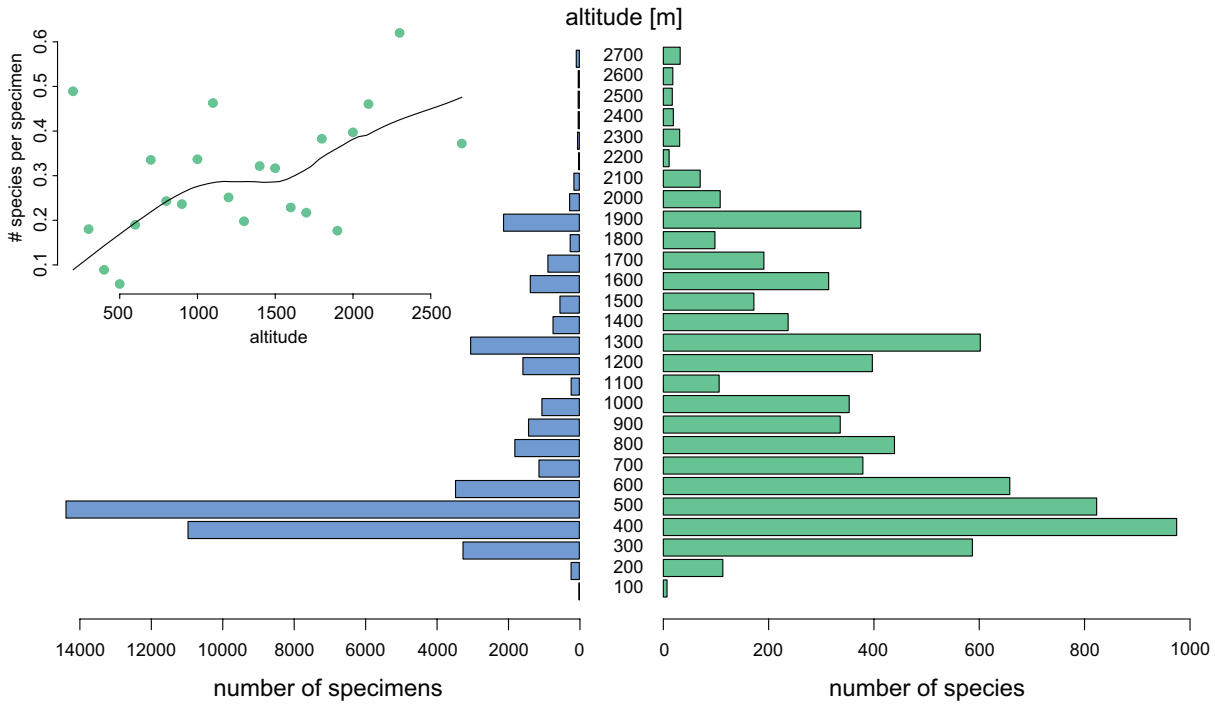


Figure 2. Altitudinal distribution of the number of specimens (left) and corresponding number of species (right) of ichneumonids in the GBIF database. The inlay on the left shows the relationship between the number of species per collected specimen and altitude, with the smoothing line fitted by the Loess algorithm.

both the number of specimens and corresponding number of species reach a maximum between 400 and 600 m altitude, the number of species is also high at higher altitudes, such as in the montane zone around 1,300 m and in the subalpine / alpine zone between 1,500 and 2,200 m, where far less specimens were collected. The relationship between the numbers of species per collected specimen is given as an inlay in Figure 2, together with a smoothing curve. It demonstrates that judging from the ichneumonid specimens collected so far in Switzerland, at higher altitudes, far fewer specimens need to be collected in order to find additional species.

List of species of Ichneumonidae in Switzerland

The species recorded below for Switzerland are listed for each subfamily, with genera and species sorted alphabetically. Species names are followed by the collection in which we have examined specimens, the literature reference in parentheses, and, if any, a references to a comment at the end of the results section (in the format "C1"). An asterix ("*") instead of a literature reference indicates that a species is here reported for Switzerland for the first time.

Acaenitinae

Acaenitus dubitator: MZL (Ferrière 1947)
Coleocentrus caligatus: NMBE (Steck 1891)
Coleocentrus croceicornis: MZL (Aubert 1969a)
Coleocentrus exareolatus: NMB (*)
Coleocentrus excitator: MZL (Blösch 1906)
Leptacoenites notabilis: MZL (*)
Mesoclistus rufipes: MZL (Blösch 1906)
Phaenolobus fraudator: NMBE (*)
Phaenolobus fulvicornis: NMBE (Bauer 2002)
Phaenolobus saltans: MZL (*)
Phaenolobus terebrator: NMBE (Ferrière 1947)
Procinetus decimator: MZL (Dalla Torre 1902)

Adelognathinae

Adelognathus brevicornis: MZL (*)
Adelognathus britannicus: MZL (*)
Adelognathus dorsalis: MZL (*)
Adelognathus laevicollis: MZL (*)
Adelognathus nigriceps: MZL (*)
Adelognathus nigrifrons: MZL (*)
Adelognathus pallipes: MZL (*)
Adelognathus pusillus: MZL (*)
Adelognathus rufithorax: MZL (*)
Adelognathus thomsoni: MZL (*)

Agriotypinae

Agriotypus armatus: MZL (Blösch 1906)

Alomyinae

Alomya debellator: NMBE (Ferrière 1947)
Alomya punctalata: (Horstmann 1998) – C2
Alomya semiflava: (Artmann-Graf et al. 2009; Coulon 1933)

Anomaloninae

Agrypon anomelas: NMBE (*)
Agrypon anxium: NMBE (Moreau et al. 2010)
Agrypon batis: NMB (*)
Agrypon canaliculatum: MHNG (*)
Agrypon clandestinum: NMBE (Blösch 1906)
Agrypon delarvatum: NMBE (Ferrière 1947)
Agrypon flaveolatum: NMBE (Anonymous 1960)
Agrypon flexorioides: MHNG (*)
Agrypon flexorium: NMBE (Blösch 1906)
Agrypon gracilipes: MHNG (*)
Agrypon interstitiale: NMBE (Schnee 1989)
Agrypon polyxenae: NMBE (*)
Agrypon varitarsum: MZL (Ferrière 1947)
Anomalon cruentatum: NMBE (Blösch 1906)
Aphanistes bellicosus: NMBE (*)
Aphanistes gliscens: MZL (Schnee 2008)
Aphanistes klugii: NMBE (*)
Aphanistes ruficornis: NMBE (Ferrière 1947)
Barylypa delictor: NMBE (*)
Barylypa helleni: NMBE (*)
Barylypa pallida: MNHG (*)
Barylypa propugnator: MZL (*)
Barylypa uniguttata: MZL (Artmann-Graf et al. 2009)
Erigorgus annulitarsis: NMBE (*)
Erigorgus cerinops: MZL (Blösch 1906)
Erigorgus femorator: NMBE (Schnee 2008)
Erigorgus fibulator: NMBE (Ferrière 1947)
Erigorgus latro: NMB (*)
Erigorgus melanobatus: NMBE (Schnee 2008)
Erigorgus procerus: NMBE (*)
Habronyx heros: NMBE (*)
Habronyx nigricornis: NMB (Delucchi 1982)
Heteropelma amictum: NMBE (Blösch 1906)
Heteropelma fulvitarse: NMBE (Artmann-Graf 2012)
Heteropelma megarthrum: NMBE (Artmann-Graf et al. 2009)
Perisphincter brevicollis: NMB (*)
Therion brevicorne: MHNG (*)
Therion circumflexum: NMBE (Schnee 2008)
Therion giganteum: MHNG (*)
Trichomma enecator: NMBE (Delucchi 1957)
Trichomma fulvidens: MZL (*)
Trichomma occisor: NMBE (*)

Banchinae

Alloplasta piceator: MZL (Blösch 1906)
Apophua bipunctoria: MZL (Blösch 1906)
Apophua evanescens: MZL (Delucchi 1957)
Apophua genalis: MZL (Aubert 1978)
Banchus crefeldensis: NMB (Aubert 1978)
Banchus dilatatorius: NMB (*)
Banchus falcatorius: NMB (Blösch 1906)
Banchus hastator: NMB (Fitton 1985)
Banchus moppiti: (Fitton 1985)
Banchus palpalis: MHNG (*)
Banchus pictus: NMB (Blösch 1906)
Banchus volutatorius: NMB (Fuesslin 1775)
Cephaloglypta murinanae: (Mills and Kenis 1991)
Cryptopimpla brevicaudis: MZL (*)

Cryptopimpla calceolata: MZL (Blösch 1906)
Cryptopimpla caligata: MZL (Blösch 1906)
Cryptopimpla errabunda: MZL (Aubert 1978; Blösch 1906)
Cryptopimpla genalis: MZL (Aubert 1969b)
Cryptopimpla helvetica: (Brauns 1901) – C2
Cryptopimpla hertrichi: MZL (Aubert 1978)
Cryptopimpla subfumata: MZL (Aubert 1978)
Diblastomorpha cylindrator: MZL (Dalla Torre 1902) – C3
Exetastes adpressorius: MZL (Blösch 1906)
Exetastes albiger: (Townes et al. 1965)
Exetastes alpius: MZL (Aubert 1978)
Exetastes atrator: NMBE (Ferrière 1947)
Exetastes crassus: NMBE (*)
Exetastes degener: MZL (Aubert 1978)
Exetastes fornicator: MZL (Blösch 1906)
Exetastes geniculosus: MZL (Ferrière 1947)
Exetastes illusor: MZL (Blösch 1906)
Exetastes illyricus: MZL (*)
Exetastes laevigator: MZL (Habermehl 1923) – C3
Exetastes nigripes: MZL (Ferrière 1947)
Exetastes rufifemur: MZL (Blösch 1906)
Glypta bifoveolata: (Artmann-Graf et al. 2009)
Glypta caudata: MZL (*)
Glypta ceratites: MZL (Blösch 1906) – C3
Glypta consimilis: MZL (Aubert 1978)
Glypta dentifera: MZL (Aubert 1978)
Glypta elongata: MZL (Aubert 1969b) – C3, C4
Glypta exophthalmus: MZL (Aubert 1978)
Glypta femorator: MZL (Aubert 1978)
Glypta gracilis: MZL (Ferrière 1947)
Glypta haesitator: NMBE (Blösch 1906)
Glypta incisa: MZL (Ferrière 1947)
Glypta lapponica: MZL (Aubert 1978)
Glypta lineata: MZL (Bovey and Ferrière 1944)
Glypta mensurator: MZL (Blösch 1906)
Glypta microcera: MZL (Aubert 1978)
Glypta nigricornis: MZL (*)
Glypta nigrina: MZL (Aubert 1978)
Glypta parvicaudata: MZL (Aubert 1978)
Glypta pedata: MZL (Aubert 1978)
Glypta pictipes: MZL (Aubert 1978)
Glypta resinanae: MZL (Aubert 1978)
Glypta rubricator: MZL (Aubert 1978) – C1
Glypta salsolicola: MZL (Aubert 1978)
Glypta sculpturata: MZL (Ferrière 1947)
Glypta scutellaris: MZL (Aubert 1978)
Glypta similis: MZL (Aubert 1978)
Glypta tegularis: NMBE (*)
Glypta tenuicornis: MZL (Aubert 1978)
Glypta teres: MZL (Aubert 1978)
Glypta tuberculator: MZL (Aubert 1972) – C1
Glypta varicoxa: MZL (Aubert 1978)
Glypta woerzi: MZL (Aubert 1978)
Lissonota accusator: MZL (Ferrière 1947)
Lissonota admontensis: MZL (Aubert 1978)
Lissonota albicoxis: MZL (Aubert 1978)
Lissonota alpinicola: (Bauer 1985) – C2
Lissonota alpivagator: MZL (Aubert 1976a) – C1
Lissonota antennalis: MZL (Aubert 1978)
Lissonota argiola: MZL (Blösch 1906)
Lissonota biguttata: MZL (Blösch 1906)
Lissonota bistrigata: NMBE (Aubert 1978)
Lissonota bivittata: MZL (*)
Lissonota buccator: MZL (Aubert 1976a)
Lissonota carbonaria: MZL (Bovey 1936)
Lissonota clypealis: MZL (Aubert 1978)
Lissonota clypeator: MZL (Ferrière 1947)
Lissonota complicator: MZL (Aubert 1978)
Lissonota coracina: MZL (Blösch 1906)
Lissonota cruentator: MZL (Aubert 1978)
Lissonota culiciformis: MZL (Blösch 1906)
Lissonota deversor: MZL (Blösch 1906)
Lissonota digestor: MZL (Aubert 1978)
Lissonota dubia: MZL (Blösch 1906)
Lissonota excelsa: MZL (Aubert 1978)
Lissonota extrema: MZL (Aubert 1978)
Lissonota fletcheri: MZL (Aubert 1978)
Lissonota folii: MZL (Delucchi 1982)
Lissonota fundator: MZL (Blösch 1906)
Lissonota histrio: MZL (Ferrière 1947)
Lissonota humerella: MZL (Aubert 1978)
Lissonota impressor: MZL (Ferrière 1947)
Lissonota linearis: MZL (*)
Lissonota lineata: MZL (Rey del Castillo 1992)
Lissonota lineolaris: MZL (Blösch 1906)
Lissonota longigena: (Bauer 1985) – C2
Lissonota luffiator: MZL (Aubert 1978)
Lissonota maculata: MZL (Habermehl 1918)
Lissonota mutator: MZL (Aubert 1969b) – C1
Lissonota nigridens: MZL (Aubert 1978)
Lissonota obscuripes: MZL (Aubert 1978)
Lissonota obsoleta: NMBE (*)
Lissonota palpalis: MZL (*)
Lissonota pectinator: MZL (Aubert 1978) – C1
Lissonota picticoxis: MZL (Aubert 1978)
Lissonota pimplator: MZL (Ferrière 1947)
Lissonota proxima: MZL (Aubert 1978)
Lissonota punctiventrator: (Aubert 1978)
Lissonota punctiventris: MZL (Aubert 1978)
Lissonota quadrinotata: MZL (Aubert 1978)
Lissonota rubricosa: MZL (Aubert 1978)
Lissonota rufitarsis: MZL (Aubert 1978)
Lissonota saturator: MZL (Delucchi 1957)
Lissonota sector: MZL (*)
Lissonota silvatica: MZL (Aubert 1969b)
Lissonota stigmator: MZL (Aubert 1978) – C1
Lissonota thuringiaca: MZL (Aubert 1978)
Lissonota transversostriata: MZL (Aubert 1978)
Lissonota variabilis: MZL (Ferrière 1947)
Lissonota versicolor: MZL (Aubert 1978)
Rynchobanchus bicolor: MZL (Artmann-Graf et al. 2009)
Syzeuctus maculipennis: NMBE (Dalla Torre 1902) – C3
Syzeuctus puberulus: NMBE (Dalla Torre 1902)
Syzeuctus szilagysagiensis: MZL (Aubert 1978)

Brachycyrtinae

Brachycyrtus ornatus: MZL (*)

Campopleginae

Bathyplectes immolator: (Horstmann 1974)
Campoletis agilis: (Riedel 2017)
Campoletis annulata: (Riedel 2017)
Campoletis ensator: (Riedel 2017)
Campoletis femoralis: (Riedel 2017)
Campoletis fuscipes: (Riedel 2017)
Campoletis latrator: (Riedel 2017)
Campoletis procerus: (Riedel 2017) – C5
Campoletis rapax: (Riedel 2017)
Campoletis rectangulator: (Riedel 2017)
Campoletis thomsoni: (Riedel 2017)
Campoletis trichoptili: (Riedel 2017)
Campoletis varians: NMBE (Ferrière 1947)
Campoletis viennensis: (Riedel 2017)
Campoletis zonata: (Artmann-Graf et al. 2009)
Campoplex alticolellae: (Horstmann 1980a)
Campoplex difformis: (Blösch 1906), Mills93
Campoplex dubitator: (Jenner et al. 2004)
Campoplex faunus: (Delucchi 1982; Mills 1993)
Campoplex helveticus: (Horstmann 1985) – C2
Campoplex laricanae: MZL (Horstmann 1985) – C1
Campoplex laricis: MZL (Horstmann 1993a) – C1
Campoplex occipitor: MZL (Delucchi 1982)
Campoplex punctipleuris: (Horstmann 1980a)
Campoplex satanator: (Aubert 1966a)
Campoplex tumidulus: (Mills and Kenis 1991)
Casinaria albipalpis: MZL (Riedel 2018)
Casinaria mesozosta: NMBE (*)
Casinaria moesta: MZL (Kenis et al. 2005)
Casinaria nigripes: MZL (Horstmann 1973)
Casinaria stygia: (Kenis et al. 2005)
Charops cantator: NMBE (Blösch 1906; Ferrière 1947)
Cymodusa antennator: (Dbar 1984)
Cymodusa leucocera: (Dbar 1984; Ferrière 1947)
Diadegma armillatum: NMBE (Blösch 1906)
Diadegma auricellae: NMBE (Horstmann 2008) – C1
Diadegma colutellae: NMBE (Horstmann 2008) – C1
Diadegma dinianator: MZL (Delucchi 1982)
Diadegma fenestrale: NMBE (Blösch 1906)
Diadegma laricinellum: ETHZ (Shaw and Horstmann 1997)
Diadegma latungulum: NMBE (*)
Diadegma satanicolor: MZL (Aubert 1971) – C1
Diadegma semiclausum: NMBE (Azidah et al. 2000)
Diadegma sordipes: (Shaw et al. 2016)
Diadegma valesiator: (Aubert 1970a) – C1
Dusona alpigena: MZL (Hinz 1972)
Dusona alpina: MZL (*)
Dusona alticola: (Artmann-Graf et al. 2009)
Dusona anceps: MZL (*)
Dusona angustata: (Horstmann 2011)
Dusona angustifrons: MZL (*)
Dusona annexa: MZL (Horstmann 2011)
Dusona bellipes: MZL (Horstmann 2011)
Dusona bicoloripes: MZL (Artmann-Graf et al. 2009)
Dusona blanda: MZL (Horstmann 2011)
Dusona bucculenta: MZL (*)
Dusona carinifrons: MZL (*)
Dusona carpathica: (Horstmann 2011)
Dusona circumcinctus: MZL (*)
Dusona circumspectans: MZL (*)
Dusona confusa: MZL (*)
Dusona cultrator: MZL (Blösch 1906)
Dusona disclusa: MZL (*)
Dusona dubitor: (Kenis et al. 2005)
Dusona erythrogaster: MZL (*)
Dusona falcator: MZL (Artmann-Graf et al. 2009)
Dusona flagellator: (Artmann-Graf et al. 2009)
Dusona genalis: MZL (Horstmann 2011)
Dusona habermehli: MZL (Horstmann 2011)
Dusona humilis: MZL (Horstmann 2011)
Dusona inermis: MZL (Kenis et al. 2005)
Dusona infesta: MZL (*)
Dusona insignita: MZL (Ferrière 1947)
Dusona juvenilis: MZL (*)
Dusona leptogaster: MZL (Horstmann 2011)
Dusona limnobia: (Horstmann 2011)
Dusona mercator: MZL (*)
Dusona montana: MZL (Teunissen 1947)
Dusona nidulator: MZL (Blösch 1906)
Dusona notabilis: MZL (*)
Dusona obliterata: MZL (Blösch 1906)
Dusona opaca: MZL (Horstmann 2011)
Dusona peregrina: MZL (*)
Dusona petiolator: MZL (*)
Dusona pineticola: MZL (Horstmann 2011)
Dusona polita: MZL (*)
Dusona prominula: MZL (Kenis et al. 2005)
Dusona pugillator: MZL (Fuesslin 1775)
Dusona pulmentariae: (Horstmann 2011)
Dusona rubidatae: (Horstmann 2011)
Dusona rugifer: MZL (*)
Dusona rugulosa: (Horstmann 2011)
Dusona sobolicida: MZL (Horstmann 2011)
Dusona spinipes: MZL (Horstmann 2011)
Dusona stenogaster: MZL (Horstmann 2011)
Dusona stragifex: MZL (Ferrière 1947)
Dusona stygia: MZL (*)
Dusona subimpressa: MZL (Horstmann 2011)
Dusona tenuis: MZL (Blösch 1906)
Dusona terebrator: MZL (*)
Dusona variator: (Hinz 1990)
Dusona vigilator: MZL (*)
Dusona xenocampta: MZL (Horstmann 2011)
Echthronomas quadrinotata: (Artmann-Graf et al. 2009)
Enytus appositor: (Shaw et al. 2016)
Enytus montanus: (Delucchi 1982; Mills 1993)
Hyposoter caudator: NMBE (Horstmann 2008) – C1
Hyposoter culminator: (Aubert 1980)
Hyposoter didymator: (Artmann-Graf et al. 2009)
Hyposoter ebeninus: NMBE (Blösch 1906)
Hyposoter placidus: NMBE (*)
Hyposoter rapacitor: (Aubert 1971)

Lathrostizus alpicola: (Horstmann 2004)
Lathrostizus lugens: (Kasparyan and Kopelke 2009; Kopelke 1994)
Lemophagus errabundus: (Haye and Kenis 2004)
Lemophagus pulcher: (Gold et al. 2001)
Macrus parvulus: NMBE (*)
Nemeritis caudatula: (Horstmann 1994)
Nemeritis fallax: NMBE (Horstmann 1994)
Nepiesta robusta: BNM (*)
Olesicampe gallicator: (Aubert 1964)
Phobocampe bicingulata: (Artmann-Graf et al. 2009; Blösch 1906)
Phobocampe crassiuscula: (Blösch 1906; Kenis et al. 2005)
Porizon moderator: (Brockerhoff and Kenis 1996)
Rhimphoctona megacephalus: (Artmann-Graf et al. 2009)
Rhimphoctona obscuripes: (Horstmann 1980b)
Rhimphoctona rufocoxalis: (Ferrière 1947; Horstmann 1980b)
Rhimphoctona teredo: (Horstmann 1980b)
Rhimphoctona xoridiformis: (Blösch 1906; Horstmann 1980b)
Sinophorus bilimbus: (Sanborne 1984) – C2
Sinophorus cotidianus: (Sanborne 1984) – C2
Sinophorus latifossus: (Sanborne 1984) – C2
Sinophorus turionum: NMBE (Bovey and Ferrière 1944)
Sinophorus villosus: (Sanborne 1984)
Tranosema nigridens: MZL (Horstmann 1978)
Tranosema rostrale: (Mills and Kenis 1991)

Collyriinae

Collyria coxator: MZL (Blösch 1906)
Collyria trichophthalma: MZL (Klopfstein et al. 2011)

Cremastinae

Cremastus bellicosus: MZL (Blösch 1906)
Cremastus crassicornis: MZL (*)
Cremastus geminus: MZL (Sedivy 1970)
Cremastus puberulus: MZL (Sedivy 1970)
Cremastus spectator: MZL (*)
Dimophora evanialis: MZL (*)
Dimophora nitens: MZL (Ferrière 1947)
Pristomerus armatus: (Horstmann 1990a)
Pristomerus horribilis: (Horstmann 1990a)
Pristomerus orbitalis: MZL (Delucchi 1957)
Pristomerus vulnerator: MZL (Bovey and Ferrière 1944)

Cryptinae

Aconias tarsatus: MZL (Ferrière 1947)
Acrolyta rufocincta: MZL (Ferrière 1947)
Acroricnus stylator: NMBE (Habermehl 1918)
Agasthenes varitarsus: ART (*)
Agrothereutes abbreviatus: NMBE (Blösch 1906)
Agrothereutes adustus: NMBE (*)
Agrothereutes aterrimus: MZL (*)
Agrothereutes fumipennis: NMBE (Blösch 1906)
Agrothereutes hospes: NMBE (Ferrière 1947)
Agrothereutes leucorhaeus: NMBE (Blösch 1906)
Agrothereutes mandator: NMBE (Blösch 1906)
Agrothereutes mansuetor: MZL (*)
Agrothereutes tibialis: NMBE (Blösch 1906) – C6
Apsilops cinctorius: NMBE (*)
Aptesis cretata: MZL (Coulon 1933)
Aptesis exannulata: MZL (*)
Aptesis femoralis: NMBE (Ferrière 1947)
Aptesis flagitator: NMBE (*)
Aptesis jejunator: NMBE (Blösch 1906)
Aptesis nigricollis: MZL (Ferrière 1947)
Aptesis nigritula: MZL (*)
Aptesis nigrocincta: NMBE (Kopelke 1994)
Aptesis polita: (Bauer 1985)
Aptesis pugnax: NMBE (*)
Aptesis terminata: NMBE (Blösch 1906)
Aritranis director: NMBE (*)
Aritranis explorator: ART (*)
Aritranis nigrifemur: MZL (*)
Aritranis nigripes: NMBE (Schwarz 2005)
Aritranis occisor: NMBE (Schwarz 2005)
Ateleute linearis: MZL (*)
Atractodes albovinctus: MZL (*)
Atractodes alpinus: (Jussila 2001)
Atractodes ambiguus: (Jussila 1979)
Atractodes angustipennis: (Jussila 2001)
Atractodes assimilis: (Jussila 2001)
Atractodes bicolor: (Blösch 1906; Jussila 2001) – C3
Atractodes croceicornis: (Jussila 2001)
Atractodes designatus: (Jussila 2001) – C2
Atractodes exilis: (Förster 1876; Jussila 1979) – C3
Atractodes exitialis: (Jussila 1979) – C7
Atractodes ficticius: (Förster 1876; Jussila 1979) – C2
Atractodes helveticus: (Förster 1876; Jussila 2001) – C2
Atractodes incrassator: (Jussila 1979)
Atractodes pauxillus: (Förster 1876; Jussila 2001) – C3
Atractodes pediophilus: (Förster 1876; Jussila 2001) – C3
Atractodes picipes: (Jussila 1979)
Atractodes pusillus: (Förster 1876; Jussila 2001) – C3
Bathythrix aerea: MZL (Sawoniewicz 1980)
Bathythrix argentata: MZL (*)
Bathythrix claviger: NMBE (*)
Bathythrix collaris: MZL (*)
Bathythrix decipiens: MZL (*)
Bathythrix formosa: MZL (*)
Bathythrix fragilis: MZL (*)
Bathythrix illustris: MZL (*)
Bathythrix lamina: MZL (Artmann-Graf et al. 2009)
Bathythrix linearis: NMBE (*)
Bathythrix pellucidator: MZL (Blösch 1906)
Bathythrix strigosa: MZL (*)
Bathythrix tenuis: NMBE (*)
Bathythrix thomsoni: MZL (*)
Brachypimpla brachyura: MZL (Ferrière 1947)
Buathra divisoria: NMBE (*)
Buathra laborator: NMBE (Habermehl 1918)
Buathra tarsoleucos: NMBE (Blösch 1906)
Chirotica albobasalis: MZL (Horstmann 1983)
Chirotica decorator: (Horstmann 1983)

Chirotica tenuipes: (Horstmann 1983) – C2
Colocnema rufina: NMBE (Blösch 1906)
Cratocryptus subpetiolatus: MZL (*)
Cremnodes atricapillus: (Horstmann 1993b)
Cryptus armator: ZSM (Schwarz 2015)
Cryptus bucculentus: NMBE (Schwarz 2015)
Cryptus dianae: NMBE (Habermehl 1918)
Cryptus fibulatus: MZL (Schwarz 2015)
Cryptus immitis: NMBE (Ferrière 1947)
Cryptus inculcator: NMBE (Fuesslin 1775)
Cryptus inquisitor: NMBE (Schwarz 2015)
Cryptus luctuosus: MZL (Schwarz 2015) – C8
Cryptus lugubris: NMBE (Ferrière 1947)
Cryptus macellus: MZL (*)
Cryptus minator: MZL (Schwarz 2015)
Cryptus moschator: NMB (Habermehl 1918)
Cryptus obscuripes: NMBE (Schwarz 2015)
Cryptus spinosus: NMBE (Schwarz 2015)
Cryptus spiralis: MZL (Schwarz 2015)
Cryptus titubator: MZL (Habermehl 1918)
Cryptus triguttatus: MZL (Schwarz 2015)
Cryptus tuberculatus: MZL (Ferrière 1947)
Cryptus valesiacus: (Schwarz 2015)
Cryptus viduatorius: NMBE (Blösch 1906)
Cubocephalus anatorius: NMBE (Artmann-Graf et al. 2009)
Cubocephalus associator: NMBE (Ferrière 1947)
Cubocephalus femoralis: NMBE (*)
Cubocephalus incurvator: MZL (Aubert 1977) – C1
Cubocephalus nigriventris: NMBE (*)
Cubocephalus sternocerus: NMBE (*)
Cubocephalus thomsoni: MZL (*)
Demopheles corruptor: NMBE (*)
Dichrogaster aestivalis: MZL (*)
Dichrogaster liostylus: MZL (*)
Dichrogaster longicaudata: MZL (*)
Dichrogaster modesta: (Townes 1983)
Dichrogaster perlae: NMBE (Townes 1983)
Dichrogaster schimitscheki: NMBE (*)
Echthrus reluctator: NMBE (Blösch 1906) – C3
Enclisis macilenta: MZL (Schwarz 1989)
Enclisis ornaticeps: MZL (*)
Enclisis vindex: MZL (Artmann-Graf et al. 2009)
Endasys alutaceus: MZL (Sawoniewicz and Luhman 1992)
Endasys annulatus: MZL (Sawoniewicz and Luhman 1992)
Endasys brevis: MZL (Blösch 1906)
Endasys cnemargus: NMBE (Sawoniewicz and Luhman 1992)
Endasys euxestus: MZL (Sawoniewicz and Luhman 1992)
Endasys femoralis: NMBE (*)
Endasys lissorulus: MZL (Sawoniewicz and Luhman 1992)
Endasys melanopodis: MZL (*)
Endasys melanurus: (Sawoniewicz and Luhman 1992)
Endasys plagiator: MZL (Artmann-Graf et al. 2009)
Endasys rugifacies: MZL (*)
Endasys rusticus: MZL (*)
Endasys senilis: MZL (Blösch 1906)
Endasys stictogastris: MZL (Sawoniewicz and Luhman 1992)
Endasys transverseareolatus: MZL (*)
Endasys varipes: (Sawoniewicz and Luhman 1992)
Eudelus scabriculus: MZL (*)
Eudelus simillimus: MZL (*)
Gambrus bipunctatus: MZL (*)
Gambrus carnifex: MZL (*)
Gambrus ornatus: MZL (Ferrière 1947)
Gambrus tricolor: MZL (*)
Gelis agilis: NMBE (Ferrière 1947)
Gelis albicinctoides: (Schwarz 1998) – C2
Gelis areator: NMBE (Ferrière 1947)
Gelis bicolor: (Schwarz 2002a)
Gelis caudatulus: NMBE (*)
Gelis cinctus: NMBE (Blösch 1906)
Gelis cursitans: (Schwarz 1998)
Gelis discedens: NMBE (Schwarz 2002a)
Gelis fortificator: (Schwarz 1998)
Gelis hortensis: NMBE (*)
Gelis intermedius: NMBE (Schwarz 2002a)
Gelis meigenii: (Schwarz 1998)
Gelis melanocephalus: NMBE (Blösch 1906)
Gelis melanophorus: (Schwarz 2002a)
Gelis micrurus: (Schwarz 2002a)
Gelis mutillatus: NMBE (*)
Gelis nigritulus: (Schwarz 1998)
Gelis petraeus: (Schwarz 1998)
Gelis proximus: NMBE (Ferrière 1947)
Gelis pulicarius: NMBE (*)
Gelis recens: NMBE (*)
Gelis rotundiventris: (Schwarz and Horstmann 1993) – C3
Gelis seyrigi: (Schwarz 1998)
Gelis spurius: NMBE (Schwarz 2002a)
Gelis stevenii: (Schwarz 1998)
Gelis trux: NMBE (Blösch 1906)
Gelis vicinus: NMBE (Blösch 1906; Diller and Horstmann 1997) – C3, C9
Gelis viduus: (Schwarz 2002a)
Gelis zeirapherator: MZL (Delucchi 1982)
Giraudia grisescens: MZL (Coulon 1933)
Giraudia gyratoria: NMBE (Blösch 1906)
Glyphicnemis atrata: NMBE (Habermehl 1919)
Glyphicnemis profligator: NMBE (Ferrière 1947)
Helcostizus restaurator: NMBE (Blösch 1906)
Hemiteles bipunctator: NMBE (*)
Hidryta fusiventris: MZL (*)
Hidryta sordida: MZL (*)
Hoplocryptus bellosus: NMBE (Schwarz 2007)
Hoplocryptus besseianus: NMBE (Schwarz 2007)
Hoplocryptus bohemani: MZL (Schwarz 2007)
Hoplocryptus confector: MZL (Blösch 1906)
Hoplocryptus coxator: MZL (Schwarz 2007)
Hoplocryptus heliophilus: MZL (Schwarz 2007)

Hoplocryptus magrettii: MZL (Habermehl 1919)
Hoplocryptus melanocephalus: MZL (Schwarz 2007)
Hoplocryptus murarius: NMBE (Schwarz 2007)
Hoplocryptus odoriferator: MZL (Schwarz 2007)
Idiolispa analis: NMBE (Blösch 1906)
Idiolispa grossa: MZL (*)
Idiolispa hungarica: MZL (*)
Idiolispa obfuscator: NMBE (*)
Idiolispa subalpina: (Ferrière 1947; Schwarz 1988) – C3
Isadelphus helveticus: (Horstmann 2009) – C2
Isadelphus inimicus: MZL (Bovey 1937)
Isadelphus longisetosus: MZL (Bovey 1936)
Ischnus agitator: NMBE (*)
Ischnus alternator: NMBE (Blösch 1906)
Ischnus inquisitorius: NMBE (Blösch 1906)
Ischnus migrator: NMBE (Aubert 1968a) – C3
Javra anomala: MZL (*)
Javra tenebrosa: (Aubert 1968a) – C2
Latibulus argiolus: MZL (Ferrière 1947)
Listrognathus firmator: NMBE (Horstmann 1990b)
Listrognathus furax: NMBE (*)
Listrognathus helveticae: NMBE (Horstmann 1968) – C2
Listrognathus mactator: NMBE (*)
Listrognathus obnoxius: NMBE (Ferrière 1947)
Listrognathus pubescens: NMBE (Horstmann 1990b)
Lochetica westoni: MZL (Blösch 1906)
Lysibia nana: NMBE (Blösch 1906)
Mastrus deminuens: NMBE (Blösch 1906)
Mastrus varicoxis: NMBE (Bovey 1936)
Meringopus attentorius: NMBE (*)
Meringopus calescens: NMBE (Habermehl 1918) – C3
Meringopus cyanator: NMBE (*)
Meringopus nigerrimus: NMBE (Ferrière 1947)
Meringopus titillator: NMBE (Fuesslin 1775)
Meringopus turanus: MZL (Blösch 1906) – C10
Mesoleptus congener: (Jussila et al. 2010) – C2
Mesoleptus devotus: (Jussila et al. 2010) – C3
Mesoleptus incessor: MZL (Dalla Torre 1902; Jussila et al. 2010) – C3
Mesoleptus laevigatus: (Dalla Torre 1902; Jussila et al. 2010)
Mesoleptus laticinctus: NMBE (Dalla Torre 1902; Jussila et al. 2010) – C3
Mesoleptus pronus: (Jussila et al. 2010) – C3
Mesoleptus vigilatorius: (Artmann-Graf et al. 2009)
Mesostenus albinotatus: NMBE (*)
Mesostenus dentifer: NMBE (*)
Mesostenus funebris: NMBE (*)
Mesostenus transfuga: NMBE (Blösch 1906)
Myrmeleonostenus italicus: NMBE (Dalla Torre 1902)
Nematopodius formosus: NMBE (Blösch 1906)
Nippocryptus quadriannulatus: MZL (Schwarz 2018)
Nippocryptus vittatorius: MZL (*)
Odontoneura annulicornis: MZL (*)
Oresbius arridens: MZL (Blösch 1906)
Oresbius bipunctatus: MZL (*)
Oresbius leucopsis: NMBE (Blösch 1906)
Oresbius subguttatus: NMBE (*)
Parmortha pleuralis: NMBE (*)
Phygadeuon elegans: (Horstmann 1993b)
Phygadeuon geniculatus: (Horstmann 2001b)
Phygadeuon trichops: NMBE (Wishart et al. 1957)
Picardiella melanoleuca: NMBE (*)
Plectocryptus albulatorius: MZL (*)
Plectocryptus alpinus: NMBE (*)
Plectocryptus effeminatus: (Artmann-Graf et al. 2009)
Plectocryptus periculosus: NMBE (*)
Pleolophus brachypterus: NMBE (Blösch 1906)
Pleolophus larvatus: MZL (*)
Pleolophus vestigialis: NMBE (Horstmann 1993c) – C3
Polytribax arrogans: NMBE (Blösch 1906)
Polytribax pelinocheirus: NMBE (Ferrière 1947)
Polytribax perspicillator: NMBE (Artmann-Graf et al. 2009)
Polytribax picticornis: MZL (*)
Polytribax rufipes: NMBE (Blösch 1906)
Polytribax senex: (Kriechbaumer 1893) – C2
Pycnocryptodes crenulatus: (Horstmann 2000) – C2
Pycnocryptodes insinuator: MZL (Oehlke and Townes 1969) – C3
Pygocryptus brevicornis: NMBE (*)
Pygocryptus rufofacialis: NMBE (*)
Rhembobius perscrutator: MZL (*)
Rhembobius quadrispinus: NMBE (Blösch 1906)
Schenkia crassicornis: MZL (*)
Schenkia opacula: MZL (*)
Schenkia rubricollis: NMBE (Habermehl 1919)
Schenkia rufithorax: MZL (*)
Schreineria populnea: NMBE (Horstmann 1990b)
Sphecophaga vesparum: MZL (Blösch 1906; Dalla Torre 1902)
Stenarella domator: NMBE (Blösch 1906)
Stibeutes heinemanni: (Horstmann 1993b)
Stibeutes tricinctor: (Aubert 1968a)
Stilpnus blandus: MZL (*)
Stilpnus gagates: NMBE (Blösch 1906) – C3
Stilpnus montanus: (Jussila 1987) – C2
Stilpnus parvulus: MZL (*)
Stilpnus pavoniae: (Jussila 1987) – C3
Stilpnus tenebricosus: (Jussila 1987) – C3
Thaumatogelis neesii: NMBE (*)
Theroscopus alpator: MZL (Aubert 1989b) – C1
Theroscopus hemipteron: (Horstmann 1993b)
Theroscopus pedestris: NMBE (Blösch 1906)
Thrybius brevispina: MZL (*)
Thrybius praedator: MZL (*)
Tropistes falcatus: MZL (*)
Tropistes nitidipennis: MZL (*)
Trychosis ambigua: NMBE (*)
Trychosis atripes: MZL (*)
Trychosis gradaria: MZL (Dalla Torre 1902; Ferrière 1947)
Trychosis ingrata: NMBE (Blösch 1906)
Trychosis jugorum: (Schwarz 2018) – C6
Trychosis legator: NMBE (Blösch 1906)
Trychosis neglecta: NMBE (Blösch 1906)

Trychosis pauper: NMBE (*)
Trychosis priesneri: NMBE (van Rossem 1971)
Trychosis tristator: NMBE (Artmann-Graf et al. 2009)
Xenolytus bitinctus: MZL (*)
Xylophrurus augustus: MZL (Ferrière 1947)
Xylophrurus coraebi: (Artmann-Graf et al. 2009)
Xylophrurus lancifer: MZL (*)
Zoophthorus laticinctus: NMBE (Brauns 1888) – C3

Ctenopelmatinae

Absyrtus vernalis: MZL (Aubert 2000)
Absyrtus vicinator: MZL (Aubert 2000)
Alexeter clavator: MZL (Aubert 2000)
Alexeter gracilentus: MZL (Aubert 2000)
Alexeter hypargyrici: (Hinz 1996)
Alexeter nebulator: MZL (Aubert 2000)
Alexeter niger: MZL (Aubert 2000)
Alexeter rapinator: MZL (Aubert 2000)
Alexeter segmentarius: MZL (Blösch 1906)
Anisotacrus bipunctatus: MZL (Aubert 2000)
Anisotacrus xanthostigma: MZL (Aubert 2000)
Anoncus gallicola: (Kasparyan and Kopelke 2009)
Asthenara scabricula: MZL (Aubert 2000)
Asthenara socia: MZL (Aubert 2000)
Azelus erythropalpus: MZL (Aubert 2000)
Barytarbes adpropinquator: MZL (Ferrière 1947)
Barytarbes flavoscutellatus: MZL (Aubert 2000)
Barytarbes illuminator: MZL (Aubert 2000)
Barytarbes pectoralis: MZL (Aubert 2000)
Barytarbes superbus: MZL (Aubert 2000)
Bremiella pulchella: NMBE (Kriechbaumer 1890b) – C1
Ctenopelma elegantulum: MZL (Aubert 2000)
Ctenopelma luciferum: MZL (Blösch 1906)
Ctenopelma nigripenne: MZL (Aubert 2000) – C3
Ctenopelma nigrum: MZL (Aubert 2000)
Ctenopelma ruficorne: MZL (Aubert 2000)
Ctenopelma rufiventre: MZL (Aubert 2000)
Ctenopelma tomentosum: MZL (Ferrière 1947)
Dentimachus politus: MZL (Aubert 1970b)
Euryproctus alpinus: MZL (Aubert 2000)
Euryproctus annulatus: MZL (Aubert 2000)
Euryproctus bivinctus: MZL (Aubert 2000)
Euryproctus crassicornis: MZL (Aubert 2000)
Euryproctus geniculosus: MZL (Blösch 1906)
Euryproctus holmgreni: MZL (Aubert 1969c) – C3
Euryproctus luteicornis: MZL (Aubert 2000)
Euryproctus mundus: MZL (Aubert 2000)
Euryproctus nemoralis: MZL (Blösch 1906)
Glyptorhaestus punctatus: MZL (Aubert 2000)
Gunomeria macrodactylus: MZL (Aubert 2000)
Gunomeria sordida: MZL (Aubert 2000)
Hadrodactylus confusus: MZL (Aubert 2000)
Hadrodactylus faciator: MZL (Idar 1981)
Hadrodactylus femoralis: (Idar 1981)
Hadrodactylus flavifrons: (Idar 1981)
Hadrodactylus flavofacialis: (Horstmann 2000)
Hadrodactylus fugax: MZL (Ferrière 1947)
Hadrodactylus genalis: NMBE (*)
Hadrodactylus gracilipes: (Artmann-Graf et al. 2009; Aubert 2000)
Hadrodactylus indefessus: (Kasparyan and Shaw 2009)
Hadrodactylus insignis: MZL (Aubert 2000)
Hadrodactylus rectinervis: MZL (Aubert 2000)
Hadrodactylus semirufus: MZL (Aubert 2000)
Hadrodactylus tiphae: MZL (Aubert 2000)
Hadrodactylus villosulus: MZL (Aubert 2000)
Himerta defectiva: MZL (Aubert 2000)
Himerta scutellaris: MZL (*)
Himerta sepulchralis: MZL (Aubert 2000)
Homaspis rufina: MZL (Aubert 2000)
Homaspis subalpina: MZL (Aubert 2000)
Hypamblys albopictus: MZL (Aubert 2000)
Hypamblys romani: MZL (Aubert 2000)
Hyperbatus aemulus: (Kasparyan 1998)
Labrossyta scotoptera: MZL (Aubert 2000)
Lagarotis alpina: MZL (Aubert 2000)
Lagarotis debitor: MZL (Blösch 1906)
Lagarotis pubescens: MZL (Ferrière 1947)
Lagarotis semicaligata: MZL (Aubert 2000)
Lagarotis simulator: (Artmann-Graf et al. 2009)
Lagarotis ustulata: MZL (*)
Lamachus alpinator: MZL (*) – C1
Lamachus australis: MZL (Mey and Oehlke 1988) – C2
Lamachus coalitorius: MZL (*)
Lamachus consimilis: MZL (*)
Lamachus cruralis: MZL (Aubert 2000)
Lamachus dispar: MZL (Aubert 2000)
Lamachus frutetorum: (Aubert 2000)
Lamachus virgultorum: MZL (*)
Lathiponus semiluctuosus: MZL (Aubert 2000)
Lathrolestes buccinator: MZL (Aubert 2000)
Lathrolestes caudatus: MZL (*)
Lathrolestes citreus: MZL (Aubert 2000)
Lathrolestes erythrocephalus: MZL (Blösch 1906)
Lathrolestes luteolator: MZL (Aubert 2000)
Lathrolestes morator: MZL (Aubert 1984)
Lathrolestes nigricollis: MZL (Aubert 2000)
Lathrolestes orbitalis: MZL (Aubert 2000)
Lathrolestes pictilis: MZL (Aubert 2000)
Lathrolestes pleuralis: (Reshchikov 2015)
Lathrolestes tripunctor: MZL (Aubert 2000)
Lathrolestes verticalis: MZL (Aubert 2000)
Lethades curvispina: MZL (Aubert 2000)
Lethades schaffneri: (Hinz 1996) – C2
Lethades subcoriaceus: (Hinz 1976) – C3
Mesoleius altalpinus: (Bauer 1985) – C2
Mesoleius armillatorius: MZL (Blösch 1906)
Mesoleius aulicus: (Artmann-Graf et al. 2009; Ferrière 1947)
Mesoleius lindemansi: (Kasparyan 2000)
Mesoleptidea cingulata: MZL (Blösch 1906)
Mesoleptidea hohenwartensis: MZL (Aubert 2000)
Mesoleptidea prosoleuca: MZL (Ferrière 1947)
Mesoleptidea stalii: MZL (Aubert 2000)
Mesoleptidea sylvatica: MZL (Aubert 2000)
Notopygus emarginatus: MZL (Aubert 2000)

Notopygus nigricornis: MZL (*)
Occapes selandriae: MZL (Aubert 2000)
Oetophorus naevius: MZL (Aubert 2000)
Olethrodotis modesta: MZL (Aubert 2000)
Opheltes glaucopterus: MZL (Aubert 2000)
Otlophorus anceps: MZL (Aubert 2000)
Otlophorus congruens: MZL (*)
Otlophorus italicus: MZL (*)
Otlophorus nigritarsus: (Horstmann 1999)
Otlophorus pulverulentus: MZL (Aubert 2000)
Pantorhaestes xanthostomus: MZL (Aubert 2000)
Perilimicron alticolator: MZL (Aubert 1989a) – C1
Perilissus albitarsis: MZL (Aubert 2000)
Perilissus alpestrator: MZL (Aubert 1969c)
Perilissus banaticus: MZL (Aubert 2000)
Perilissus compressus: MZL (Aubert 2000)
Perilissus coxalis: MZL (Aubert 2000)
Perilissus holmgreni: MZL (Aubert 2000)
Perilissus lutescens: MZL (Aubert 2000)
Perilissus pallidus: MZL (Blösch 1906)
Perilissus rufoniger: MZL (Blösch 1906)
Perilissus sericeus: MZL (Aubert 2000)
Perilissus spilonotus: MZL (Aubert 2000)
Perilissus unguiculator: MZL (Aubert 1987) – C1
Perilissus variator: MZL (Blösch 1906)
Perispuda bignellii: MZL (Aubert 2000)
Perispuda facialis: MZL (Aubert 2000)
Perispuda mesoxantha: MZL (Aubert 2000)
Perispuda sulphurata: MZL (Aubert 2000)
Phobetes alpinator: MZL (Aubert 1976a) – C1
Phobetes cerinostomus: MZL (*)
Phobetes leptocerus: MZL (Aubert 2000)
Phobetes thomsoni: MZL (Aubert 2000)
Pion fortipes: MZL (Blösch 1906)
Pion nigripes: MZL (Aubert 2000)
Priopoda apicaria: MZL (Aubert 2000)
Priopoda xanthopsana: MZL (Blösch 1906)
Priopoda xanthopsanator: MZL (*) – C11
Protarchus melanurus: MZL (*)
Protarchus testatorius: MZL (Ferrière 1947)
Rhaestus lativentris: MZL (Aubert 2000)
Rhaestus ophthalmicus: MZL (Aubert 2000)
Rhaestus rufipes: MZL (Aubert 2000)
Rhinotorus alpinus: MZL (*)
Rhinotorus leucostomus: MZL (*)
Rhinotorus nasutus: MZL (*)
Rhorodes petiolator: MZL (Aubert 1970b) – C1
Rhorus alpinator: MZL (Aubert 1965a) – C1
Rhorus alpinipunctor: MZL (Kasparyan 2014)
Rhorus brunnifemur: (Kasparyan 2015)
Rhorus chrysopus: MZL (Kasparyan 2017)
Rhorus exstirpatorius: MZL (Blösch 1906)
Rhorus femoralis: MZL (Aubert 2000)
Rhorus flavopictus: MZL (*)
Rhorus longicornis: MZL (Blösch 1906)
Rhorus longigena: MZL (Aubert 2000)
Rhorus palustris: MZL (Aubert 2000)
Rhorus punctus: MZL (Aubert 2000)
Rhorus subfasciatus: MZL (Aubert 2000)
Rhorus substitutor: MZL (Eichhorn 1977)
Saotis mirabilis: MZL (Kasparyan and Kopelke 2010)
Saotis morleyi: (Kasparyan and Kopelke 2010)
Saotis nigriscuta: MZL (*)
Saotis nigriventris: (Kasparyan and Kopelke 2010)
Saotis pygidiator: (Kasparyan 2009)
Scolobates auriculatus: MZL (Aubert 2000)
Scolobates nigerrimus: MZL (Aubert 2000)
Scopesis bicolor: MZL (Ferrière 1947)
Scopesis frontator: MZL (Blösch 1906)
Scopesis gesticulator: MZL (Blösch 1906)
Scopesis macropus: MZL (Aubert 2000)
Scopesis obscura: MZL (Aubert 2000)
Scopesis polita: MZL (Aubert 2000)
Scopesis rubrotincta: MZL (Aubert 2000)
Scopesis rufonotata: MZL (*)
Scopesis tegularis: MZL (Aubert 2000)
Sympherta antilope: MZL (Aubert 2000)
Sympherta canaliculata: MZL (Aubert 2000)
Sympherta facialis: MZL (Aubert 2000)
Sympherta foveolator: MZL (Aubert 2000)
Sympherta montana: MZL (Aubert 2000)
Sympherta obligator: MZL (Aubert 2000)
Sympherta styriaca: (Artmann-Graf et al. 2009)
Sympherta sulcata: MZL (Aubert 2000)
Sympherta ullrichi: MZL (Ferrière 1947)
Syndipnus alpicolor: MZL (Aubert 1998) – C1
Syndipnus conformis: MZL (Aubert 2000)
Syndipnus lateralis: MZL (Aubert 2000)
Syndipnus macrocerus: MZL (*)
Syndipnus pannicularius: MZL (Aubert 2000)
Synodites amoenus: (Aubert 1976a)
Synodites breviusculus: MZL (Blösch 1906)
Synodites decipiens: MZL (Aubert 1998)
Synodites erosus: (Aubert 2000)
Synodites notatus: MZL (Aubert 2000)
Synodites orbitalis: MZL (*)
Synoecetes alpinator: MZL (Aubert 1970b)
Synoecetes anterior: MZL (Aubert 2000)
Synoecetes tenuicornis: MZL (Aubert 2000)
Synomelix albipes: MZL (Aubert 2000)
Synomelix faciator: (Aubert 2000)
Syntactus delusor: MZL (Fuesslin 1775)
Syntactus minor: MZL (Aubert 2000)
Trematopygodes aprilinus: MZL (Aubert 2000)
Trematopygus horvathi: (Hinz 1986)
Trematopygus melanocerus: MZL (Hinz 1986)
Trematopygus nigricornis: MZL (Aubert 2000)
Trematopygus ruficornis: (Aubert 2000)
Trematopygus vellicans: MZL (Aubert 2000)
Xenoschesis fulvicornis: MZL (Ferrière 1947)
Xenoschesis fulvipes: MZL (Ferrière 1947)
Xenoschesis ustulata: MZL (Blösch 1906)
Zaplethocornia filicornutor: MZL (Aubert 1976a)
Zaplethocornia procurator: MZL (Blösch 1906)

Cylloceriinae

Allomacrus arcticus: MZL (Dalla Torre 1902)
Cylloceria caligata: (van Rossem 1981)
Cylloceria melancholica: NMB (Ferrière 1947)
Cylloceria occupator: MZL (*)

Diacritinae

Diacritus aciculatus: MZL (*)

Diplazontinae

Bioblapsis cultiformis: NMBE (Klopfstein et al. 2007)
Bioblapsis polita: MZL (Klopfstein 2014)
Campocraspedon annulitarsis: NMBE (Klopfstein 2014)
Campocraspedon caudatus: NMBE (Klopfstein et al. 2007)
Daschia brevitarsis: MZL (Dalla Torre 1902) – C2
Diplazon angustus: NMBE (Diller 1986) – C3
Diplazon annulatus: MZL (Ferrière 1947)
Diplazon cascadensis: ZSM (Diller 1986) – C3
Diplazon deletus: NMBE (Klopfstein et al. 2007)
Diplazon flixi: NMBE (Klopfstein 2014)
Diplazon laetatorius: MZL (Blösch 1906)
Diplazon multicolor: MHNG (Klopfstein et al. 2007)
Diplazon neoalpinus: NMBE (Klopfstein et al. 2011)
Diplazon pallicoxa: MZL (Klopfstein et al. 2011)
Diplazon parvus: NMBE (Klopfstein 2014)
Diplazon pectoratorius: NMBE (Blösch 1906)
Diplazon scutatorius: NMBE (Klopfstein et al. 2007)
Diplazon tetragonus: NMBE (Blösch 1906)
Diplazon tibiatorius: NMBE (Blösch 1906)
Diplazon varicoxa: NMBE (Ferrière 1947)
Diplazon zetteli: NMBE (Klopfstein 2014)
Enizemum nigricorne: MZL (Klopfstein 2014)
Enizemum ornatum: MZL (Klopfstein et al. 2007)
Enizemum scutellare: MZL (Klopfstein 2014)
Episemura ensata: MZL (Klopfstein 2014)
Fossatyloides gracilentus: NMBE (Klopfstein et al. 2007)
Homotropus collinus: MZL (Klopfstein 2014)
Homotropus dimidiatus: MZL (Klopfstein 2014)
Homotropus elegans: MZL (Klopfstein 2014)
Homotropus frontorius: MZL (Klopfstein 2014)
Homotropus haemorrhoidalis: NMB (Klopfstein 2014)
Homotropus longiventris: MZL (Klopfstein et al. 2010)
Homotropus megaspis: MZL (Klopfstein et al. 2007)
Homotropus melanogaster: NMBE (Klopfstein et al. 2007)
Homotropus nigritarsus: NMBE (Beirne 1941)
Homotropus nigrolineatus: MZL (Klopfstein et al. 2007)
Homotropus pallipes: MZL (Beirne 1941)
Homotropus pictus: NMBE (Blösch 1906)
Homotropus signatus: NMBE (Townes et al. 1965)
Homotropus sundevalli: NMBE (Klopfstein 2014)
Phthorima compressa: NMBE (Seyrig 1928)
Phthorima obscuripennis: MZL (Klopfstein 2014)
Phthorima xanthaspis: NMBE (Klopfstein 2014)
Promethes bridgmani: MZL (Beirne 1941)
Promethes melanaspis: MZL (Seyrig 1928)
Promethes nigriventris: MZL (Klopfstein et al. 2011)
Promethes sulcator: NMBE (Blösch 1906)
Sussaba aciculata: NMBE (Klopfstein et al. 2007)
Sussaba cognata: NMBE (Beirne 1941)
Sussaba dorsalis: NMBE (Klopfstein et al. 2007)
Sussaba erigator: NMBE (Ferrière 1947)
Sussaba flavipes: NMBE (Diller 1980)
Sussaba placita: MZL (Klopfstein 2014)
Sussaba pulchella: NMBE (Dalla Torre 1902)
Sussaba punctiventris: NMBE (Klopfstein et al. 2007)
Sussaba roberti: NMBE (Klopfstein 2014)
Syrphoctonus desvignesii: MZL (Klopfstein et al. 2010)
Syrphoctonus fissorius: MZL (Klopfstein et al. 2010)
Syrphoctonus idari: ZSM (Diller 1985)
Syrphoctonus tarsatorius: NMBE (Beirne 1941)
Syrphophilus bizonarius: NMBE (Blösch 1906)
Syrphophilus stibarus: MZL (Aubert 1976a)
Syrphophilus tricinctorius: NMBE (Klopfstein et al. 2007)
Tymmophorus erythrozonus: NMBE (Beirne 1941)
Tymmophorus obscuripes: NMBE (Klopfstein et al. 2007)
Tymmophorus suspiciosus: NMBE (Beirne 1941)
Woldstedtius bauri: NMBE (Klopfstein 2014)
Woldstedtius biguttatus: MZL (Klopfstein et al. 2007)
Woldstedtius citropectoralis: MZL (Klopfstein et al. 2007)
Woldstedtius flavolineatus: MZL (Klopfstein et al. 2007)
Woldstedtius holarcticus: NMBE (Klopfstein et al. 2007)
Woldstedtius nigrolineatops: NMBE (Klopfstein 2014)
Xestopelta gracillima: MZL (Klopfstein 2014)
Eucerotinae
Euceros kiushuensis: (Barron 1978)
Euceros pruinosus: (Barron 1978; Blösch 1906)

Hybrizontinae

Hybrizon buccatus: (Blösch 1906; van Achterberg 1999)

Ichneumoninae

Achaius margineguttatus: (Hilpert et al. 1993) – C3
Achaius oratorius: NMBE (Blösch 1906)
Aethecerus discolor: MZL (Fulmek 1968)
Aethecerus dispar: MZL (*)
Aethecerus exilis: MZL (*)
Aethecerus longulus: MZL (*)
Aethecerus nitidus: MZL (Blösch 1906)
Aethecerus placidus: MZL (*)
Aethecerus regius: MZL (*)
Aethecerus rugifrons: MZL (*)
Aglaojoppa centummaculata: NMBE (*)
Amblyjoppa fuscipennis: NMBE (Ferrière 1947)
Amblyjoppa proteus: NMBE (*)
Amblyteles armatorius: NMBE (Blösch 1906)
Anisobas cingulatellus: NMB (Blösch 1906)
Anisobas hostilis: (Horstmann 2007)
Anisobas platystylus: (Chapman 1910; Horstmann 2007)
Anisobas rebellis: MZL (Horstmann 2007)
Aoplus castaneus: NMBE (Hilpert et al. 1993; Pic 1926) – C3

Aoplus defraudator: NMBE (Artmann-Graf 2016)
Aoplus mustela: (Bauer 2001)
Aoplus ochropis: NMBE (Artmann-Graf 2016)
Aoplus ruficeps: NMBE (Blösch 1906)
Aoplus theresae: (Berthoumieu 1896) – C2
Apaeleticus bellicosus: MZL (*)
Apaeleticus inimicus: MZL (Dalla Torre 1902)
Apaeleticus mesostictus: NMB (*)
Asthenolabus latiscapus: MZL (*)
Asthenolabus vitratorius: MZL (Coulon 1933)
Baeosemus mitigosus: MZL (*)
Baeosemus oenescens: MZL (Habermehl 1917) – C2
Baranisobas ridibundus: NMBE (Dalla Torre 1902) – C3
Barichneumon anator: NMBE (Blösch 1906)
Barichneumon anatorius: (Berthoumieu 1899; Diller and Horstmann 1997) – C2
Barichneumon bilunulatus: MZL (Blösch 1906)
Barichneumon chionomus: NMBE (Ferrière 1947)
Barichneumon derogator: (Bauer 2001)
Barichneumon gemellus: MZL (Artmann-Graf 2016)
Barichneumon peregrinator: (Artmann-Graf 2016; Fuesslin 1775)
Barichneumon praeceptor: (Artmann-Graf 2012)
Callajoppa cirrogaster: MZL (Blösch 1906)
Callajoppa exaltatoria: MZL (Blösch 1906)
Catadelphus arrogator: NMBE (*)
Centeterus confector: MZL (Blösch 1906)
Centeterus major: MZL (*)
Centeterus rubiginosus: MZL (Bauer 2001)
Chasmias motatorius: NMBE (Blösch 1906)
Chasmias paludator: NMBE (Blösch 1906)
Coelichneumon albicillus: NMBE (Riedel 2012)
Coelichneumon atratorius: MZL (Ferrière 1947)
Coelichneumon biannulatus: NMBE (Bauer 2001)
Coelichneumon biguttorius: NMBE (Riedel 2012)
Coelichneumon biguttulatus: NMBE (Artmann-Graf 2012)
Coelichneumon bilineatus: NMBE (Kirchner 1867)
Coelichneumon bohemani: NMB (Pic 1902) – C3
Coelichneumon comitator: NMBE (Fuesslin 1775)
Coelichneumon consimilis: NMBE (Tischbein 1881) – C3
Coelichneumon cyaniventris: NMBE (Artmann-Graf et al. 2009)
Coelichneumon desinatorius: NMBE (Artmann-Graf et al. 2009)
Coelichneumon dorsosignatus: MZL (Riedel 2012)
Coelichneumon dubius: MZL (Riedel 2012)
Coelichneumon eburnifrons: MZL (Artmann-Graf 2012)
Coelichneumon erythromerus: NMB (Horstmann 2000)
Coelichneumon falsificus: NMBE (Artmann-Graf 2012)
Coelichneumon funebrator: NMBE (Horstmann 2006c)
Coelichneumon graecus: NMBE (Riedel 2012)
Coelichneumon haemorrhoidalis: NMBE (Artmann-Graf 2012) – C3
Coelichneumon impressor: NMBE (Habermehl 1916)
Coelichneumon leucocerus: NMBE (Blösch 1906)
Coelichneumon metidjensis: NMB (Riedel 2012)
Coelichneumon nigerrimus: MZL (Riedel 2012)
Coelichneumon nobilis: NMBE (Riedel 2012)
Coelichneumon ophiusae: NMBE (Riedel 2012) – C3
Coelichneumon opulentus: NMB (Riedel 2012)
Coelichneumon orbitator: NMB (Riedel 2012)
Coelichneumon rudis: NMBE (Riedel 2012)
Coelichneumon ruficauda: NMB (Blösch 1906; Riedel 2012)
Coelichneumon sinister: NMBE (Artmann-Graf et al. 2009)
Coelichneumon sugillatorius: NMBE (Fuesslin 1775) – C3
Coelichneumon validus: NMBE (Riedel 2012)
Colpognathus celerator: MZL (Blösch 1906)
Colpognathus divisus: MZL (Coulon 1933)
Cotiheresiarches dirus: NMBE (*)
Cratichneumon coruscator: NMBE (Fuesslin 1775)
Cratichneumon culex: NMBE (Blösch 1906)
Cratichneumon flavifrons: NMBE (Artmann-Graf et al. 2009)
Cratichneumon fugitivus: NMBE (Berthoumieu 1899) – C3
Cratichneumon jocularis: NMBE (Bauer 2001)
Cratichneumon luteiventris: NMBE (Blösch 1906)
Cratichneumon parvulus: NMBE (Dalla Torre 1902; Horstmann 2006a) – C1
Cratichneumon rufifrons: NMBE (*)
Cratichneumon semirufus: (Artmann-Graf 2012)
Cratichneumon sexarmillatus: (Artmann-Graf 2016)
Cratichneumon sicarius: NMBE (Blösch 1906)
Cratichneumon versator: NMBE (Artmann-Graf 2016)
Cratichneumon viator: NMBE (Blösch 1906)
Crypteffigies albilarvatus: NMBE (Delucchi 1982)
Crypteffigies lanius: (Artmann-Graf 2016)
Crytea sanguinator: NMBE (Artmann-Graf et al. 2009)
Ctenichneumon divisorius: NMBE (Ferrière 1947)
Ctenichneumon funereus: NMBE (Blösch 1906)
Ctenichneumon inspector: NMBE (Bauer 2001)
Ctenichneumon melanocastanus: NMBE (Blösch 1906)
Ctenichneumon messorius: (Artmann-Graf 2017; Habermehl 1917)
Ctenichneumon nitens: (Bauer 2001; Blösch 1906)
Ctenichneumon panzeri: ETHZ (Artmann-Graf et al. 2009; Blösch 1906)
Ctenichneumon repentinus: (Artmann-Graf 2017) – C12
Cyclolabus alpinus: (Habermehl 1917; Riedel 2006) – C2
Cyclolabus axillatorius: MZL (Blösch 1906)
Cyclolabus nigricollis: NMB (*)
Dentilabus variegatus: NMBE (*)
Diadromus albinotatus: MZL (*)
Diadromus collaris: MZL (*)
Diadromus heteroneurus: MZL (*)
Diadromus intermedius: MZL (Berthoumieu 1899) – C3
Diadromus pulchellus: (Mason et al. 2013)
Diadromus subtilicornis: MZL (Berthoumieu 1899) – C3
Diadromus tenax: MZL (*)
Diadromus troglodytes: MZL (*)
Diadromus varicolor: MZL (Habermehl 1917)
Diaschisaspis campoplegoides: MZL (*)
Dicaelotus andrei: MZL (*)
Dicaelotus cameroni: MZL (*)

Dicaelotus montanus: MZL (*)
Dicaelotus parvulus: MZL (*)
Dicaelotus pictus: MZL (*)
Dicaelotus punctiventris: MZL (*)
Dicaelotus ruficornis: MZL (*)
Dicaelotus rufiventris: (Berthoumieu 1899; Diller and Horstmann 1994) – C2
Diphyus amatorius: NMBE (Blösch 1906)
Diphyus arduus: (Berthoumieu 1896) – C2
Diphyus ater: (Wesmael 1855) – C2
Diphyus bicingulatus: (Artmann-Graf 2017; Ferrière 1947)
Diphyus castanopyga: (Artmann-Graf 2017; Dalla Torre 1902)
Diphyus gibbosus: (Berthoumieu 1899; Diller and Horstmann 1997) – C2
Diphyus latebricola: (Artmann-Graf 2017)
Diphyus luctatorius: (Artmann-Graf 2017; Fuesslin 1775)
Diphyus mercatorius: NMBE (Vidal 1993)
Diphyus ochromelas: NMBE (Blösch 1906)
Diphyus palliatorius: NMBE (Tischbein 1881) – C3
Diphyus politus: (Townes et al. 1965) – C2
Diphyus pseudomercator: (Artmann-Graf 2017)
Diphyus quadripunctorius: NMBE (Blösch 1906)
Diphyus raptorius: (Artmann-Graf 2017; Fuesslin 1775)
Diphyus salicatorius: NMBE (Artmann-Graf 2017)
Diphyus septemguttatus: NMBE (Bauer 2001)
Dirophanes callopus: MZL (Berthoumieu 1900) – C3
Dirophanes coryphaeus: MZL (*)
Dirophanes foveolatus: MZL (*)
Dirophanes fulvitarsis: MZL (Blösch 1906)
Dirophanes invisor: MZL (Blösch 1906)
Dirophanes maculicornis: MZL (*)
Dirophanes mysticus: MZL (*)
Dirophanes regenerator: MZL (Dalla Torre 1902)
Ectopius rubellus: MZL (*)
Ectopoides brevicornis: MZL (*)
Epitomus infuscatus: MZL (*)
Eupalamus lacteator: NMBE (*)
Eupalamus oscillator: (Artmann-Graf 2016)
Eurylabus larvatus: MZL (*)
Eurylabus torvus: MZL (Blösch 1906)
Eurylabus tristis: MZL (*)
Eutanyacra crispatoria: (Artmann-Graf et al. 2009; Blösch 1906)
Eutanyacra glaucatoria: (Artmann-Graf 2017; Blösch 1906)
Eutanyacra ruficornis: NMBE (Artmann-Graf 2017)
Exephanes fulvescens: MZL (*)
Exephanes ischioxanthus: MZL (Artmann-Graf et al. 2009)
Exephanes occupator: MZL (Zwölfer 1962)
Exephanes riesei: MZL (*)
Gareila nivata: (Artmann-Graf 2016)
Gareila patruelis: NMBE (*)
Goedartia alboguttata: MZL (Blösch 1906)
Hemichneumon subdolus: MZL (*)
Heresiarches eudoxius: MZL (*)
Herpestomus arridens: MZL (Berthoumieu 1899) – C3
Herpestomus brunnicornis: MZL (Blösch 1906)
Heterischnus bicolorator: MZL (Aubert 1965b) – C1
Heterischnus coxator: (Fitton 1982) – C2
Heterischnus debilis: MZL (*)
Heterischnus filiformis: MZL (*)
Heterischnus truncator: MZL (Blösch 1906) – C3
Homotherus locutor: (Artmann-Graf 2016)
Homotherus varipes: (Artmann-Graf 2016)
Hoplismenus krapinensis: ART (*)
Hoplismenus lamprolabus: ART (*)
Hoplismenus pica: (Meyer 1933, Artmann-Graf et al. 2009)
Hoplismenus krapinensis: ART (Blösch 1906)
Hypomecus quadriannulatus: NMB (*)
Ichneumon acosmus: ZSM (Kriechbaumer 1880) – C2, C13
Ichneumon acuticornis: (Hilpert 1992)
Ichneumon affector: NMBE (Habermehl 1916) – C3
Ichneumon albiger: NMBE (Ferrière 1947)
Ichneumon alius: NMBE (Dalla Torre 1902)
Ichneumon alpestriops: (Hilpert 1992)
Ichneumon alpinator: NMBE (Tschopp et al. 2013)
Ichneumon analis: MZL (*)
Ichneumon analisorius: MZL (*)
Ichneumon balteatus: MZL (*)
Ichneumon bellipes: (Hilpert 1992)
Ichneumon berninae: NMBE (Dalla Torre 1902) – C2
Ichneumon bucculentus: MZL (Blösch 1906)
Ichneumon caedator: MZL (Ferrière 1947)
Ichneumon caloscelis: MZL (Blösch 1906)
Ichneumon cerebrosus: MZL (Hilpert 1992) – C2
Ichneumon cerinthius: NMBE (Dalla Torre 1902; Hilpert 1992) – C3
Ichneumon cessator: MZL (Ferrière 1947)
Ichneumon computatorius: MZL (Blösch 1906)
Ichneumon confusor: MZL (Blösch 1906)
Ichneumon coniger: MZL (*)
Ichneumon cynthiae: (Hilpert 1992)
Ichneumon deliratorius: NMBE (Artmann-Graf 2015)
Ichneumon dilleri: NMBE (Berthoumieu 1896) – C3
Ichneumon emancipatus: MZL (Ferrière 1947)
Ichneumon erythromerus: (Hilpert 1992; Kirchner 1867)
Ichneumon exilicornis: MZL (Kirchner 1867)
Ichneumon extensorius: NMBE (Fuesslin 1775)
Ichneumon formosus: (Ferrière 1947; Hilpert 1992)
Ichneumon freyi: NMBE (Hilpert 1992) – C2
Ichneumon gracilentus: MZL (Blösch 1906) – C3
Ichneumon gracilicornis: NMBE (Ferrière 1947)
Ichneumon gratus: (Hilpert 1992; Wesmael 1855) – C2
Ichneumon haematonotus: MZL (*)
Ichneumon haemorrhoicus: (Ferrière 1947; Hilpert 1992)
Ichneumon helveticus: (Hilpert 1992) – C2, C14
Ichneumon ignobilis: MZL (Dalla Torre 1902; Hilpert 1992)
Ichneumon ingratus: (Artmann-Graf 2012)
Ichneumon inops: (Artmann-Graf et al. 2009; Hilpert 1992)
Ichneumon inquinatus: NMBE (Coulon 1933)
Ichneumon insidiosus: (Hilpert 1992)
Ichneumon languidus: (Hilpert 1992)
Ichneumon ligatorius: (Hilpert 1992; Kirchner 1867) – C3
Ichneumon lugens: NMBE (Tschopp et al. 2013)
Ichneumon luteipes: MZL (Wesmael 1855) – C2
Ichneumon macilentus: (Hilpert 1992)

Ichneumon marmotus: (Hilpert 1992) – C2
Ichneumon megapodius: MZL (Habermehl 1916) – C3
Ichneumon melanosomus: MZL (Wesmael 1855) – C2
Ichneumon melanotis: (Artmann-Graf et al. 2009; Ferrière 1947)
Ichneumon memorator: MZL (Ferrière 1947)
Ichneumon minutorius: MZL (Ferrière 1947)
Ichneumon molitorius: (Artmann-Graf et al. 2009; Fuesslin 1775) – C15
Ichneumon novemalbatus: MZL (Artmann-Graf 2015)
Ichneumon obliteratus: (Wesmael 1855) – C2
Ichneumon oblongus: MZL (Blösch 1906)
Ichneumon oviventroides: (Hinz 1975)
Ichneumon parengensis: NMBE (*)
Ichneumon pinquicornis: (Hilpert 1992)
Ichneumon polyxanthus: (Kriechbaumer 1869) – C2
Ichneumon primatorius: NMBE (Ferrière 1947)
Ichneumon proletarius: NMBE (Hilpert 1992)
Ichneumon pseudocaloscelis: NMBE (Hilpert 1992)
Ichneumon quadrialbatus: MZL (Ferrière 1947)
Ichneumon quaesitorius: MZL (Fuesslin 1775)
Ichneumon rufigena: (Kriechbaumer 1869) – C2
Ichneumon sarcitorius: (Fuesslin 1775; Hilpert 1992)
Ichneumon saxifragator: (Artmann-Graf 2015) – C13
Ichneumon sculpturatus: MZL (*)
Ichneumon sexcinctus: (Hilpert 1992; Meyer 1933)
Ichneumon silaceus: (Artmann-Graf 2015; Habermehl 1916)
Ichneumon simulans: NMBE (Hilpert 1992)
Ichneumon stramentarius: NMBE (Blösch 1906) – C3
Ichneumon stramentor: (Hilpert 1992)
Ichneumon suspiciosus: MZL (Ferrière 1947)
Ichneumon terminatorius: (Blösch 1906; Hilpert 1992)
Ichneumon trialbatus: (Artmann-Graf et al. 2009; Meyer 1933)
Ichneumon tuberculipes: MZL (Hilpert 1992)
Ichneumon vafer: NMBE (Hilpert 1992)
Ichneumon validicornis: MZL (*)
Ichneumon villepreuxae: (Habermehl 1909) – C3, C16
Ichneumon vorax: (Ferrière 1947; Hilpert 1992)
Ichneumon vulneratorius: MZL (*)
Ichneumon xanthorius: (Artmann-Graf et al. 2009)
Limerodops elongatus: NMBE (Bauer 2001)
Limerodops subsericans: (Artmann-Graf et al. 2009; Blösch 1906)
Linycus exhortator: NMBE (Blösch 1906)
Linycus flavitarsis: NMB (*)
Listrodromus nycthemerus: MZL (*)
Lymantrichneumon disparis: (Artmann-Graf et al. 2009; Blösch 1906)
Mevesia alternans: MZL (Artmann-Graf et al. 2009)
Mevesia arguta: MZL (*)
Misetus oculatus: MZL (*)
Neotypus coreensis: NMBE (Blösch 1906)
Neotypus melanocephalus: NMBE (*)
Neotypus nobilitator: (Bauer 2001)
Notosemus bohemani: MZL (*)
Oiorhinus pallipalpis: MZL (*)
Oronotus binotatus: MZL (*)
Orotylus mitis: MZL (*)
Patrocloides sputator: (Artmann-Graf et al. 2009; Blösch 1906)
Phaeogenes curator: MZL (*)
Phaeogenes heterogonus: MZL (*)
Phaeogenes melanogonos: MZL (Blösch 1906)
Phaeogenes nigridens: MZL (Coulon 1933)
Phaeogenes planifrons: MZL (Artmann-Graf et al. 2009)
Phaeogenes semivulpinus: MZL (*)
Platylabops apricus: (Artmann-Graf 2016)
Platylabops lariciatae: (Kenis et al. 2005)
Platylabus auriculatus: MZL (Riedel 2008)
Platylabus baueri: NMBE (Riedel 2008)
Platylabus curtorius: NMBE (*)
Platylabus dolorosus: (Pic 1902; Riedel 2008) – C3
Platylabus gigas: MZL (Riedel 2008)
Platylabus helveticus: NMB (Riedel 2008) – C1
Platylabus heteromallus: (Riedel 2008)
Platylabus histrio: MZL (Riedel 2008)
Platylabus intermedius: NMBE (Riedel 2008)
Platylabus iridipennis: NMB (Riedel 2008)
Platylabus mesoleucus: MZL (Riedel 2008)
Platylabus neglectus: MZL (Riedel 2008)
Platylabus obator: NMB (Riedel 2008)
Platylabus odiosus: NMB (Riedel 2008)
Platylabus oehlkei: NMB (Riedel 2008)
Platylabus opaculus: NMB (Riedel 2008)
Platylabus orbitalis: (Blösch 1906; Riedel 2008) – C3
Platylabus pallidens: (Riedel 2008)
Platylabus perexiguus: MZL (Riedel 2008)
Platylabus pseudopumilio: MZL (Riedel 2008)
Platylabus pumilio: MZL (Riedel 2008)
Platylabus ruficoxatus: NMB (Riedel 2008)
Platylabus rufus: NMBE (Blösch 1906; Riedel 2008)
Platylabus transversus: MZL (Riedel 2008)
Platylabus tricingulatus: NMB (Riedel 2008)
Platylabus vibratorius: NMB (Blösch 1906)
Platymischos atriventris: NMB (Meyer 1933)
Platymischos bassicus: MZL (*)
Pristicerops infractorius: NMBE (Coulon 1933)
Pristicerops infractorius: NMBE (Dalla Torre 1902)
Pristiceros serrarius: NMB (*)
Probolus culpatorius: MZL (Fuesslin 1775)
Protichneumon fusorius: NMB (Blösch 1906)
Protichneumon pisorius: NMB (Fuesslin 1775)
Protichneumon similatorius: NMB (Bauer 2001; Blösch 1906)
Pseudoamblyteles homocerus: NMB (Habermehl 1917)
Psilomastax pyramidalis: NMB (Dell and Burckhardt 2004)
Spilichneumon ammonius: NMBE (*)
Spilichneumon celenae: (Artmann-Graf 2017)
Spilichneumon johansoni: NMBE (Artmann-Graf et al. 2009)
Spilichneumon limnophilus: NMBE (Artmann-Graf 2017)
Spilichneumon occisorius: (Artmann-Graf et al. 2009; Blösch 1906)

Spilothyrateles illuminatorius: RIE (Blösch 1906)
Spilothyrateles podolicus: (Artmann-Graf 2017)
Spilothyrateles punctus: NMBE (Berthoumieu 1895) – C3
Stenaoplus pictus: (Artmann-Graf et al. 2009)
Stenichneumon alpicola: (Horstmann 2000) – C3
Stenichneumon militarius: (Artmann-Graf et al. 2009; Ferrière 1947)
Stenobarichneumon basiglyptus: (Artmann-Graf 2016; Ferrière 1947)
Stenodontus marginellus: MZL (Blösch 1906)
Syspasis albiguttata: MZL (Coulon 1933)
Syspasis carinator: MZL (*)
Syspasis lineator: MZL (Tischbein 1881) – C3
Syspasis scutellator: MZL (Blösch 1906)
Syspasis tauma: MZL (*)
Thyrateles camelinus: NMBE (Artmann-Graf et al. 2009; Blösch 1906) – C3
Thyrateles haereticus: (Julliard 1948; Townes et al. 1965)
Trachyarus anceps: MZL (*)
Trachyarus brevipennis: (Gokhman 2007)
Trachyarus corvinus: NMBE (*)
Trachyarus decipiens: (Gokhman 2007)
Trachyarus fuscipes: (Gokhman 2007)
Trachyarus punctigaster: MZL (*)
Tricholabus strigatorius: (Artmann-Graf et al. 2009)
Triptognathus atripes: (Artmann-Graf 2017; Berthoumieu 1895)
Triptognathus luteomaculatus: (Hilpert et al. 1993) – C2
Triptognathus unifasciatus: (Artmann-Graf 2017; Coulon 1933)
Trogus lapidator: NMBE (Blösch 1906)
Tycherus australogeminus: MZL (*)
Tycherus bellicornis: MZL (*)
Tycherus bolivari: MZL (*)
Tycherus boreoalpinus: MZL (*)
Tycherus cephalotes: MZL (*)
Tycherus elongatus: MZL (*)
Tycherus fennicus: MZL (*)
Tycherus flavidens: MZL (*)
Tycherus fuscibucca: (Brockerhoff and Kenis 1996)
Tycherus fuscicornis: MZL (*)
Tycherus gracilis: MZL (*)
Tycherus impiger: MZL (*)
Tycherus ischiomelinus: MZL (*)
Tycherus jucundus: MZL (*)
Tycherus maxi: (Diller and Zwakhals 2009)
Tycherus modestus: MZL (Dalla Torre 1902) – C3
Tycherus montivagator: MZL (*)
Tycherus ophtalmicus: MZL (Ferrière 1947)
Tycherus osculator: MZL (Dalla Torre 1902)
Tycherus septentrionalis: MZL (*)
Tycherus socialis: MZL (*)
Tycherus stockerorum: NMBE (Diller et al. 2008)
Tycherus suspicax: MZL (*)
Tycherus teres: MZL (*)
Tycherus vafer: (Diller and Horstmann 1994) – C3
Tycherus vagus: (Jenner et al. 2004)
Ulesta perspicua: MZL (Kriechbaumer 1872b) – C3
Virgichneumon albosignatus: (Artmann-Graf et al. 2009; Blösch 1906)
Virgichneumon callicerus: (Artmann-Graf 2016; Ferrière 1947)
Virgichneumon digrammus: (Artmann-Graf 2016)
Virgichneumon dumeticola: (Artmann-Graf 2016)
Virgichneumon krapinensis: (Artmann-Graf 2012)
Virgichneumon monostagon: (Artmann-Graf 2012)
Virgichneumon tergenus: (Artmann-Graf et al. 2009)
Vulgichneumon bimaculatus: (Artmann-Graf 2016)
Vulgichneumon deceptor: (Artmann-Graf et al. 2009; Ferrière 1947)
Vulgichneumon saturatorius: (Artmann-Graf et al. 2009; Fuesslin 1775)
Vulgichneumon suavis: (Artmann-Graf et al. 2009; Blösch 1906)

Lycorininae

Lycorina triangulifera: MHNG (*)

Mesochorinae

Astiphromma aggressor: MZL (Riedel 2015)
Astiphromma albitarse: MZL (Riedel 2015)
Astiphromma alpinum: NMB (Riedel 2015)
Astiphromma anale: NMB (Schwenke 1999)
Astiphromma buccatum: (Schwenke 1999)
Astiphromma diversum: (Artmann-Graf et al. 2009; Schwenke 1999)
Astiphromma dorsale: MZL (Riedel 2015)
Astiphromma hirsutum: MZL (Riedel 2015)
Astiphromma nigrocoxatum: MZL (Riedel 2015)
Astiphromma pictum: MZL (Riedel 2015)
Astiphromma scutellatum: MZL (Riedel 2015)
Astiphromma splenium: MZL (Blösch 1906)
Astiphromma striatum: MZL (Riedel 2015)
Astiphromma tenuicorne: NMB (Riedel 2015)
Astiphromma varipes: MZL (Riedel 2015)
Cidaphus atricilla: (Habermehl 1923; Lee 1991) – C3
Mesochorus arenarius: (Schwenke 1999)
Mesochorus callis: (Schwenke 1999)
Mesochorus chasseralis: (Schwenke 1999) – C2
Mesochorus clarus: (Schwenke 1999)
Mesochorus coartatus: (Schwenke 1999)
Mesochorus curvulus: (Schwenke 1999)
Mesochorus declinans: (Schwenke 1999)
Mesochorus formosus: MHNG (*)
Mesochorus giberius: ETHZ (*)
Mesochorus halticae: (Schwenke 1999) – C2
Mesochorus lilioceriphilus: (Schwenke 2000) – C2
Mesochorus olerum: NMBE (Horstmann 2006b)
Mesochorus punctipleuris: (Blösch 1906; Schwenke 1999)
Mesochorus scopulus: (Schwenke 1999) – C2
Mesochorus semirufus: (Blösch 1906; Schwenke 1999)
Mesochorus sublimis: (Schwenke 1999) – C2
Mesochorus suomiensis: (Schwenke 1999)
Mesochorus superbus: RIE (*)
Mesochorus tenthredinidis: (Horstmann 2006b)
Mesochorus tetricus: (Schwenke 1999)

Metopiinae

Chorinaeus australis: MZL (Aeschlimann 1975)
Chorinaeus brevicalcar: (Aeschlimann 1975)
Chorinaeus cristator: MZL (Aeschlimann 1975)
Chorinaeus flavipes: MZL (*)
Chorinaeus funebris: MZL (Bovey 1958)
Chorinaeus hastianae: (Aeschlimann 1975)
Chorinaeus longicornis: MZL (Aeschlimann 1975)
Chorinaeus subcarinatus: (Aeschlimann 1975)
Chorinaeus talpa: MZL (Aeschlimann 1975)
Colpotrochia cincta: MZL (Blösch 1906)
Exochus albicinctus: MZL (*)
Exochus alpinus: MZL (*)
Exochus citripes: MZL (*)
Exochus consimilis: MZL (*)
Exochus erythronotus: MZL (Blösch 1906)
Exochus flavomarginatus: MZL (*)
Exochus foveolatus: MZL (*)
Exochus gravipes: MZL (Blösch 1906)
Exochus gravis: MZL (*)
Exochus incidens: MZL (*)
Exochus lentipes: MZL (Moreau et al. 2010)
Exochus lictor: MZL (*)
Exochus marklini: MZL (*)
Exochus mitratus: MZL (*)
Exochus nigripalpis: MZL (Ferrière 1947)
Exochus pictus: MZL (*)
Exochus prosopius: MZL (*)
Exochus semilividus: MZL (Dalla Torre 1902)
Exochus suborbitalis: MZL (*)
Exochus tibialis: MZL (Blösch 1906)
Exochus vafer: MZL (*)
Hypsicera britannica: MZL (Aeschlimann 1989)
Hypsicera curvator: MZL (*)
Hypsicera eriplanator: MZL (Aubert 1969c) – C1
Hypsicera femoralis: MZL (Blösch 1906)
Hypsicera flaviceps: MZL (*)
Hypsicera subtilitor: MZL (*)
Lapton femoralis: MZL (Ferrière 1946)
Metopius citratus: MZL (Blösch 1906)
Metopius dentatus: MZL (Blösch 1906)
Metopius fuscipennis: MZL (*)
Metopius leiopygus: NMBE (*)
Metopius longispina: (Clément 1930)
Metopius pinatorius: MZL (*)
Periope auscultator: MZL (*)
Periope hoerhammeri: MZL (*)
Spudaeus scaber: MZL (*)
Stethoncus sulcator: (Aubert 1965c)
Triclistus aethiops: (Aeschlimann 1973a; Ferrière 1947)
Triclistus albicinctus: MZL (Aeschlimann 1973a)
Triclistus alpinator: MZL (Aeschlimann 1973a)
Triclistus congener: MZL (Aeschlimann 1973a)
Triclistus globulipes: MZL (Aeschlimann 1973a)
Triclistus lativentris: MZL (Aeschlimann 1973a)
Triclistus niger: MZL (Aeschlimann 1973a; Ferrière 1947)
Triclistus pallipes: MZL (Aeschlimann 1973a; Bovey 1958)
Triclistus podagricus: MZL (Aeschlimann 1973a; Delucchi 1957) – C1
Triclistus pygmaeus: MZL (Aeschlimann 1973a)
Trieces dinianae: ETHZ (Aeschlimann 1973b) – C1
Trieces facialis: MZL (*)
Trieces rufimitranae: (Aeschlimann 1973b)
Trieces thuringiacus: MZL (Aeschlimann 1973b)
Trieces tricarinatus: MZL (Anonymous 1960)
Microleptinae
Microleptes splendidulus: MZL (*)

Ophioninae

Enicospilus adustus: ETHZ (Haller 1885, Broad and Shaw 2016) – C1
Enicospilus combustus: NMB (*)
Enicospilus merdarius: NMB (Townes et al. 1965) – C3
Enicospilus ramidulus: MZL (Blösch 1906)
Enicospilus repentinus: MZL (Ferrière 1947)
Eremotylus divisor: MZL (*)
Eremotylus marginatus: MZL (Horstmann 1981a)
Hellwigia obscura: (Artmann-Graf 2012)
Ophion areolaris: MZL (*)
Ophion brevicornis: MZL (*)
Ophion costatus: NMBE (Artmann-Graf 2012)
Ophion forticornis: NMBE (*)
Ophion longigena: NMBE (*)
Ophion luteus: NMBE (Fuesslin 1775)
Ophion minutus: MZL (Kenis et al. 2005)
Ophion obscuratus: MZL (Artmann-Graf et al. 2009)
Ophion ocellaris: MZL (Artmann-Graf et al. 2009)
Ophion parvulus: NMBE (Artmann-Graf et al. 2009)
Ophion pteridis: MZL (*)
Ophion scutellaris: MZL (Artmann-Graf et al. 2009)
Ophion ventricosus: MZL (Blösch 1906)
Stauropoctonus bombycivorus: NMBE (*)

Orthocentrinae

Aperileptus albipalpus: MZL (*)
Aperileptus flavus: MZL (*)
Aperileptus impurus: MZL (*)
Aperileptus vanus: NMBE (*)
Apoclima signaticorne: MZL (*)
Batakomacrus caudatus: MZL (*)
Catastenus femoralis: MZL (*)
Dialipsis exilis: MZL (*)
Entypoma robustator: MZL (Aubert 1968b)
Entypoma robustum: MZL (*)
Entypoma suspiciosum: MZL (*)
Eusterinx bispinosa: MZL (*)
Eusterinx fleischeri: (Aubert 1968b)
Eusterinx minima: MZL (Aubert 1976b)
Eusterinx obscurella: MZL (*)
Eusterinx oligomera: MZL (Dalla Torre 1902, van Rossem 1982) – C3
Eusterinx subdola: MZL (*)
Eusterinx tenuicincta: MZL (*)
Gnathochorisis crassulus: NMBE (*)
Gnathochorisis dentifer: MZL (*)

Helictes borealis: NMBE (van Rossem 1987)
Helictes conspicuus: (van Rossem 1987)
Helictes erythrostoma: NMBE (van Rossem 1987)
Hyperacmus crassicornis: MZL (*)
Megastylus cruentator: NMBE (Blösch 1906)
Megastylus excubitor: MZL (*)
Megastylus flavopictus: MZL (*)
Megastylus impressor: NMBE (*)
Megastylus orbitator: MZL (*)
Megastylus pectoralis: NMBE (*)
Megastylus pleuralis: MZL (*)
Orthocentrus asper: MZL (*)
Orthocentrus attenuatus: MZL (*)
Orthocentrus frontator: MZL (*)
Orthocentrus fulvipes: MZL (Blösch 1906)
Orthocentrus hirsutor: MZL (Aubert 1970c)
Orthocentrus marginatus: MZL (*)
Orthocentrus protervus: MZL (*)
Orthocentrus sannio: MZL (Blösch)
Orthocentrus spurius: MZL (Seyrig 1928)
Orthocentrus winnertzii: MZL (*)
Pantisarthrus lubricus: MZL (*)
Picrostigeus debilis: NMBE (*)
Picrostigeus obscurus: NMBE (*)
Plectiscidea amicalis: MZL (*)
Plectiscidea canaliculata: MZL (*)
Plectiscidea collaris: MZL (*)
Plectiscidea communis: NMBE (*)
Plectiscidea crassicornis: MZL (van Rossem 1987)
Plectiscidea eurystigma: MZL (*)
Plectiscidea humeralis: MZL (*)
Plectiscidea melanocera: MZL (*)
Plectiscidea monticola: MZL (van Rossem 1987) – C2
Plectiscidea nava: (van Rossem 1987)
Plectiscidea quadrierosa: (Aubert 1976b)
Plectiscidea tenuicornis: MZL (*)
Plectiscidea vagator: (van Rossem 1987) – C2
Plectiscus impurator: MZL (*)
Proclitus attentus: MZL (*)
Proclitus comes: MZL (*)
Proclitus fulvicornis: MZL (*)
Proclitus paganus: MZL (*)
Proclitus praetor: MZL (*)
Proclitus rudis: MZL (*)
Stenomacrus carbonariae: MZL (*)
Stenomacrus cubiceps: NMBE (*)
Stenomacrus curvicaudatus: MZL (*)
Stenomacrus inferior: MZL (Aubert 1981)
Stenomacrus laricis: MZL (*)
Stenomacrus laticollis: MZL (*)
Stenomacrus merula: MZL (*)
Stenomacrus pallipes: MZL (*)
Symplecis alpicola: (Dalla Torre 1902) – C2
Symplecis beaumontor: MZL (Aubert 1968b) – C1
Symplecis bicingulata: MZL (*)

Orthopelmatinae

Orthopelma brevicorne: MHNG (*)
Orthopelma mediator: NMBE (Blösch 1906)

Oxytorinae

Oxytorus armatus: MZL (Ferrière 1947)
Oxytorus luridator: MZL (Blösch 1906)

Pimplinae

Acrodactyla carinator: MZL (Aubert 1969a) – C1
Acrodactyla degener: MZL (Aubert 1969a)
Acrodactyla quadrisculpta: MZL (Aubert 1969a)
Acropimpla didyma: MZL (Blösch 1906)
Acropimpla pictipes: MZL (Aubert 1969a)
Apechthis capulifera: MZL (Aubert 1969a)
Apechthis compunctor: MZL (Fuesslin 1775)
Apechthis quadridentata: MZL (Delucchi 1982)
Apechthis rufata: MZL (Blösch 1906)
Atractogaster semisculptus: (Kriechbaumer 1872a) – C2
Clistopyga incitator: MZL (*)
Clistopyga rufator: MZL (*)
Delomerista laevis: MZL (Habermehl 1917)
Delomerista mandibularis: MZL (Aubert 1969a)
Dolichomitus aciculatus: NMBE (Mevi-Schuetz et al. 2006)
Dolichomitus agnoscendus: NMBE (Mevi-Schuetz et al. 2006)
Dolichomitus cephalotes: MZL (Aubert 1969a)
Dolichomitus curticornis: NMBE (Mevi-Schuetz et al. 2006)
Dolichomitus diversicostae: NMBE (Mevi-Schuetz et al. 2006)
Dolichomitus dobrogensis: NMBE (Mevi-Schuetz et al. 2006)
Dolichomitus dux: NMBE (Aubert 1969a)
Dolichomitus imperator: NMBE (Aubert 1969a)
Dolichomitus kriechbaumeri: NMBE (Kriechbaumer 1896)
Dolichomitus mesocentrus: NMBE (Blösch 1906)
Dolichomitus messor: NMBE (Aubert 1969a)
Dolichomitus populneus: NMBE (Aubert 1969a)
Dolichomitus pterelas: NMBE (Aubert 1969a)
Dolichomitus scutellaris: MZL (Aubert 1969a)
Dolichomitus sericeus: NMBE (Mevi-Schuetz et al. 2006)
Dolichomitus terebrans: MZL (Ferrière 1947)
Dolichomitus tuberculatus: MZL (Blösch 1906)
Endromopoda arundinator: MZL (*)
Endromopoda detrita: MZL (Blösch 1906)
Endromopoda nigricoxis: MZL (Aubert 1969a)
Endromopoda phragmitidis: NMBE (Dely-Draskovits et al. 1993)
Ephialtes duplicauda: MZL (*)
Ephialtes manifestator: MZL (Fuesslin 1775)
Exeristes arundinis: MZL (Aubert 1969a)
Exeristes roborator: MZL (Artmann-Graf et al. 2009)
Exeristes ruficollis: NMBE (*)
Fredegunda diluta: MZL (Aubert 1969a)
Gregopimpla inquisitor: MZL (Aubert 1966c)
Gregopimpla malacosomae: MHNG (*)
Iseropus stercorator: MZL (Ferrière 1947)
Itoplectis alternans: MZL (Uffeln 1940)

Itoplectis aterrima: NMBE (Aubert 1966b)
Itoplectis clavicornis: MZL (*)
Itoplectis curticauda: MZL (Blösch 1906)
Itoplectis enslini: MZL (Perkins 1957) – C3
Itoplectis insignis: MZL (Aubert 1969a) – C2
Itoplectis maculator: NMBE (Blösch 1906)
Itoplectis quadricingulata: MHNG (Ferrière 1947)
Itoplectis tunetana: MZL (Aubert 1969a)
Itoplectis viduata: MZL (Julliard 1948)
Liotryphon ascaniae: MZL (Aubert 1969a)
Liotryphon caudatus: MZL (Geier 1957)
Liotryphon crassiseta: NMBE (Aubert 1969a)
Liotryphon punctulatus: MZL (Aubert 1969a)
Liotryphon strobilellae: MZL (Aubert 1969a)
Megaetaira madida: MZL (*)
Oxyrrhexis carbonator: MZL (*)
Paraperithous gnathaulax: MZL (Aubert 1969a)
Perithous albicinctus: MZL (Aubert 1969a)
Perithous divinator: MZL (Aubert 1969a)
Perithous scurra: MZL (Blösch 1906)
Perithous septemcinctorius: MZL (Blösch 1906)
Pimpla arctica: MZL (Ferrière 1947)
Pimpla contemplator: MZL (Ferrière 1947)
Pimpla flavicoxis: MZL (Artmann-Graf et al. 2009)
Pimpla illecebrator: (Artmann-Graf et al. 2009)
Pimpla insignatoria: (Artmann-Graf 2012)
Pimpla melanacrias: NMB (Ferrière 1947)
Pimpla murinanae: NMB (Kasparyan 1974)
Pimpla nigrohirsuta: (Horstmann 2001c)
Pimpla rufipes: NMB (Blösch 1906)
Pimpla sodalis: NMBE (Ferrière 1947) – C3
Pimpla spuria: NMB (Ferrière 1947)
Pimpla turionellae: NMB (Fuesslin 1775)
Pimpla wilchristi: NMBE (*)
Piogaster pilosator: MZL (*)
Polysphincta boops: MZL (*)
Polysphincta rufipes: MZL (Aubert 1969a)
Polysphincta tuberosa: MZL (Aubert 1969a)
Pseudorhyssa alpestris: NMBE (*) – C17
Pseudorhyssa nigricornis: NMBE (Aubert 1969a) – C17
Reclinervellus nielseni: MZL (*)
Scambus alpestrator: (Aubert 1969a)
Scambus brevicornis: MZL (Blösch 1906)
Scambus buolianae: NMB (Artmann-Graf et al. 2009)
Scambus calobatus: NMB (Blösch 1906)
Scambus capitator: (Aubert 1966c) – C3
Scambus cincticarpus: MZL (Dalla Torre 1902) – C2
Scambus eucosmidarum: NMBE (Aubert 1966c)
Scambus inanis: NMBE (Aubert 1969a)
Scambus nigricans: NMBE (Townes et al. 1965)
Scambus pomorum: MZL (Aubert 1966c)
Scambus sagax: MZL (Aubert 1969a)
Scambus signatus: MZL (Aubert 1969a)
Scambus strobilorum: MZL (Aubert 1966c)
Scambus vesicarius: MZL (Aubert 1969a)
Schizopyga circulator: MZL (*)
Schizopyga frigida: MZL (Aubert 1969a)
Schizopyga pictifrons: MZL (*)
Schizopyga podagrica: NMBE (*)
Sinarachna nigricornis: MZL (*)
Sinarachna pallipes: MZL (Aubert 1969a)
Theronia atalantae: MZL (Dalla Torre 1902)
Theronia laevigata: MZL (Aubert 1969a)
Townesia tenuiventris: MZL (*)
Tromatobia forsiusi: NMBE (*)
Tromatobia lineatoria: MZL (*)
Tromatobia ornata: MZL (Ferrière 1947)
Tromatobia ovivora: MZL (Artmann-Graf et al. 2009)
Tromatobia variabilis: MZL (*)
Zaglyptus multicolor: MZL (Blösch 1906)
Zaglyptus varipes: NMBE (Artmann-Graf et al. 2009)
Zatypota albicoxa: NMBE (*)
Zatypota bohemani: MZL (*)
Zatypota discolor: MZL (Habermehl 1917)
Zatypota percontatoria: MZL (Aubert 1969a)
Zatypota picticollis: NMB (Ferrière 1947)

Poemeniinae

Deuteroxorides elevator: NMB (Aubert 1969a)
Neoxorides collaris: NMBE (Blösch 1906)
Neoxorides montanus: NMBE (*)
Neoxorides nitens: NMBE (Artmann-Graf et al. 2009)
Podoschistus scutellaris: NMBE (*)
Poemenia brachyura: NMBE (Ferrière 1947)
Poemenia collaris: NMBE (*)
Poemenia hectica: NMBE (Blösch 1906)
Poemenia notata: NMBE (Aubert 1969a)

Rhyssinae

Megarhyssa perlata: RIE (*)
Megarhyssa rixator: MZL (Steck 1891)
Megarhyssa superba: RIE (Dalla Torre 1902)
Rhyssa amoena: NMBE (*)
Rhyssa kriechbaumeri: ZSM (Kriechbaumer 1887) – C1
Rhyssa persuasoria: MZL (Fuesslin 1775)
Rhyssella approximator: NMBE (Artmann-Graf et al. 2009)
Rhyssella obliterata: MZL (*)

Stilbopinae

Stilbops asper: MZL (Aubert 1978)
Stilbops ruficornis: MZL (Artmann-Graf et al. 2009)
Stilbops vetulus: MZL (*)

Tersilochinae

Astrenis paradoxa: MZL (*)
Barycnemis alpina: (Horstmann 1981b)
Barycnemis angustipennis: (Blösch 1906; Horstmann 1981b)
Barycnemis dissimilis: (Horstmann 1981b)
Barycnemis exhaustor: NMB (Blösch 1906)
Barycnemis filicornis: (Horstmann 1981b)
Barycnemis gravipes: NMB (Blösch 1906)
Barycnemis harpura: NMB (Blösch 1906; Horstmann 1981b)
Diaparsis jucunda: (Gold et al. 2001)

Diaparsis nutritor: (Horstmann 1971)
Earobia paradoxa: MZL (Perkins 1958) – C2
Epistathmus crassicornis: (Horstmann 1981b)
Gelanes altenhoferi: (Khalaim and Blank 2011)
Gelanes cuspidatus: (Khalaim and Blank 2011)
Gelanes fusculus: (Khalaim and Blank 2011)
Gelanes simillimus: (Khalaim and Blank 2011)
Phradis brevis: (Khalaim et al. 2009)
Phradis interstitialis: (Horstmann 1971)
Phrudus monilicornis: MZL (Vikberg and Koponen 2000)
Probles caudiculatus: (Khalaim 2007)
Probles extensor: (Aubert 1971) – C2
Probles flavipes: (Horstmann 1971)
Probles longisetosus: (Horstmann 1981b)
Probles microcephalus: (Horstmann 1971)
Probles nigriventris: (Horstmann 1971)
Probles tenuicornis: (Horstmann 1981b) – C2
Probles versutus: (Horstmann 1981b)
Tersilochus caudatus: (Ferrière 1947; Horstmann 1971)
Tersilochus curvator: (Jordan 1998)
Tersilochus jocator: (Horstmann 1971)
Tryphoninae
Acrotomus lucidulus: MHNG (Blösch 1906)
Acrotomus succinctus: MHNG (*)
Boethus thoracicus: MHNG (Horstmann 2006a; Kriechbaumer 1890b) – C3
Cladeutes discedens: MZL (*)
Cosmoconus ceratophorus: (Artmann-Graf 2014; Ferrière 1947)
Cosmoconus elongator: MZL (Ferrière 1947)
Cosmoconus genalis: MZL (*)
Cosmoconus meridionator: (Artmann-Graf et al. 2009)
Cosmoconus nigriventris: (Artmann-Graf et al. 2009)
Cteniscus maculiventris: MHNG (Kerrich 1952)
Cteniscus scalaris: (Kerrich 1953)
Ctenochira annulata: MZL (*)
Ctenochira arcuata: MZL (Aubert 1965a) – C3
Ctenochira genalis: MZL (*)
Ctenochira gilvipes: (Artmann-Graf 2014)
Ctenochira grossa: MZL (*)
Ctenochira helveticator: MZL (Aubert 1965a) – C1
Ctenochira infesta: MZL (*) – C18
Ctenochira irrisa: (Kasparyan 1973)
Ctenochira marginata: (Artmann-Graf 2014)
Ctenochira oreophila: MZL (*)
Ctenochira pastoralis: MZL (Blösch 1906)
Ctenochira pectinata: MZL (*)
Ctenochira pratensis: MZL (*)
Ctenochira propinqua: MZL (*)
Ctenochira rubranator: MZL (Kasparyan 1973)
Ctenochira rufipes: MZL (Kasparyan 1973)
Ctenochira sphaerocephala: MZL (*)
Ctenochira tarsata: (Kasparyan 1973)
Cycasis rubiginosa: MHNG (Kirchner 1867)
Dyspetes luteomarginatus: MZL (Artmann-Graf et al. 2009)
Eclytus ornatus: MZL (*)
Eridolius alacer: MZL (Artmann-Graf et al. 2009)
Eridolius basalis: MZL (Blösch 1906)
Eridolius dorsator: MZL (Kasparyan 1990)
Eridolius flavomaculatus: MZL (*)
Eridolius pachysoma: MZL (Artmann-Graf et al. 2009)
Eridolius rufilabris: MZL (Kasparyan 1990)
Eridolius rufonotatus: MHNG (Kerrich 1952)
Erromenus alpestrator: MZL (Aubert 1969c) – C1
Erromenus alpinator: MZL (Aubert 1969c) – C1
Erromenus bibulus: (Artmann-Graf 2014)
Erromenus brunnicans: MZL (Blösch 1906)
Erromenus junior: MZL (Blösch 1906)
Erromenus melanonotus: MZL (*)
Erromenus nitens: MZL (Aubert 1969c) – C3
Erromenus plebejus: MZL (*)
Erromenus punctatus: MZL (*)
Erromenus punctulatus: MZL (Townes et al. 1992)
Erromenus terebrellator: MZL (Aubert 1969c) – C1
Erromenus zonarius: MZL (Ferrière 1947)
Exenterus adspersus: (Kerrich 1952)
Exenterus amictorius: MHNG (Blösch 1906)
Exenterus ictericus: MZL (Kerrich 1952)
Exenterus vellicatus: MZL (*)
Exyston albicinctus: MHNG (Kerrich 1952)
Exyston genalis: MHNG (Kerrich 1952)
Exyston montanus: MHNG (Fitton 1976) – C1
Exyston pratorum: MHNG (Kerrich 1952)
Exyston sponsorius: MHNG (Blösch 1906)
Exyston subnitidus: MHNG (Kerrich 1952)
Grypocentrus albipes: MZL (*)
Grypocentrus cinctellus: MZL (Artmann-Graf 2014)
Grypocentrus incisulus: MZL (*)
Hercus fontinalis: MZL (Baltensweiler 1958)
Kristotomus laetus: MZL (Ferrière 1947)
Kristotomus laticeps: MZL (*)
Kristotomus ridibundus: MZL (Kerrich 1952)
Kristotomus triangulatorius: MZL (Ferrière 1947)
Monoblastus brachyacanthus: MZL (Blösch 1906)
Monoblastus caudatus: MZL (*)
Monoblastus discedens: (Artmann-Graf 2014)
Monoblastus fulvescens: NMBE (Brauns 1888)
Monoblastus marginellus: MZL (*)
Neleges proditor: MZL (Artmann-Graf 2014)
Netelia caucasica: MZL (*)
Netelia contiguator: MZL (Delrio 1975)
Netelia cristata: MZL (Delrio 1975)
Netelia elevator: MZL (Delrio 1975)
Netelia fulvator: MZL (Delrio 1975)
Netelia fuscicornis: MZL (Blösch 1906)
Netelia japonica: MZL (Delrio 1975)
Netelia latungula: MZL (Delrio 1975)
Netelia lineolata: MZL (Delrio 1975)
Netelia melanura: MZL (*)
Netelia nigricarpus: MZL (Delrio 1975)
Netelia ocellaris: MZL (Delrio 1975)
Netelia opacula: MZL (Delrio 1975)
Netelia silantjewi: (Delrio 1975)
Netelia tarsata: MZL (Delrio 1975)
Netelia terebrator: MZL (Delrio 1975)
Netelia testacea: MZL (Artmann-Graf et al. 2009)

Netelia thomsonii: MZL (Kriechbaumer 1890a) – C3
Netelia vinulae: MZL (*)
Netelia virgata: MZL (Blösch 1906)
Oedemopsis scabricula: MZL (*)
Otoblastus luteomarginatus: MZL (*)
Phytodietus alpinator: MZL (Kasparyan 1993a)
Phytodietus arcuatorius: MZL (Haeselbarth 1989)
Phytodietus astutus: MZL (Ferrière 1947)
Phytodietus elongator: MZL (*)
Phytodietus femoralis: MZL (Haeselbarth 1989)
Phytodietus gelitorius: MZL (Delucchi 1982)
Phytodietus geniculatus: (Kasparyan 1993a)
Phytodietus griseanae: MZL (Kerrich 1962) – C2
Phytodietus ornatus: MZL (*)
Phytodietus polyzonias: MZL (Blösch 1906)
Phytodietus variegatus: MZL (*)
Polyblastus melanostigmus: MZL (Townes et al. 1992)
Polyblastus pedalis: MZL (*)
Polyblastus pumilus: MZL (*)
Polyblastus tener: MZL (Artmann-Graf 2014)
Polyblastus varitarsus: MZL (Blösch 1906)
Polyblastus wahlbergi: MZL (*)
Polyblastus westringi: MZL (*)
Smicroplectrus bohemani: (Kerrich 1952)
Smicroplectrus excisus: (Kerrich 1952)
Smicroplectrus heinrichi: MHNG (Kerrich 1952)
Smicroplectrus jucundus: MHNG (Kerrich 1952)
Smicroplectrus quinquecinctus: MHNG (Kerrich 1952)
Sphinctus serotinus: MZL (*)
Thymaris collaris: MZL (Kasparyan 1993b)
Thymaris niger: MZL (Kasparyan 1993b) – C19
Thymaris tener: MZL (Blösch 1906)
Tryphon abditus: MZL (*)
Tryphon atriceps: MZL (Blösch 1906)
Tryphon bidentatus: MZL (Blösch 1906)
Tryphon bidentulus: MZL (Artmann-Graf 2014)
Tryphon brevipetiolaris: MZL (Kasparyan 1969)
Tryphon duplicatus: MZL (*)
Tryphon exclamationis: MZL (*)
Tryphon fulviventris: MZL (Kasparyan 1973)
Tryphon hinzi: MZL (*)
Tryphon latrator: MZL (Blösch 1906)
Tryphon nigripes: MZL (Artmann-Graf et al. 2009)
Tryphon obtusator: MZL (Ferrière 1947)
Tryphon rarus: MZL (Kasparyan 1969) – C1
Tryphon relator: MZL (Blösch 1906)
Tryphon rutilator: MZL (Fuesslin 1775)
Tryphon signator: MZL (Blösch 1906)
Tryphon subsulcatus: MZL (*)
Tryphon thomsoni: MZL (Artmann-Graf 2014)
Tryphon trochanteratus: MZL (Artmann-Graf 2014)

Xoridinae

Ischnoceros caligatus: MZL (Dalla Torre 1902)
Ischnoceros rusticus: MZL (*)
Odontocolon appendiculatum: MZL (Ferrière 1947)
Odontocolon dentipes: NMBE (Blösch 1906)
Odontocolon geniculatum: MZL (Townes et al. 1965) – C2
Odontocolon quercinum: MZL (Townes et al. 1965)
Odontocolon spinipes: NMBE (Bauer 2002)
Odontocolon thomsoni: NMBE (Aubert 1969a)
Xorides alpestris: NMB (Aubert 1969a)
Xorides ater: MZL (Ferrière 1947)
Xorides brachylabis: NMBE (Ferrière 1947)
Xorides csikii: MZL (Aubert 1969a)
Xorides filiformis: MZL (Artmann-Graf et al. 2009)
Xorides fuligator: MZL (Blösch 1906)
Xorides gravenhorstii: MZL (Bauer 2002)
Xorides indicatorius: MZL (*)
Xorides irrigator: NMBE (Blösch 1906)
Xorides niger: MZL (Aubert 1969a)
Xorides praecatorius: NMBE (Blösch 1906)
Xorides propinquus: NMB (*)
Xorides rufipes: NMBE (Aubert 1969a)
Xorides sepulchralis: MHNG (*)

Comments

C1. The type locality of this species is in Switzerland and we have examined the name-bearing type(s) (at the institution specified in the list).
C2. The type locality of this species is in Switzerland, but no name-bearing types were examined (either because they are kept at an institution outside Switzerland, or their whereabouts are unknown).
C3. Name-bearing type of a junior synonym from Switzerland.
C4. Identified as subspecies *helveticator* Aubert (1969b).
C5. New combination for *Campoplex procerus* (Brischke, 1880) according to Riedel (2017).
C6. This is a valid species, not a synonym (Schwarz 2018).
C7. Identified as subspecies *alpigena* Förster, 1876.
C8. Identified as subspecies *holalpinus* Heinrich, 1951.
C9. Combination according to Schwarz (2016).
C10. This taxon in fact represents a complex of species which is currently under revision (M. Schwarz, pers. com.). The interpretation of this species might thus still change in the future.
C11. The status of this taxon is uncertain, see Klopfstein & Baur (2011).
C12. Reported in Artmann-Graf (2017) as "*Ctenichneumon rependinum* (Gravenhorst, 1820)".
C13. *Ichneumon acosmus* was described based on males only, and Hilpert (1992) in his revision of the genus suggested that they might belong to *Ichneumon saxifragator* Bauer (1985), for which only females are known. As he was uncertain, he did not formally synonymize the two though, and we still list both species here.
C14. *Ichneumon helveticus* was described based on males only, and Hilpert (1992) in his revision of the genus suggested that they might belong to

Ichneumon stenocerus Thomson. As he was uncertain, he did not formally synonymize the two though, and we still list both species here.

C15. *Ichneumon molitorius* Linnaeus, 1761 has a primary junior homonym, *Ichneumon molitorius* Cuvier, 1883 (Kittel 2016). We here refer to the species described by Linnaeus.

C16. *Ichneumon villepreuxae* Kittel, 2016 is a replacement name for *Ichneumon fuliginosus* Habermehl, 1909, which is a primary junior homonym of *Ichneumon fuliginosus* Gmelin, 1790. Habermehl (1909) described the species after a male from Switzerland. The location of the holotype is unknown, and we have not found any specimens in the Swiss collections.

C17. According to a recent phylogenetic study (Klopfstein et al. 2018), *Pseudorhyssa* belongs to the subfamilie Pimplinae, not Poemeniinae.

C18. Identified as subspecies *bipustulata* (Holmgren, 1857).

C19. *Thymaris niger* Taschenberg, 1865 has a secondary junior homonym, *Thymaris niger* (Momoi, 1970), which is likely a junior synonym of *T.maurus* Kasparyan, 1993 (according to Bennett 2015). We here refer to the species described by Taschenberg.

Discussion

Current state of ichneumonid research in Switzerland

Our checklist increases the number of ichneumonid species reported from Switzerland by several hundreds, even after excluding more than 200 doubtful records. The fact that all the major collections in Switzerland have been covered during the preparation of this list might imply that it is nearing completeness, a notion that we have to reject clearly. First of all, only some groups of ichneumonids were studied by specialists in detail, while others only received a patchy and somewhat unpredictable coverage. For example, the lists of Acaenitinae, Anomaloninae, Diplazontinae, Pimplinae, Poemeniinae, Rhyssinae and Xoridinae, as well as most of the small subfamilies, are probably fairly complete, as are those of some genera of Cryptinae and Ichneumoninae, for which extensive Swiss material has been included in recent revisions (see species list for references). On the other hand, entire subfamilies might easily still double their numbers for Switzerland, either because they are in need of taxonomic revisions, such as for example the Orthocentrinae and many genera of Campopleginae, and/or because the Swiss material still awaits treatment by a specialist.

Second, the Swiss collections only harbour specimens from part of the country. Only from five of the 5 km x 5 km squares on the map in Figure 1a are more than 1,000 ichneumonid specimens known, and these localities correspond to the collecting grounds of just a few entomologists: Auvernier NE, where J. de Beaumont lived; Lausanne VD, where he often went on collecting trips; Peney GE, where Henri Tournier lived; Bern BE, the main collecting area of Theodor Steck; and finally the Col de Bretolet in the commune of Champéry, a long-term bird-ringing station that was visited during repeated field trips by J. de Beaumont and both J.F. Aubert (the Plecoptera specialist) and J.F. Aubert (the Ichneumonidae specialist). Large areas of Switzerland, including the central and north-eastern parts and most of the Alps, have barely or not at all been sampled for ichneumonids. Even in easily accessible areas such as the central plane, numerous new records for Switzerland can still be expected, as evidenced by some recent faunistic studies from the area around Olten (Artmann-Graf 2012; 2014; 2015; 2016; 2017; Artmann-Graf et al. 2009).

How many species can we expect?

The present checklist increases the number of ichneumonids known from Switzerland to 1,878. This number is somewhat difficult to compare to estimates for the surrounding countries, because literature records are often unreliable in this group. Recent checklists compiled by specialists only exist for Germany (Horstmann 2001a: 3,332 species. Update in preparation by Riedel et al. pers. comm.: ~3,630 species) and for the United Kingdom (Broad 2016: 2,447 species). While the much higher number for Germany might partly be caused by its much larger size, the United Kingdom can be expected to harbour fewer species than Switzerland. This is supported by comparing the diversity of better-known groups that act as hosts for ichneumonids between the two countries, such as Macrolepidoptera (Broad et al. 2018). Asked for an educated guess of the number of species of ichneumonids in Switzerland, the late Klaus Horstmann, one of the most renowned specialists of the group, gave an estimate of 2,500 to 3,000 species (pers. comm.). If this is true, then there are still about 700 to 1,200 species left to discover, some of which might even be new to science. A not insignificant number of these can probably be expected in the subalpine and alpine habitats in Switzerland.

The alpine region: a hotspot of ichneumonid diversity?

Our analysis of altitudinal patterns in the ichneumonid data from GBIF (Fig. 2) found an increase in the number of species per collected specimen with altitude. Several reasons might contribute to this finding, first of all the lower number of specimens collected at higher altitudes in general and thus lower chance of approaching species saturation than at lower altitudes. Alternative explanations could be because the habitats at high altitude are more intact than those at low altitudes because they are less intensely managed, which might profit parasitoids as representatives of a high trophic level; a higher species turnover between different habitat types in the Alps; or a generally higher diversity of ichneumonids at high altitude. While the latter might be true for species attacking host groups that have a pronounced diversity peak in the alpine region, such as Ctenopelmatinae and Tryphoninae

attacking Symphyta and Diplazontinae attacking Syrphidae, it does not seem likely for other subfamilies.

Even if this pattern turns out to be an artefact caused by the overall poor sampling of this group in Switzerland and especially at higher altitudes, it clearly shows that the alpine regions are in need of further study. An overview of ichneumonids collected above the tree line in Hohen Tauern in Austria (Schwarz 2002b) concluded that about 9% of the species of the country could be collected there in a very small area. It also found that many more species can be expected, judging from the high number of singletons, and that about 10% of the species were probably not only new for the country, but for science. Aubert described more than 20 new species from the Col de Bretolet in the Valais (Klopfstein and Baur 2011), and an analysis of Malaise trap samples from Alp Flix in the Grison found 40% of European species of Diplazontinae, three of which are new to science, on an area of just a few square kilometres (Klopfstein 2014; Klopfstein et al. 2007).

Conclusion

This checklist represents a big step forward in our knowledge of Ichneumonidae in Switzerland. However, given the poor taxonomic and faunistics state of research in the group, it can only provide a starting point for further studies. A lot remains to be done, with hundreds of additional species still awaiting discovery in our country. Given the poor state of knowledge of the alpine ichneumonid fauna in general, many of these species will probably be new to science as well. Our findings underline the importance of resources being allocated to more poorly known insect groups, not only in order to provide species lists, but also to improve our understanding of the interrelations between species of different orders and guilds. The family Ichneumonidae includes many large and colourful species, and even though identification often presents challenges, they are a very rewarding study group and deserve increased attention by the entomological community in Switzerland.

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References

Aeschlimann JP (1973a) Révision des espèces ouest-paléarctiques du genre *Triclistus* Förster (Hymenoptera, Ichneumonidae). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 46: 219–252.

Aeschlimann JP (1973b) Révision des espèces ouest-paléarctiques du genre *Trieces* (Hym. Ichneumonidae). Annales de la Société Entomologique de France (NS) 9: 975–987. https://doi.org/10.1080/00379271.2015.1129843

Aeschlimann JP (1975) Révision des espèces ouest-paléarctiques de genre *Chorinaeus* Holmgren (Hymenoptera, Ichneumonidae). Annales de la Société Entomologique de France (NS) 11: 723–744. https://doi.org/10.1080/00379271.2003.10697379

Aeschlimann JP (1989) Révision des espèces ouest-paléarctiques de genre *Hypsicera* Latreille (Hymenoptera, Ichneumonidae). Annales de la Société Entomologique de France (NS) 25: 33–39. https://doi.org/10.1080/00379271.2003.10697379

Anonymous (1960) Sécretariat du service d'identification des Entomophages. Liste d'identification No. 3. Entomophaga 5: 337–373. https://doi.org/10.1007/bf02372953

Antropov AV, Belokobylskij SA, Compton SG, Dlussky GG, Khalaim AI, Kolyada VA, Kozlov MA, Perfilieva KS, Rasnitsyn AP (2014) The wasps, bees and ants (Insecta: Vespida=Hymenoptera) from the Insect Limestone (Late Eocene) of the Isle of Wight, UK. Earth and Environmental Science Transactions of the Royal Society of Edinburgh 104: 335–446. https://doi.org/10.1017/s1755691014000103

Artmann-Graf G (2012) Neue Schlupfwespenfunde (Hymenoptera: Ichneumonidae) für die Schweiz. Entomo Helvetica 5: 109–115.

Artmann-Graf G (2014) Tryphonini (Hymenoptera, Ichneumonidae) in der Region Olten. Entomo Helvetica 7: 13–18.

Artmann-Graf G (2015) Einige Funde von Arten der Gattung *Ichneumon* (Hymenoptera: Ichneumonidae) in der Schweiz. Entomo Helvetica 8: 153–156.

Artmann-Graf G (2016) Einige Schlupfwespenfunde der Gattungsgruppe der Cratichneumonina (Hymenoptera, Ichneumonidae, Ichneumoninae) in der Schweiz. Entomo Helvetica 9: 157–160.

Artmann-Graf G (2017) Schlupfwespenfunde aus der Gattungsgruppe der Amblytelina (Hymenopera, Ichneumonidae, Ichneumoninae, Ichneumonini) in der Schweiz. Entomo Helvetica 10: 55–61.

Artmann-Graf G, Bauer R, Schmid P (2009) Schlupfwespenfunde (Insecta: Hymenoptera, Ichneumonidae) aus der Region Olten, Nordwestschweiz, 1984–2003. Contributions to Natural History (Bern) 11: 1–23.

Aubert JF (1964) Ichneumonides de France et du Bassin méditerranéen appartenant à un genre nouveau et neuf espèces nouvelles. Bulletin de la Société Entomologique de Mulhouse 1964: 35–40. https://doi.org/10.5962/bhl.part.8617

Aubert JF (1965a) Huit ichneumonides *Ctenochira* Forst., *Erromenus* Holmgr. et *Rhorus* Foerst. inédites, capturées principalement au Laboratoire du Col de Bretolet (Valais). Bulletin de la Société Entomologique de Mulhouse 1965: 68–72.

Aubert JF (1965b) Ichneumonides d'Europe appartenant a dix espèces nouvelles et plusieurs genres nouveaux. Bulletin de la Société Entomologique de Mulhouse 1965: 15–23. https://doi.org/10.5962/bhl.part.4690

Aubert JF (1965c) Révision provisoire du genre *Stethoncus* Townes avec description d'une espèce nouvelle (Hymenoptera, Ichneumonidae). Beiträge zur Entomologie 15: 77–82.

Aubert JF (1966a) Ichneumonides parasites de la Tordeuse du Mélèze (*Zeiraphera diniana* Gn.) comprenant quatre espèces nouvelles. Bulletin de la Société Entomologique de Mulhouse 1966: 1–7. https://doi.org/10.4267/2042/20420

Aubert JF (1966b) Les ichneumonides *Itoplectis* Först. du groupe de *alternans* Grav. avec description d'une espèce nouvelle. Bulletin de la Société Entomologique de Mulhouse 1966: 73–75. https://doi.org/10.5962/bhl.part.2963

Aubert JF (1966c) Les ichneumonides *Scambus* Htg., *Acropimpla* Townes et *Iseropus* Foerst. du Musée zoologique de Lausanne, avec clefs inédites pour toutes les espèces européennes. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 38: 145–172. https://doi.org/10.3406/linly.1967.5894

Aubert JF (1968a) Ichneumonides Cryptinae inédites du continent européen. Bulletin de la Société Entomologique de Mulhouse 1968: 1–9.

Aubert JF (1968b) Révision du genre *Eusterinx* Foerst. et descriptions d'autres ichneumonides Microleptinae inédites. Bulletin de la Société Entomologique de Mulhouse 1968: 37–41.

Aubert JF (1969a) Les ichneumonides ouest-paléarctiques et leurs hôtes 1. Pimplinae, Xoridinae, Acaenitinae. Laboratoire d'Evolution des Etres Organises, Paris, 302 pp.

Aubert JF (1969b) Prélude a une révision des ichneumonides Banchinae (=Lissonotinae) ouest-paléarctiques. Bulletin de la Société Entomologique de Mulhouse 1969: 85–94.

Aubert JF (1969c) Supplément aux ichneumonides non pétiolées inédites et révision du genre *Erromenus* Holm. Bulletin de la Société Entomologique de Mulhouse 1969: 37–46. https://doi.org/10.5962/bhl.part.29504

Aubert JF (1970a) Ichneumonides pétiolées inédites. Bulletin de la Société Entomologique de Mulhouse 1970: 65–73.

Aubert JF (1970b) Nouveau supplément aux Ichneumonidae non pétiolées avec description d'un genre nouveau. Bulletin de la Société Entomologique de Mulhouse 1970: 49–56. https://doi.org/10.5962/bhl.part.26802

Aubert JF (1970c) Révision des travaux concernant les ichneumonides de France et 7e supplément au catalogue de Gaulle (100 espèces nouvelles pour la faune française). Bulletin de la Société Linnéenne de Lyon 39: 269–280. https://doi.org/10.3406/linly.1970.6125

Aubert JF (1971) Supplément aux ichneumonides pétiolées avec neuf espèces nouvelles. Bulletin de la Société Entomologique de Mulhouse 1971: 35–43. https://doi.org/10.5962/bhl.part.8617

Aubert JF (1972) Deuxième prélude a une révision des Banchinae ouest-paléarctiques. Bulletin de la Société Entomologique de Mulhouse 1971: 83–86.

Aubert JF (1976a) Ichneumonides non pétiolées inédites ou mal connues. Bulletin de la Société Entomologique de Mulhouse 1976: 25–32.

Aubert JF (1976b) Révision des *Aperileptus* Först. et *Plectiscidea* Vier. (*Plectiscus* auct.) de Förster et de Strobl (Hymenoptera: Ichneumonidae). Opuscula Zoologica 138: 1–8.

Aubert JF (1978) Les ichneumonides ouest-paléarctiques et leurs hôtes 2. Banchinae et suppl. aux Pimplinae. Laboratoire d'Évolution des Êtres Organisés, Echaffour, 318 pp.

Aubert JF (1980) 9e. supplément au catalogue de Gaulle (100 espèces d'ichneumonides nouvelles pour la faune française). Bulletin de la Société Linnéenne de Lyon 49: 533–544. https://doi.org/10.3406/linly.1980.10452

Aubert JF (1981) Révision des ichneumonides *Stenomacrus* sensu lato. Mitteilungen der Münchener Entomologischen Gesellschaft 71: 139–159.

Aubert JF (1984) Douze ichneumonides non pétiolées mal connues ou inédites. Bulletin de la Société Entomologique de Mulhouse 1984: 17–23.

Aubert JF (1987) Deuxième prélude à une révision des Ichneumonides Scolobatinae. Bulletin de la Société Entomologique de Mulhouse 1987: 33–40.

Aubert JF (1989a) Ichneumonides non pétiolées inédites et quatrième suppl. aux Scolobatinae (Ctenopelmatinae): les Homaspsis Foerst. Bulletin de la Société Entomologique de Mulhouse 1989.

Aubert JF (1989b) Ichneumonides pétiolées inédites obtenues d'élevages. Bulletin de la Société Entomologique de Mulhouse 1989: 49–58.

Aubert JF (1998) Huitième supplément aux ichneumonides Scolobatinae, principalement du Musée de Saint-Pétersbourg Bulletin de la Société Entomologique de Mulhouse 1998: 17–25. https://doi.org/10.5962/bhl.part.29504

Aubert JF (2000) Les ichneumonides ouest-paléarctiques et leurs hôtes. 3. Scolobatinae (=Ctenopelmatinae) et suppl. aux volumes précédents. Litterae Zoologicae 5: 1–310.

Azidah AA, Fitton MG, Quicke DLJ (2000) Identification of the *Diadegma* species (Hymenoptera: Ichneumonidae, Campopleginae) attacking the diamondback moth, *Plutella xylostella* (Lepidoptera: Plutellidae). Bulletin of Entomological Research 90: 375–389. https://doi.org/10.1017/s0007485300000511

Baltensweiler W (1958) Zur Kenntnis der Parasiten des grauen Lärchenwicklers *Zeiraphera griseana* Hübner im Oberengadin. Mitteilungen der Schweizerischen Anstalt für das Forstliche Versuchswesen 34: 399–478. https://doi.org/10.1111/j.1439-0418.1960.tb01368.x

Barron JR (1978) Systematics of the world Eucerotinae (Hymenoptera, Ichneumonidae) Part 2. Non-Nearctic species. Naturaliste Canadien 105: 327–374.

Bauer R (1985) Neue Ichneumoniden von den Hochalpen (Hymenoptera, Ichneumonidae). Nachrichtenblatt der Bayerischen Entomologen 34: 131–135.

Bauer R (2001) Bemerkungen über die Ichneumoniden der Alpen mit einigen Neubeschreibungen. Teil III (Hymenoptera, Ichneumonidae, Ichneumoninae). Entomofauna 22: 245–272.

Bauer R (2002) Bemerkungen über die Ichneumoniden der Alpen. Teil IV (Hymenoptera, Ichneumonidae). Entomofauna 23: 93–107.

Beirne BP (1941) British species of Diplazonini (Bassini auctt.) with a study of the genital and postgenital abdominal sclerites in the male. Transactions of the Royal Entomological Society of London 91: 661–712. https://doi.org/10.1111/j.1365-2311.1941.tb01042.x

Bennett AMR (2015) Revision of the world genera of Tryphoninae (Hymenoptera : Ichneumonidae). Memoirs of the American Entomological Institute 86: 1–387.

Berthoumieu V (1895) Ichneumonides d'Europe et des pays limitrophes. Annales de la Société Entomologique de France (NS) 63: 593–664. https://doi.org/10.5962/bhl.part.29504

Berthoumieu V (1896) Ichneumonides. Description d'espèces nouvelles. Revue Scientifique du Bourbonnais 9: 193–196.

Berthoumieu V (1899) 4e supplément aux ichneumonides d'Europe Hymen. Bulletin de la Société Entomologique de France 1899: 135–138. https://doi.org/10.5962/bhl.part.29504

Berthoumieu V (1900) 5e supplément aux ichneumonides d'Europe (Hymen.). Bulletin de la Société Entomologique de France 1900: 249–252. https://doi.org/10.5962/bhl.part.29504

Blösch C (1906) Verzeichnis einiger Braconiden und Ichneumoniden aus der Umgebung von Laufenburg (Aargau). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 11: 221–234.

Bovey P (1936) Sur la biologie du carpocapse des prunes (*Laspeyresia funebrana* Tr.). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 16: 730–732.

Bovey P (1937) Recherches sur la carpocapse des prunes *Laspeyresia* (*Grapholita*) *funebrana* Tr. Revue de Pathologie Végétale 24: 189–317.

Bovey P (1958) Le problème de la torgeuse grise du mélèze *Eucosma griseana* (Hübner) (Lepidoptera, Tortricidae) dans les forêts alpines. Proceedings of the 10th International Congress of Entomology, 1956 4: 123–131.

Bovey P, Ferrière C (1944) Sur quelques parasites des tordeuses du genre *Gypsonoma* Meyrick. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 19: 199–201.

Brauns S (1888) Neue Ichneumoniden der Schweiz. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 8: 1–9.

Brauns S (1901) Nachträge zu den Lissonotinen (Hym.). Zeitschrift für Systematische Hymenopterologie und Dipterologie 1: 157–160, 177–183.

Broad GR (2016) Checklist of British and Irish Hymenoptera – Ichneumonidae. Biodiversity Data Journal 4: e9042. https://doi.org/10.3897/BDJ.4.e9042

Broad GR, Shaw MR (2016) The British species of *Enicospilus* (Hymenoptera: Ophioninae). European Journal of Taxonomy 187: 1–31. https://doi.org/10.5852/ejt.2016.187

Broad GR, Shaw MR, Fitton MG (2018) The ichneumonid wasps of Britain and Ireland (Hymenoptera: Ichneumonidae). Royal Entomological Society, Telford, 382 pp.

Brockerhoff EG, Kenis M (1996) Parasitoids associated with *Cydia strobilella* (L.) in Europe, and considerations for their use for biological control in North America. Biological Control 6: 202–214. https://doi.org/10.1006/bcon.1996.0025

Chapman TA (1910) Parasites of *Callophrys rubi*. Entomologist's Gazette 43: 202.

Clément E (1930) Opuscula Hymenopterologica III. Die paläarktischen *Metopius*-Arten (Hym., Ichneumon.). Konowia 8: 325–437.

Coulon L (1933) Catalogue de la collection d'hyménoptères de la famille des Ichneumonidae du Musée d'Elbeuf. Bulletin de la Société des Sciences Naturelles Elbeuf 51: 73–96. https://doi.org/10.1080/01811789.1985.10826730

Dalla Torre CGD (1902) Catalogus Hymenopterorum. Volumen III. Trigonalida, Megalyridae, Stephanidae, Ichneumonidae, Agriotypidae, Evaniidae, Pelecinidae. Guilelmi Engelmann Lipsiae 1902: 545–1141.

Dbar RS (1984) Review of the Palaearctic species of the genus *Cymodusa* Holmgren (Hymenoptera, Ichneumonidae). Entomological Review 63: 127–138.

Dell D, Burckhardt D (2004) *Psilomastax pyramidalis* (Hymenoptera, Ichneumonidae), ein Parasitoid von *Apatura iris* (Lepidoptera, Nymphalidae): Beobachtungen aus der Region Basel (CH, F) aus den Jahren 1982–2002. Mitteilungen der Entomologischen Gesellschaft Basel 54: 83–87.

Delrio G (1975) Révision des espèces ouest-paléarctiques du genre *Netelia* Gray (Hym., Ichneumonidae). Studi Sassaresi Sez III – Annali della Facolta di Agraria dell'Universita di Sassari 23: 1–126.

Delucchi V (1957) Liste d'identification No. 1 Service d'identification des entomophages de le Commission Internationale de lutte biologique contre les ennemis des cultures. Entomophaga 1: 113–127. https://doi.org/10.1007/bf02377895

Delucchi V (1982) Parasitoids and hyperparasitoids of *Zeiraphera diniana* (Lep., Tortricidae) and their role in population control in outbreak areas. Entomophaga 27: 77–92. https://doi.org/10.1007/bf02371940

Dely-Draskovits A, Papp J, Thuroczy C, Bächli G, Vasarhelyi T (1993) Über die in *Lipara*-Gallen (Diptera: Chloropidae) lebenden Hymenopteren in der Schweiz. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 66: 35–40.

Diller EH (1980) Klärung einiger Taxa der Gattung *Sussaba* Cameron, 1909 (Hymenoptera, Ichneumonidae, Diplazontinae). Entomofauna 1: 58–64.

Diller EH (1985) Eine neue Art der Gattung *Syrphoctonus* Förster, 1869 (Hymenoptera, Ichneumonidae, Diplazontinae). Entomofauna 6: 197–201.

Diller EH (1986) Neue Arten der Gattung *Diplazon* Viereck, 1914 (Hymenoptera, Ichneumonidae, Diplazontinae). Entomofauna 7: 485–495.

Diller EH, Horstmann K (1994) Typenrevision der von Victor Berthoumieu beschriebenen Phaeogenini (Insecta, Hymenoptera, Ichneumonidae, Ichneumoninae). Spixiana 17: 247–260.

Diller EH, Horstmann K (1997) Typenrevision der von Victor Berthoumieu beschriebenen Ichneumoninae (ohne Phaeogenini) (Insecta, Hymenoptera, Ichneumonidae). Spixiana 20: 39–71.

Diller EH, Schönitzer K, Melzer RR (2008) Eine neue, alpine *Tycherus*-Art (Insecta: Hymenoptera, Ichneumonidae, Ichneumoninae, Phaeogenini). Mitteilungen der Münchener Entomologischen Gesellschaft 98: 37–42.

Diller EH, Zwakhals K (2009) Beschreibung einer palaearktischen *Tycherus*-Art (Insecta, Hymenoptera, Ichneumonidae, Ichneumoninae, Phaeogenini). Linzer biologische Beiträge 41: 373–379.

Eichhorn O (1977) Autökologische Untersuchungen an Populationen der gemeinen Kiefern-Buschhornblattwespe *Diprion pini* (L.) (Hym.: Diprionidae) II. Zur Kenntnis der Larvenparasiten und ihrer Synchronisation mit dem Wirt. Zeitschrift für Angewandte Entomologie 83: 15–36. https://doi.org/10.1111/j.1439-0418.1977.tb02371.x

Ferrière C (1946) Un ichneumonide redécouvert en Suisse. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 19: 694–697.

Ferrière C (1947) Hyménoptères térébrants du Parc National Suisse et des régions limitrophes. Ergebnisse der Wissenschaftlichen Untersuchung des Schweizerischen Nationalparks 2: 1–56.

Fitton MG (1976) The western Palaearctic Ichneumonidae (Hymenoptera) of British authors. Bulletin of the British Museum (Natural History), Entomology series 32: 301–373.

Fitton MG (1982) A catalogue and reclassification of the Ichneumonidae (Hymenoptera) described by C.G. Thomson. Bulletin of the British Museum (Natural History), Entomology series 45: 1–119.

Fitton MG (1985) The Ichneumon-fly genus *Banchus* (Hymenoptera) in the Old World. Bulletin of the British Museum (Natural History), Entomology series 51: 1–60.

Förster A (1871) Uebersicht der Gattungen und Arten der Familie der Plectiscoiden. Verhandlungen des Naturhistorischen Vereins der Preussischen Rheinlande und Westfalens 28: 71–123. https://doi.org/10.1002/iroh.3510680506

Förster A (1876) Synoptische Übersicht der Gattungen und Arten der Stilpnoiden. Verhandlungen des Naturhistorischen Vereins der Preussischen Rheinlande und Westfalens 33: 17–196. https://doi.org/10.1002/iroh.19890740114

Fuesslin JC (1775) Verzeichnis der ihm bekannten Schweizerischen Insekten. Self-published, Zürich and Winterthur, 1–62.

Fulmek L (1968) Parasitinsekten der Insektengallen Europas. Beiträge zur Entomologie 18: 719–952.

Geier P (1957) Observations sur les parasites du carpocapse (*Cydia pomonella* L.) près de Geneve. Revue Suisse de Zoologie 64: 497–525. https://doi.org/10.5962/bhl.part.75499

Gokhman VE (2007) Revision of the genus *Trachyarus* Thomson –(Insecta, Hymenoptera, Ichneumonidae, Alomyini). Spixiana 30: 65–83.

Gold MS, Casagrande RA, Tewksbury LA, Livingston SB, Kenis M (2001) European parasitoids of *Lilioceris lilii* (Coleoptera: Chrysomelidae). Canadian Entomologist 133: 671–674. https://doi.org/10.4039/Ent133671-5

Habermehl H (1909) Neue deutsche und schweizerische Ichneumoniden (Hym.). Deutsche Entomologische Zeitschrift 1909: 563–573.

Habermehl H (1916) Beiträge zur Kenntnis der palaearktischen Ichneumonidenfauna. Zeitschrift für Wissenschaftliche Insektenbiologie 12: 232–237, 280–287.

Habermehl H (1917) Beiträge zur Kenntnis der palaearktischen Ichneumonidenfauna. Zeitschrift für Wissenschaftliche Insektenbiologie 13: 20–27, 51–58, 110–117, 161–168, 226–234.

Habermehl H (1918) Beiträge zur Kenntnis der palaearktischen Ichneumonidenfauna. Zeitschrift für Wissenschaftliche Insektenbiologie 13: 306–316.

Habermehl H (1919) Beiträge zur Kenntnis der palaearktischen Ichneumonidenfauna. Zeitschrift für Wissenschaftliche Insektenbiologie 15: 15–22.

Habermehl H (1923) Beiträge zur Kenntnis der palaearktischen Ichneumonidenfauna. Konowia 1: 266–282.

Haeselbarth E (1989) Determination list of entomophagous insects. Nr. 11. IOBC-WPRS Bulletin: 1–63.

Haller G (1885) Entomologische Notizen. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 7: 194–203. https://doi.org/10.5962/bhl.part.4553

Haye T, Kenis M (2004) Biology of *Lilioceris* spp. (Coleoptera: Chrysomelidae) and their parasitoids in Europe. Biological Control 29: 399–408. https://doi.org/10.1016/j.biocontrol.2003.09.005

Hilpert H (1992) Zur Systematik der Gattung *Ichneumon* Linnaeus, 1758 in der Westpalaearktis (Hymenoptera, Ichneumonidae, Ichneumoninae). Entomofauna Suppl. 6: 1–389.

Hilpert H, Hinz R, Horstmann K (1993) Typenrevision der von Maurice Pic beschriebenen Ichneumoninae (ohne Phaeogenini) (Hymenoptera, Ichneumonidae). Spixiana 16: 173–187.

Hinz R (1972) Zur Systematik und Ökologie der Ichneumoniden IV (Hym.). Deutsche Entomologische Zeitschrift 19: 45–54. https://doi.org/10.1002/mmnd.19720190107

Hinz R (1975) Vier Bemerkungen zur Systematik der Ichneumonidae (Hym.). Nachrichtenblatt der Bayerischen Entomologen 24: 65–68.

Hinz R (1976) Zur Systematik und Ökologie der Ichneumoniden V. Deutsche Entomologische Zeitschrift 23: 99–105. https://doi.org/10.1002/mmnd.19760230111

Hinz R (1986) Die paläarktischen Arten der Gattung *Trematopygus* Holmgren (Hymenoptera, Ichneumonidae). Spixiana 8: 265–276.

Hinz R (1990) Beiträge zur Taxonomie der Gattung *Delopia* Cameron, 1903 (*Dusona* auct.). Entomofauna 11: 261–271.

Hinz R (1996) Zur Systematik einiger Ctenopelmatinae (Hymenoptera, Ichneumonidae). Nachrichtenblatt der Bayerischen Entomologen 45: 75–78.

Hinz R, Horstmann K (2007) Über Wirtsbeziehungen europäischer *Ichneumon*-Arten (Insecta, Hymenoptera, Ichneumonidae, Ichneumoninae). Spixiana 30: 39–63.

Horstmann K (1968) Revision einiger Arten der Gattungen *Mesostenus* Gravenhorst, *Agrothereutes* Foerster und *Ischnus* Gravenhorst (Hymenoptera, Ichneumonidae). Entomophaga 13: 121–133. https://doi.org/10.1007/BF02371782

Horstmann K (1971) Revision der europäischen Tersilochinen I (Hymenoptera, Ichneumonidae). Veröffentlichungen der Zoologischen Staatssammlung (München) 15: 47–138.

Horstmann K (1973) Revision der westpaläarktischen Arten der Gattung *Nemeritis* Holmgren (Hymenoptera: Ichneumonidae). Opuscula Zoologica 125: 1–14.

Horstmann K (1974) Revision der westpalaearktischen Arten der Schlupfwespen-Gattungen *Bathyplectes* und *Biolysia* (Hymenoptera: Ichneumonidae). Entomologica Germanica 1: 58–81.

Horstmann K (1978) Bemerkungen zur Systematik einiger Gattungen der Campopleginae. Mitteilungen der Münchener Entomologischen Gesellschaft 67: 65–83.

Horstmann K (1980a) Neue westpaläarktische Campopleginen-Arten (Hymenoptera, Ichneumonidae). Mitteilungen der Münchener Entomologischen Gesellschaft 69: 117–132.

Horstmann K (1980b) Revision der europäischen Arten der Gattung *Rhimphoctona* Förster (Hymenoptera, Ichneumonidae). Nachrichtenblatt der Bayerischen Entomologen 29: 17–24.

Horstmann K (1981a) Die paläarktischen Arten der Gattungen *Eremotylus* Förster, 1869, und *Simophion* Cushman, 1947 (Hymenoptera, Ichneumonidae). Entomofauna 2: 415–432.

Horstmann K (1981b) Revision der europäischen Tersilochinen II (Hymenoptera, Ichneumonidae). Spixiana Suppl. 4: 1–76.

Horstmann K (1983) Die westpaläarktischen Arten der Gattung *Chirotica* Förster, 1869 (Hymenoptera, Ichneumonidae). Entomofauna 4: 1–33.

Horstmann K (1985) Revision der mit *difformis* (Gmelin, 1790) verwandten westpaläarktichen Arten der Gattung *Campoplex* Gravenhorst, 1829 (Hymenoptera, Ichneumonidae). Entomofauna 6: 129–163.

Horstmann K (1990a) Die westpaläarktischen Arten der Gattung *Pristomerus* Curtis, 1836 (Hymenoptera, Ichneumonidae). Entomofauna 11: 9–44.

Horstmann K (1990b) Die westpalaearktischen Arten einiger Gattungen der Cryptini (Hymenoptera, Ichneumonidae). Mitteilungen der Münchener Entomologischen Gesellschaft 79: 65–89.

Horstmann K (1993a) Neue Taxa der Campopleginae aus den Gattungen *Campoplex* Gravenhorst, *Diadegma* Förster und *Nemeritis* Holmgren (Hymenoptera, Ichneumonidae). Zeitschrift der Arbeitsgemeinschaft Österreichischer Entomologen 44: 116–127.

Horstmann K (1993b) Revision der brachypteren Weibchen der westpalaearktischen Cryptinae (Hymenoptera, Ichneumonidae). Entomofauna 14: 85–148.

Horstmann K (1993c) Revision der von Ferdinand Rudow beschriebenen Ichneumonidae I. (Hymenoptera). Beiträge zur Entomologie 43: 3–38.

Horstmann K (1994) Nachtrag zur Revision der westpaläarktischen *Nemeritis*-Arten (Hymenoptera, Ichneumonidae, Campopleginae). Mitteilungen der Münchener Entomologischen Gesellschaft 84: 79–90.

Horstmann K (1998) Revisionen von Schlupfwespen-Arten II (Hymenoptera: Ichneumonidae, Braconidae). Mitteilungen der Münchener Entomologischen Gesellschaft 88: 3–12.

Horstmann K (1999) Revisionen von Schlupfwespen-Arten III (Hymenoptera: Ichneumonidae). Mitteilungen der Münchener Entomologischen Gesellschaft 89: 47–57.

Horstmann K (2000) Revisionen von Schlupfwespen-Arten IV (Hymenoptera: Ichneumonidae). Mitteilungen der Münchener Entomologischen Gesellschaft 90: 39–50.

Horstmann K (2001a) Ichneumonidae. In: Dathe HH, Taeger A, Plank SM (Eds) Verzeichnis der Hautflügler Deutschlands. Entomologische Nachrichten und Berichte, Dresden, 69–103.

Horstmann K (2001b) Revision der bisher zu *Iselix* Förster gestellten westpaläarktischen Arten von *Phygadeuon* Gravenhorst. Spixiana 24: 207–229.

Horstmann K (2001c) Revisionen von Schlupfwespen-Arten V (Hymenoptera: Ichneumonidae). Mitteilungen der Münchener Entomologischen Gesellschaft 91: 77–86.

Horstmann K (2004) Bemerkungen zur Systematik einiger Gattungen der Campopleginae IV (Hymenoptera, Ichneumonidae). Zeitschrift der Arbeitsgemeinschaft Österreichischer Entomologen 56: 13–35.

Horstmann K (2006a) Revisionen der von Kriechbaumer aus der Westpaläarktis und Zentralasien beschriebenen Ichneumonidae (Insecta, Hymenoptera). Spixiana 29: 1–30.

Horstmann K (2006b) Revisionen einiger europäischer Mesochorinae (Hymenoptera, Ichneumonidae). Linzer biologische Beiträge 38: 1449–1492.

Horstmann K (2006c) Revisionen von Schlupfwespen-Arten X. (Hymenoptera: Ichneumonidae, Braconidae). Mitteilungen der Münchener Entomologischen Gesellschaft 96: 5–16.

Horstmann K (2007) Revision der westpaläarktischen Arten von *Anisobas* Wesmael, 1845 (Hymenoptera, Ichneumonidae, Ichneumoninae). Entomofauna 28: 93–115.

Horstmann K (2008) Neue westpaläarktische Arten der Campopleginae (Hymenoptera, Ichneumonidae). Zeitschrift der Arbeitsgemeinschaft Österreichischer Entomologen 60: 3–27.

Horstmann K (2009) Revision der europäischen Arten von *Isadelphus* Förster, 1869 (Hymenoptera, Ichneumonidae, Cryptinae). Entomofauna 30: 473–492.

Horstmann K (2011) Verbreitung und Wirte der *Dusona*-Arten in der Westpaläarktis (Hymenoptera. Ichneumonidae, Campopleginae). Linzer biologische Beiträge 43: 1295–1330.

Idar M (1981) Revision of the European species of the genus *Hadrodactylus* Förster (Hymenoptera: Ichneumonidae). Part 2. Entomologica Scandinavica 12: 231–239. https://doi.org/10.1163/187631281794709917

Jenner WH, Kuhlmann U, Cossentine JE, Roitberg BD (2004) Phenology, distribution, and the natural parasitoid community of the cherry bark tortrix. Biological Control 31: 72–82. https://doi.org/10.1016/j.biocontrol.2004.05.007

Jordan T (1998) *Tersilochus curvator* Horstmann und *Tersilochus* sp. n. (Ichneumonidae, Tersilochinae), neue Parasitoiden der an Birken minierenden Trugmotten (Lepidoptera, Eriocraniidae). Bonner Zoologische Beiträge 47: 411–419.

Julliard C (1948) Les parasites de la chrysalide de *Vanessa urticae* dans la region de Zinal (Valais). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 21: 557–565.

Jussila R (1979) A revision of the genus *Atractodes* (Hymenoptera Ichneumonidae) in the western Palearctic region. Acta Entomologica Fennica 34: 1–44.

Jussila R (1987) Revision of the genus *Stilpnus* (Hymenoptera, Ichneumonidae) of the western Palaearctic Region. Annales Entomologici Fennici 53: 1–16.

Jussila R (2001) Additions to the revision of the genus *Atractodes* (Hymenoptera: Ichneumonidae) of the Palaearctic region. III. Entomologica Fennica 12: 193–216.

Jussila R, Sääksjärvi IE, Bordera S (2010) Revision of the western Palaearctic *Mesoleptus* (Hymenoptera: Ichneumonidae). Annales de la Société Entomologique de France (NS) 46: 499–518. https://doi.org/10.1080/00379271.2010.10697687

Kasparyan DR (1969) Review of the Palearctic Ichneumonids of the genus *Tryphon* Fallen (Hymenoptera, Ichneumonidae). II. Entomological Review 48: 572–584.

Kasparyan DR (1973) Ichneumonidae (Subfamily Tryphoninae) Tribe Tryphonini (Translated from Russian: Amerind Publishing Co. Ltd., New Delhi, 1981). Nauka Publisher, Leningrad, 414 pp.

Kasparyan DR (1974) Review of the Palearctic species of the tribe Pimplini (Hymenoptera, Ichneumonidae). The genus *Pimpla* Fabricius. Entomological Review 53: 102–117.

Kasparyan DR (1990) Ichneumonidae. Subfamily Tryphoninae: Tribe Exenterini. Subfamily Adelognathinae. Nauka Publisher, Leningrad, 342 pp.

Kasparyan DR (1993a) Review of Palearctic species of wasps of the genus *Phytodietus* Grav. (Hymenoptera, Ichneumonidae). Entomological Review 73: 56–79.

Kasparyan DR (1993b) Revision of the genus *Thymaris* (Hymenoptera, 1. Ichneumonidae). Entomological Review 73: 156–168.

Kasparyan DR (1998) Taxonomic notes on the species of *Mesoleius* s.l., *Hyperbatus* and *Phaestus* in the museums of Stockholm, Lund and Munich (Hymenoptera: Ichneumonidae, Ctenopelmatinae). Zoosystematica Rossica 7: 181–183.

Kasparyan DR (2000) Palaearctic ichneumonid wasps of the genus *Mesoleius* Holmgren (s.str) (Hymenoptera, Ichneumonidae). I. Entomological Review 80: 144–148.

Kasparyan DR (2009) Two new Palaearctic species of *Saotis* Förster, 1869 (Hymenoptera: Ichneumonidae: Ctenopelmatinae). Zoosystematica Rossica 18: 118–125.

Kasparyan DR (2014) Review of the western Palaearctic ichneumon-flies of the genus *Rhorus* Förster, 1869 (Hymenoptera, Ichneumonidae: Ctenopelmatinae). Part II. The species of the *punctus*, *longicornis*, *chrysopygus*, and *substitutor* groups, the species with black abdomen, and some others [in Russian with English summary]. Entomological Review 94: 712–755. https://doi.org/10.1134/S0013873814050078

Kasparyan DR (2015) Review of the western Palaearctic ichneumon-flies of the genus *Rhorus* Förster, 1869 (Hymenoptera, Ichneumonidae: Ctenopelmatinae). Part III. The species with the reddish metasoma and black face [in Russian with English summary]. Entomological Review 95: 1257–1291. https://doi.org/10.1134/S0013873815080158

Kasparyan DR (2017) Review of the western Palaearctic ichneumon-flies of the genus *Rhorus* Förster, 1869 (Hymenoptera, Ichneumonidae: Ctenopelmatinae). Part IV. The species with the reddish metasoma and black face (Addendum) [in Russian with English summary]. Entomological Review 97: 116–131. https://doi.org/10.1134/S0013873817010122

Kasparyan DR, Kopelke JP (2009) Taxonomic review and key to European ichneumon flies (Hymenotpera, Ichneumonidae), parasitoids of gall-forming sawflies of the genera *Pontania* Costa, *Phyllocolpa* Benson, and *Euura* Newman (Hymenoptera, Tenthredinidae) on willows: Part I. Entomological Review 89: 933–957. https://doi.org/10.1134/S0013873809080089

Kasparyan DR, Kopelke JP (2010) A taxonomic review of Ichneumon-flies (Hymenoptera, Ichneumonidae), parasitoids of gall-forming sawflies (Hymenoptera, Tenthredinidae) on *Salix*. Part II. Review of the palaearctic species of the genus *Saotis* Förster with description of four new species. Entomological Review 90: 71–98. https://doi.org/10.1134/S0013873810010069

Kasparyan DR, Shaw MR (2009) A new species of *Hadrodactylus* Förster (Hymenoptera: Ichneumonidae, Ctenopelmatinae, Eurycproctini) from Britain and mainland Europe, with a review of material of the genus in the National Museums of Scotland. Entomologist's Gazette 60: 251–258.

Kenis M, Herz K, West RJ, Shaw MR (2005) Parasitoid assemblages reared from geometric defoliators (Lepidoptera: Geometridae) of larch and fir in the alps. Agricultural and Forest Entomology 7: 307–318. https://doi.org/10.1111/j.1461-9555.2005.00277.x

Kerrich GJ (1952) A review, and a revision in greater part, of the Cteniscini of the Old World (Hym., Ichneumonidae). Bulletin of the British Museum (Natural History), Entomology series 2: 307–460. https://doi.org/10.5962/bhl.part.27755

Kerrich GJ (1953) A preliminary study of the European species of the genus *Eudiaborus* mihi. (Hym. Ichneumonidae). Opuscula Entomologica, Lund 18: 151–159.

Kerrich GJ (1962) Systematic notes on Tryphoninae, Ichneumonidae (Hym.). Opuscula Entomologica 27: 46–56.

Khalaim AI (2007) Tersilochinae (in Russian). In: Lelej AS (Ed.) Key to the insects of Russia Far East Vol IV Neuropteroidea, Mecoptera, Hymenoptera Pt5. Dalnauka, Vladivostok, 566–597.

Khalaim AI, Blank SM (2011) Review of the European species of the genus *Gelanes* Horstmann (Hymenoptera: Ichneumonidae: Tersilochinae), parasitoids of xyelid sawflies (Hymenoptera: Xyelidae). Proceedings of the Zoological Institute, Leningrad 315: 154–166.

Khalaim AI, Bordera S, Rodriguez-Berrio A (2009) A review of the European species of *Phradis* (Hymenoptera: Ichneumonidae: Tersilochinae), with a description of a new species from Spain. European Journal of Entomology 106: 107–118. https://doi.org/10.14411/eje.2009.015

Kirchner L (1867) Catalogus Hymenopterorum Eurpae. Vindobonae, 285 pp.

Kittel RN (2016) Eighty-nine replacement names for Braconidae and Ichneumonidae (Insecta: Hymenoptera: Ichneumonoidea). Japanese Journal of Entomology 22: 161–174.

Klopfstein S (2014) Revision of the Western Palaearctic Diplazontinae (Hymenoptera, Ichneumonidae). Zootaxa 3801: 1–143. https://doi.org/10.11646/zootaxa.3801.1.1

Klopfstein S, Baur H (2011) Catalogue of the type specimens of Ichneumonidae (Hymenoptera) in the Jacques F. Aubert collection at the Musée de Zoologie, Lausanne, Switzerland. Zootaxa 3081: 1–90. https://doi.org/10.11646/zootaxa.3081.1.1

Klopfstein S, Kropf C, Quicke DLJ (2010) An evaluation of phylogenetic informativeness profiles and the molecular phylogeny of Diplazontinae (Hymenoptera, Ichneumonidae). Systematic Biology 59: 226–241. https://doi.org/10.1093/sysbio/syp105

Klopfstein S, Langille B, Spasejovic T, Broad RG, Cooper SJB, Austin A, Niehuis O (2018) Hybrid capture data unravels a rapid radiation of pimpliform parasitoid wasps (Hymenoptera: Ichneumonidae: Pimpliformes). Systematic Entomology online early. https://doi.org/10.1111/syen.12333

Klopfstein S, Quicke DLJ, Kropf C, Frick H (2011) Molecular and morphological phylogeny of Diplazontinae (Hymenoptera, Ichneumonidae). Zoologica Scripta 40: 379–402. https://doi.org/10.1111/j.1463-6409.2011.00481.x

Klopfstein S, Steiner S, Baur H (2007) Artenvielfalt der Diplazontinae auf der Alp Flix (Hymenoptera: Ichneumonidae). Nachrichtenblatt der Bayerischen Entomologen 56: 114–115.

Kopelke JP (1994) Der Schmarotzerkomplex (Brutparasiten und Parasitoide) der gallenbildenen *Pontania*-Arten (Insecta: Hymenoptera: Tenthredinidae). Senckenbergiana Biologica 73: 83–133.

Kriechbaumer J (1869) Beschreibung einer neuen Schlupfwespe. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 3: 129–130.

Kriechbaumer J (1872a) *Atractogaster*, nov. gen. Pimplidarum. Stettiner Entomologische Zeitung 1872: 6–10.

Kriechbaumer J (1872b) Neue Schlupfwespen aus den Alpen, gesammelt und beschrieben. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 3: 482–485.

Kriechbaumer J (1880) Neue Schlupfwespen aus den Alpen. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 6: 12–15.

Kriechbaumer J (1887) Pimpliden-Studien. 1–5. Entomologische Nachrichten 13: 81–87.

Kriechbaumer J (1890a) Ichneumoniden-Studien. Neue Ichneumoniden des Wiener Museums. II. Annalen des Naturhistorischen Hofmuseums Wien 5: 479–491.

Kriechbaumer J (1890b) Zwei neue Tryphoniden-Gattungen. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 8: 207–210.

Kriechbaumer J (1893) Cryptiden-Studien. Entomologische Nachrichten 19: 54–60.

Kriechbaumer J (1896) Neue oder wenig bekannte Ichneumoniden in der Sammlung des Ung. National-Museums. Termeszetrajzi Fuezetek 19: 128–139.

Lee JW (1991) A revision of the genus *Cidaphus* (Hymenoptera: Ichneumonidae: Mesochorinae). Contributions of the American Entomological Institute 261: 1–48.

Mason PG, Brauner AM, Miall JH, Bennett AMR (2013) *Diadromus pulchellus* in North America: filed release against leek moth and new characters to distinguish it from *Diadromus subtilicornis*, a native diamondback moth parasitoid. Biocontrol Science and Technology 23: 260–276. https://doi.org/10.1080/09583157.2012.755613

Mevi-Schuetz J, Klopfstein S, Zwakhals K, Burckhardt D (2006) The genus *Dolichomitus* Smith (Hymenoptera: Ichneumonidae) in Switzerland. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 79: 201–223.

Mey E, Oehlke J (1988) Die Hymenopteren-Kollektion O. Schmiedeknecht im Naturhistorischen Museum Rudolstadt/Thür. Rudolstädter Naturhistorische Schriften 1: 56–71.

Meyer NF (1933) Introduction and Ichneumoninae. Zoological Institute of the Academy of Sciences of the USSR, 458 pp.

Mills NJ (1993) Observations on the parasitoid complexes of budmoths (Lepidoptera: Tortricoidea) on larch in Europe. Bulletin of Entomological Research 83: 103–112. https://doi.org/10.1017/S0007485300041833

Mills NJ, Kenis M (1991) A study of the parasitoid complex of the European fir budworm, *Choristoneura murinana* (Lepidoptera: Tortricidae), and its relevance for biological control of related hosts. Bulletin of Entomological Research 81: 429–436. https://doi.org/10.1017/S0007485300031990

Moreau J, Villemant C, Benrey B, Thiery D (2010) Species diversity of larval parasitoids of the European grapevine moth (*Lobesia botrana*,

Lepidoptera: Tortricidae): The influence of region and cultivar. Biological Control 54: 300–306. https://doi.org/10.1016/j.biocontrol.2010.05.019

Oehlke J, Townes HK (1969) Schmiedeknechts Ichneumonidentypen aus der Kollektion des Museums Rudolstadt. Beiträge zur Entomologie 19: 395–412.

Perkins JF (1957) Notes on some Eurasian "*Itoplectis*" with description of new species (Hym., Ichneumonidae). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 30: 323–326.

Perkins JF (1958) Description of *Echthrolaricobius paradoxus* n.g. n.sp. Entomophaga 3: 146–148.

Pic M (1902) Diagnoses d'Ichneumoniens faisant partie de la collection Pic. Échange 18: 57–58.

Pic M (1926) Hyménoptères nouveaux. II. Échange 42: 11–12.

Quicke DLJ (2012) We know too little about parasitoid wasp distributions to draw any conclusions about latitudinal trends in species richness, body size and biology. PLoS One 7: e32101. https://doi.org/10.1371/journal.pone.0032101

Reshchikov A (2015) Review of North European species of the genus *Lathrolestes* (Hymenoptera, Ichneumonidae) with description of one new species from Öland (Sweden). Zootaxa 4033: 1–47. https://doi.org/10.11646/zootaxa.4033.1.1

Rey del Castillo C (1992) Revision de la especies oeste-palearticas del subgenero *Loxonota* Aubert, 1978 (Hymenotpera, Ichneumonidae). Annales de la Société Entomologique de France (NS) 28: 133–156.

R Core Team (2014). R: A language and environment for statistical computing. Vienna, Austria, R Foundation for Statistical Computing.

Riedel M (2006) Typenrevision einiger von Habermehl beschriebener Platylabini (Hymenoptera, Ichneumonidae, Ichneumoninae). Entomofauna 27: 169–174.

Riedel M (2008) Revision der westpaläarktischen Platylabini 1. Die Gattung *Platylabus* Wesmael, 1845 (Hymenoptera, Ichneumonidae, Ichneumoninae). Spixiana 31: 105–172.

Riedel M (2012) Revision der westpalaearktischen Arten der Gattung *Coelichneumon* Thomson (Hymenoptera: Ichneumonidae: Ichneumoninae). Linzer biologische Beiträge 44: 1477–1611.

Riedel M (2015) Revision of the European species of the genus *Astiphromma* Förster, 1869 (Hymenoptera, Ichneumonidae). Spixiana 38: 85–132.

Riedel M (2017) Die westpaläarktischen Arten der Gattung *Campoletis* Förster (Hymenoptera, Ichneumonidae, Campopleginae). Spixiana 40: 95–137.

Riedel M (2018) Revision of the Western Palaearctic species of the genus *Casinaria* Holmgren (Hymenoptera, Ichneumonidae, Campopleginae). Linzer biologische Beiträge 50: 723–763.

Sanborne M (1984) A revision of the world species of *Sinophorus* Förster (Ichneumonidae). Memoirs of the American Entomological Institute 38: 1–403.

Santos B (2017) Phylogeny and reclassification of Cryptini (Hymenoptera, Ichneumonidae, Cryptinae), with implications for ichneumonid higher-level classification. Systematic Entomology 42: 650–676. https://doi.org/10.1111/syen.12238

Sawoniewicz J (1980) Revision of European species of the genus *Bathythrix* Förster (Hym., Ichneumonidae). Annales Zoologici 35: 319–365.

Sawoniewicz J, Luhman JC (1992) Revision of Eurpean species of the subtribe Endaseina, III Genus: *Endasys* Förster, 1868 (Hymenoptera, Ichneumonidae). Entomofauna 13: 1–96.

Schnee H (1989) Revision der von Gravenhorst beschriebenen und redeskribierten Anomaloninae mit Beschreibung zweier neuer Arten (Hymenoptera, Ichneumonidae). Deutsche Entomologische Zeitschrift 36: 241–266. https://doi.org/10.1002/mmnd.19890360405

Schnee H (2008) Die Anomaloninae der Sammlung Arnold Förster – Typenrevision und faunistische Anmerkungen (Hymenoptera, Ichneumonidae). Beiträge zur Entomologie 58: 249–266.

Schwarz M (1988) Die europäischen Arten der Gattung *Idiolispa* Foerster (Ichneumonidae, Hymenoptera). Linzer biologische Beiträge 20: 37–66.

Schwarz M (1989) Revision der Gattung *Enclisis* Townes (Ichneumonidae, Hymenoptera). Linzer biologische Beiträge 21: 497–522.

Schwarz M (1998) Revision der westpalaearktischen Arten der Gattungen *Gelis* Thunberg mit apteren Weibchen und *Thaumatogelis* Schmiedeknecht (Hymenoptera, Ichneumonidae). Teil 2. Linzer biologische Beiträge 30: 629–704.

Schwarz M (2002a) Revision der westpalaearktischen Arten der Gattungen *Gelis* Thunberg mit apteren Weibchen und *Thaumatogelis* Schwarz (Hymenoptera, Ichneumonidae). Teil 3. Linzer biologische Beiträge 34: 1293–1392.

Schwarz M (2002b) Schlupfwespen (Insecta, Hymenoptera, Ichneumonidae) in den Hochlagen der Hohen Tauern (Österreich). Teil 1: Überblick. Mitteilungen aus dem Haus der Natur, Salzburg 15: 42–52.

Schwarz M (2005) Revisionen und Neubeschreibungen von Cryptinae (Hymenoptera, Ichneumonidae) 1. Linzer biologische Beiträge 37: 1641–1710.

Schwarz M (2007) Revision der westpalaearktischen Arten der Gattung *Hoplocryptus* Thomson (Hymenoptera, Ichneumonidae). Linzer biologische Beiträge 39: 1161–1219.

Schwarz M (2015) Zur Kenntnis paläarktischer *Cryptus*-Arten (Hymenoptera, Ichneumonidae, Cryptinae). Linzer biologische Beiträge 47: 749–896.

Schwarz M (2016) Die Schlupfwespengattung *Gelis* (Hymenoptera, Ichneumonidae, Cryptinae) mit macropteren Weibchen in der Westpaläarktis. Linzer biologische Beiträge 48: 1677–1752.

Schwarz M (2018) Revisionen und Neubeschreibungen von Cryptinae (Hymenoptera, Ichneumonidae) 2. Entomofauna 39: 121–185.

Schwarz M, Horstmann K (1993) Revision der von Ferdinand Rudow beschriebenen Ichneumonidae II: *Pezolochus* Förster und *Pezomachus* Gravenhorst (Hymenoptera). Beiträge zur Entomologie 43: 417–430.

Schwenke W (1999) Revision der europäischen Mesochorinae (Hymenoptera, Ichneumonoidea, Ichneumonidae). Spixiana Supplément 26: 1–124.

Schwenke W (2000) Eine neue *Mesochorus*-Art aus Käfern, mit einer Betrachtung der aus Käfern bekannten Mesochorinae (Hymenoptera, Ichneumonidae, Mesochorinae). Entomofauna 21: 49–53.

Sedivy J (1970) Westpaläarktische Arten der Gattung *Dimophora*, *Pristomerus*, *Eucremastus* und *Cremastus* (Hym., Ichneumonidae). Prirodovedne Prace Ustavu Ceskoslovenske Akademie Ved v Brne (NS) 4: 1–38.

Seyrig A (1928) Note sur les ichneumonides du Muséum National d'Histoire Naturelle. Bulletin du Muséum National d'Histoire Naturelle, Paris 34: 146–265.

Shaw MR, Horstmann K (1997) An analysis of host range in the *Diadegma nanus* group of parasitoids in western Europe, with a key to

species (Hymenoptera: Ichneumonidae: Campopleginae). Journal of Hymenoptera Research 6: 273–296.

Shaw MR, Horstmann K, Whiffin AL (2016) Two hundred and twenty-five species of reared western Palaearctic Campopleginae (Hymenoptera: Ichneumonidae) in the National Museums of Scotland, with descriptions of new species of *Campoplex* and *Diadegma*, and records of fifty-five species new to Britain. Entomologist's Gazette 67: 177–222.

Steck T (1891) Demonstration von Schlupfwespen aus dem Val Somvix. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 8: 292.

Sulzer JH (1776) Dr. Sulzers abgekürzte Geschichte der Insecten nach dem Linnaeischen System. Erster Theil. Steinerische Buchhandlung, Ziegler, Winterthur. Bd. 1, 274 pp.

Teunissen HGM (1947) Het genus *Campoplex* (Sugfam. Ophioninae. Fa. Ichneumonidae). Tijdschrift voor Entomologie 88: 249–270.

Tischbein PFL (1881) Zusätze und Bemerkungen zu der Übersicht der europäischen Arten des Genus *Ichneumon* Gr. Stettiner Entomologische Zeitung 42: 166–186.

Townes HK (1969) The genera of Ichneumonidae, part 1. Memoirs of the American Entomological Institute 11: 1–301. https://doi.org/10.1007/BF02027741

Townes HK (1983) Revisions of twenty genera of Gelini (Ichneumonidae). Memoirs of the American Entomological Institute 35: 1–281.

Townes HK, Gupta VK, Townes M (1992) The Ichneumon-flies of America north of Mexico Part 11. Tribes Oedemopsini, Tryphonini and Idiogrammatini (Hymenoptera: Ichneumonidae: Tryphoninae). Memoirs of the American Entomological Institute 50: 1–296.

Townes HK, Momoi S, Townes M (1965) A catalogue and reclassification of the eastern Palearctic Ichneumonidae. Memoirs of the American Entomological Institute 5: 1–661.

Tschopp A, Riedel M, Kropf C, Nentwig W, Klopfstein S (2013) The evolution of host associations in the parasitic wasp genus *Ichneumon* (Hymenoptera, Ichneumonidae): congergent adaptation to host pupation sites. BMC Evolutionary Biology 13: 74. https://doi.org/10.1186/1471-2148-13-74

Uffeln K (1940) In Westfalen gefangene und aus anderen Insekten erzogene Schlupfwespen. Abhandlungen aus dem Landesmuseum der Provinz Westfalen, Münster 11: 56–66.

van Achterberg C (1999) The west Palaearctic species of the subfamily Paxylommatinae (Hymenoptera: Ichneumonidae), with special reference to the genus *Hybrizon* Fallén. Zoologische Mededelingen Leiden 73: 11–26.

van Rossem G (1971) Additional notes on the genus *Trychosis* Foerster in Europe (Hym., Ichneumonidae). Tijdschrift voor Entomologie 114: 213–215.

van Rossem G (1981) A revision of some western Palaearctic Oxytorine genera (Hymenoptera, Ichneumonidae). Spixiana Suppl. 4: 79–135

van Rossem G (1982) A revision of some western Palaearctic Oxytorine genera. Part II. Genus *Eusterinx* (Hymenoptera, Ichneumonidae). Spixiana 5: 149–170.

van Rossem G (1987) A revision of western Palaearctic Oxytorine genera. Part VI. (Hymenoptera, Ichneumonidae). Tijdschrift voor Entomologie 130: 49–108.

Vidal S (1993) Determination list of entomophagous insects. Nr. 12. IOBC-WPRS Bulletin 16: 1–9.

Vikberg V, Koponen M (2000) On the taxonomy of Seleucus Holmgren and the European species of Phrudinae (Hymenoptera: Ichneumonidae). Entomologica Fennica 11: 195–228.

Wesmael C (1855) Ichneumonologica miscellana. Bulletin de l'Académie Royale des Sciences, Belgique 22: 362–435.

Wishart G, Colhoun EH, Monteith AE (1957) Parasites of *Hylemya* spp. (Diptera: Anthomyiidae) that attack cruciverous crops in Europe. Canadian Entomologist 89: 510–517. https://doi.org/10.4039/Ent89510-11

Yu DS, Van Achterberg C, Horstmann K (2016) Taxapad 2016. Ichneumonoidea 2015 (Biological and taxonomical information), Taxapad Interactive Catalogue Database on flash-drive. Nepean, Ottawa. http://www.taxapad.com

Zwölfer H (1962) Observations on the parasites of *Hydroecia micacea* Esp. and *H. petasitis* Dbl. Commonwealth Institiute of Biological Control Technical Bulletin 2: 101–158.

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PENSOFT

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Distribution of a residual population of the Dytiscid *Graphoderus bilineatus* (de Geer, 1774) in the Grande Cariçaie nature reserves, Switzerland

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Abstract

Currently, the distribution of diving beetles in Switzerland is poorly known making it difficult to determine conservation priorities for species with small and/or declining populations. In order to establish conservation priorities, in 2018, we surveyed diving beetles of the genus *Graphoderus* in the Grande Cariçaie reserves with special consideration for the Red Listed *G. bilineatus*. While *G. bilineatus* and *G. cinereus* showed high habitat niche overlap, the distribution of *G. bilineatus* was limited to mainly one of the eight reserves. When comparing our results to available historical data, the habitat of *G. bilineatus* has likely diminished during the last 40 years. Our study provides the first comprehensive documentation of the distribution of *Graphoderus* species in the Grande Cariçaie. We further highlight the importance for improving the knowledge of *G. bilineatus* distribution in Switzerland to develop policy for conservation of this globally threatened species.

Introduction

Out of the 13 Dytiscid species of the genus *Graphoderus* (Holmgren et al. 2016), four species (*G. bilineatus*; Figure 1), *G. cinereus* (Linnaeus, 1758), *G. zonatus* (Hoppe, 1795) and *G. austriacus* (Sturm, 1834)) can be found in Switzerland (Carron 2005). All four species are threatened locally in many regions of their global distribution range (e.g. Hendrich and Müller 2017); *G. bilineatus* is of particular concern. Even though the species shows a wide distribution and is encountered in most European countries, it is rare, and its distribution is very fragmented. *G. bilineatus* is declining, particularly in the western range of its distribution (Holmen 1993), and is considered extinct in several countries i.e., Belgium (Scheers 2015) and the United Kingdom (Foster 1996). The IUCN Red List (Foster 1996) indexed it as "vulnerable" and the species is now protected in most European countries, following the Appendix II of the Bern Convention (Council of Europe 1979). In Switzerland, *G. bilineatus* was first listed as vulnerable in the former Red List of endangered animal species established in 1994 (Duelli et al. 1994). Nevertheless, as the family of Dytiscids has since not been studied for an updated Red list, *G. bilineatus'* status is now unclear. As a consequence, the species does not stand on the national priority species list (OFEV 2011).

G. bilineatus is known from several locations in Switzerland, but of the available data, only two locations refer to observations made after 2000 (Info fauna - CSCF). Several observations (of at least five individuals) were made near Wetzikon, in the canton of Zürich in 2008 and 2009 (Carron 2009, Info fauna - CSCF) while all other observations are restricted to the Grande Cariçaie nature reserves. It is to be noted that the country's museum collections have not yet been completely inventoried regarding Dytiscids, resulting in a possibility of additional observations. In 1973 and 1974, Brancucci (1979; 1980) undertook a diving beetle inventory in the Motte reserve, one of the eight reserves comprising the Grande Cariçaie. His study revealed

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Figure 1. *Graphoderus bilineatus*. Copyright: Yerpo [CC BY-SA 4.0 (https://creativecommons.org/licenses/by-sa/4.0)], from Wikimedia Commons.

densely localised populations of *G. bilineatus* and *G. cinereus*. *G. bilineatus* is currently the only aquatic insect listed as priority species in the reserves, where it was rediscovered in 2001. Since then, the species has been observed irregularly in the reserves. In order to estimate the current distribution of the population of *G. bilineatus* we sampled the southern shore of Lake Neuchâtel. We thereafter compared the beetle's distribution with historical data to evaluate population trajectory. Finally, we compared *G. bilineatus*' distribution and habitat niche with those of *G. cinereus* to understand how these two species might cohabitate.

Materials and methods

Study site

The study took place in the Grande Cariçaie marshland nature reserves, Switzerland (Figure 2). The Grande Cariçaie is composed of eight reserves (2,300 hectares), spread across 40 km along the south eastern shore of Lake Neuchâtel. It is the largest lakeside marshland of the country and hosts a considerable amount of national and European priority species. The marshland arose following the first Jura water correction in 1870s, which aimed to better regulate the Aar river and reduce the risk of flooding in the surrounding areas. Following these corrections, the large marshland lowlands of the Seeland region (deep depression area at the foot of the Jura mountain chain, in which lie the lakes of Neuchâtel, Biel and Morat) dried out. The water level of Lake Neuchâtel decreased by about three meters, revealing a large portion of the lake floor on which today's marshland is found. The resulting wetland thus played the role of reservoir for many species that depend on these particular habitats. Given the level of the lake has since been artificially regulated, the Grande Cariçaie marshland is not subject to strong natural dynamics of floods and droughts, resulting in a natural succession to scrub and woodland of the area. Since the end of the 1970s, the area is under constant management for its preservation.

Sampling

In 2018, nine habitat types were sampled (Table 1) and stations (each ~50 m^2) were selected following a stratified purposeful design. 101 stations were designated along the southern shore of Lake Neuchâtel and sampled between May 7th and July 3rd, corresponding to part of the main estimated reproduction period (highest activity) of the priority species *G. bilineatus* (Brancucci 1980). In order to facilitate sampling, the stations were clustered into units of four to six geographically close stations, which were visited on the same day. We sampled the station clusters in a randomised order. The low number of sampling stations in the reserve of Grèves de la Corbière et de Chevroux (Figure 1) is due to the limited number of favourable habitats for diving beetles present in the area, which is mainly composed of forest and reed beds (*Phragmites australis*; (Cav) Trin. ex Steud., 1841).

For each station, the following measures were taken: mean depth of the water in a radius of two meters around each trap, percentage of helophyte cover, percentage of hydrophyte cover, presence/pseudo-absence of fish as well as presence/pseudo-absence of fish fry. The latter two were assessed opportunistically through sightings during the installation and retrieval of the traps, accidental captures and existing knowledge of Antoine Gander. All stations were located in open areas without shading.

We sampled the beetles by the means of two complementary methods (Hilsenhoff and Tracy 1985), using baited bottle-traps and macrofauna nets. The bottle-traps were built from 1.5 L PET bottles of which the top was cut off and replaced in the bottle upside down, creating a funnel (entry surface ~100 cm^2). Inside each bottle, we placed fresh pork liver as bait for the beetles (Kalnins 2006, Koese and Cuppen 2006). Each trap was attached to a stick, which was pegged in the soil to maintain it near the surface of the water. This ensured that the opening was kept under water and the bottle contained enough air for the beetles to breathe. This sampling method was proved to be efficient for capturing large to medium sized species from the family Dytiscidae, or Hydrophilidae beetles (Hilsenhoff 1987, Kalnins 2006, Koese and Cuppen 2006). Six bottles were placed in each sampling site, distributed in different microhabitats (e.g. open water, different vegetation types) on site

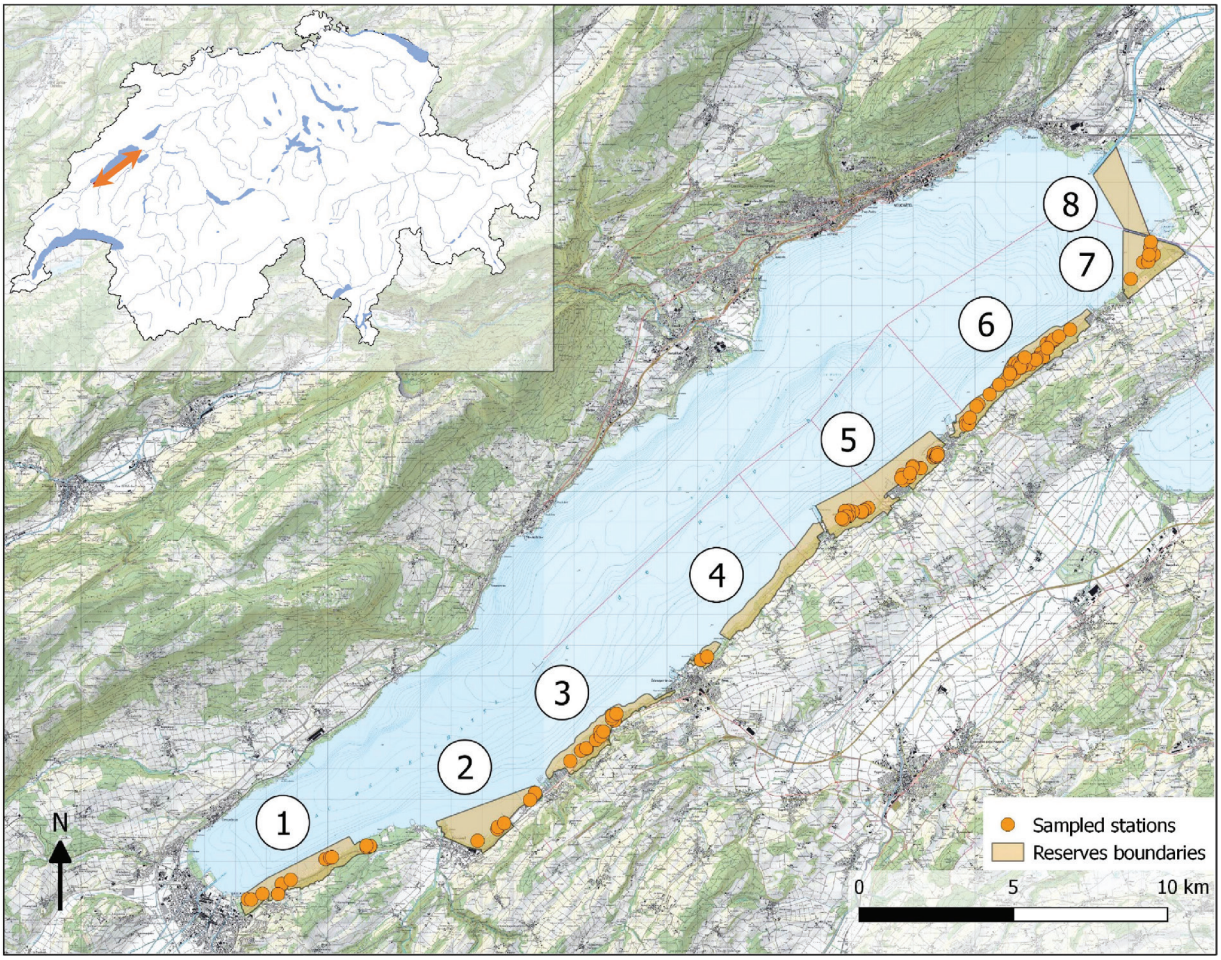


Figure 2. Location of the sampling stations in the Grande Cariçaie nature reserves, on the south eastern shore of Lake Neuchâtel. We sampled seven reserves in 2018 (delimited in brown polygons): 1) Grèves de Cheseaux, 2) Baie d'Yvonand, 3) Cheyres, 4) Grèves de la Corbière et de Chevroux, 5) Grèves d'Ostende et de Chevroux, 6) Grèves de la Motte and 7) Cudrefin. The orange points represent the sampled stations (N = 101 stations). Background picture obtained from the Swiss Federal Office of Topography swisstopo.

Table 1. *Graphoderus* sp. captures per habitat type in 2018. N° st. = number of stations of the given habitat type in which the species was captured. N° ind. = number of individuals captured in a given habitat and percentage of the total amount of individuals of that species captured in the corresponding habitat. Habitat types are ordered from the most permanently flooded habitat to the driest, with reed bed soil stripping referring to reed beds where ~30cm of the organic layer was removed as to recreated flooded areas and meadow referring to non-permanently flooded wet meadows.

Habitat type	*G. bilineatus*		*G. cinereus*		*G. zonatus*	
	N° st.	N° ind.	N° st.	N° ind.	N° st.	N° ind.
Pond	4	6 (38%)	8	23 (25%)	1	1 (25%)
Reed bed soil stripping	0	0	7	18 (19%)	0	0
Reed bed	0	0	1	6 (6%)	0	0
Rut	1	1 (6%)	2	5 (5%)	0	0
Carex elata (Koch 1926) meadow	0	0	8	21 (22%)	0	0
Cladium mariscus ((L.) Pohl, 1809) and *C. elata* meadow	1	2 (12.5%)	3	6 (6%)	0	0
C.mariscus meadow	0	0	1	1 (1%)	0	0
C. mariscus and *Carex panicea* (L., 1753) meadow	1	2 (12.5%)	1	1 (1%)	0	0
Schoenus nigricans (L., 1753) meadow	3	5 (31%)	6	14 (15%)	2	3 (75%)
TOTAL	10	16	37	94	3	4

and left overnight (~20 hours). When recovering the traps, we sorted the adult specimens in order to release all those of the genus *Graphoderus*, after having determined the species and sex of each individual. Collection and identification of beetles in the field was done by Antoine Gander, Aline Knoblauch and Khalil Outemzabet. Individuals for which identification was not certain were collected and identified in the lab with the help of a ste-

reo microscope. Identification of these specimens was later confirmed by Albertine Roulet. Specimens will be stored at the Cantonal Museum of Zoology in Lausanne. Two individuals of *G. bilineatus* and *G. zonatus* as well as three individuals of *G. cinereus* are kept in the collection of the Association de la Grande Cariçaie as reference specimens.

Given the monitoring was part of a larger inventory project, each station was equally sampled with a standard macrofauna net to capture smaller species as well as species that would not react to bait found in the bottle-traps (Hilsenhoff 1987, Koese and Cuppen 2006). We emptied the material caught in the net in a white tray in which we did the sorting. We performed a minimum of five short net swipes (duration ≈ 5 seconds, area ≈ 1m^2 per net swipe), while aiming at different microhabitats. As long as new diving beetle morph types were recognized, we continued sampling (for further details see Carron 1999; Carron et al. 2007).

Collection of historic data

Additionally, we collected historic observations from 1936 (one site south east of the Grèves de Cheseaux reserve), 1948 (one site at the same location as 1936 and one site between the Baie d'Yvonand and Cheyres reserves), 1949 (one site, same location as 1936 and 1948), 1974 (Brancucci 1979; 1980), 2001 (one site in the Motte reserve), and 2014 from the AGC data bank.

In 2014, 41 stations lying in the Motte and the Grèves d'Ostende et de Chevroux reserves were sampled using bottle traps only, between May 27th and June 20th. *G. bilineatus* was captured in four stations lying in the Motte reserve (seven beetles; Figure 3) and in three stations lying in the Grèves d'Ostende et de Chevroux reserve (nine beetles). In the same year, 49 *G. cinereus* were captured in 14 stations lying in the Motte reserve (38 beetles) and in seven stations lying in the Grèves d'Ostende et de Chevroux reserve (17 beetles). Three *G. zonatus* were captured in one station of the Motte reserve.



Figure 3. Stations in which *Graphoderus bilineatus* was captured in the Motte reserve in 2014 (green) and in 2018 (yellow). The dotted lines represent the reserve boundaries and the grey points the sampled stations (2018) in which no *Graphoderus bilineatus* were captured. Background picture obtained from the Swiss Federal Office of Topography swisstopo.

Data analysis

All analyses were conducted in R version 3.3.1 (R Core Team 2018). We used the unpaired two-sided Wilcoxon test to compare the medians of the three habitat measurements (depth, helophyte and hydrophyte cover) between the stations where *G. bilineatus* and *G. cinereus* were captured and where the species were not captured. We performed a principal component analysis (PCA) to compare the niches of *G. bilineatus* and *G. cinereus* regarding depth, helophyte and hydrophyte cover of the habitats. For the analysis of niche breadth and niche overlap, we used the R package spaa (Zhang 2016). Both analyses were computed based on the proportion of *Graphoderus* beetles captured in the nine sampled habitat types (Table 1). Niche breadth was calculated using Levin's measure of niche breadth (Levins 1968) and standardized to express the values on a scale going from 0 (no resources used in common) to 1 (complete overlap) (Hurlbert 1978).

Results

Out of the 101 stations sampled, specimens of the genus *Graphoderus* were captured in 41 of them (41% of the stations; Figure 4). Among these stations, *G. bilineatus* and *G. cinereus* were captured simultaneously in only six stations, while *G. zonatus* was once captured with both other *Graphoderus* species and twice with *G. cinereus* only. *Graphoderus* sp. were present in the following reserves: Cudrefin, Motte, Grève d'Ostende et de Chevroux, Grève de la Corbière et de Chevroux, Cheyres, and Grèves de Cheseaux. We did not capture any individuals of the genus *Graphoderus* using macrofauna nets.

Graphoderus bilineatus

Fifteen *G. bilineatus* (5 males and 10 females) were captured between May 17th and June 19th in 10 out of the 101 sampled stations (10%). A maximum of three individuals were captured together in one station. The population seems to be concentrated in the Motte reserve (11 specimens; presence in 19% of the 42 sampled stations; Figures 2, 4a) and in the Grèves d'Ostende et de Chevroux reserves (4 specimens, present in 7% of the 29 sampled stations; Figure 4b). The species was captured in various habitat types listed in Table 1. Median depth of the stations in which *G. bilineatus* was captured was 25 cm, median helophyte cover – 58%, and median hydrophyte cover – 3%. The medians of these three measures did not differ significantly from those of stations in which the species was not detected (two-sided Wilcoxon test, W_{depth} = 412.5, p-value$_{depth}$ = 0.529, $W_{helophyte\ cover}$ = 347.5, p-value$_{helophyte\ cover}$ = 0.223, $W_{hydrophyte\ cover}$ = 422.5, p-value$_{hydrophyte\ cover}$ = 0.709). Presence of fish were recorded for only one station in which *G. bilineatus* was detected and no fry were recorded.

Graphoderus cinereus

Ninety-four *G. cinereus* were captured in 37 stations (37% of all sampled stations), of which 26 males, 66 females and 2 of unidentified sex (28%, 70%, 2% respectively). They were trapped between May 7th and July 2nd. Most of the individuals were captured in the Grèves d'Ostende et de Chevroux reserve (61%; Figure 4b), some in the Motte reserve (28%; Figure 4a), and a few in the Grèves de la Corbière et de Chevroux (4%), Cudrefin (3%), Cheyres (2%) and Grèves de Cheseaux (2%) reserves. The various habitats in which *G. cinereus* were captured are listed in Table 1. Median depth of the stations in which *G. cinereus* was captured was 21 cm, median helophyte cover – 75%, median hydrophyte cover – 1%, and median for both fish and fry presence – 0. The medians of these measures did not differ significantly from those of stations in which the species was not detected (two-sided Wilcoxon test, W_{depth} =1107, p-value$_{depth}$ = 0.37, $W_{helophyte\ cover}$ = 1232.5, p-value$_{helophyte\ cover}$ = 0.735, $W_{hydrophyte\ cover}$ = 1181.5, p-value$_{hydrophyte}$ cover = 0.989, W_{fish} = 1299, p-value$_{fish}$ = 0.322), except for the presence of fry. *G. cinereus* was significantly more found in stations in which no fry had been detected (W_{fry} = 1009, p-value$_{fry}$ = 0.033). Measures from stations in which *G. cinereus* was found did not significantly differ from those of stations in which *G. bilineatus* was captured (W_{depth} =196.5, p-value$_{depth}$ = 0.774, $W_{helophyte\ cover}$ = 236, p-value$_{helophyte\ cover}$ = 0.188, $W_{hydrophyte\ cover}$ = 199.5, p-value$_{hydrophyte}$ cover = 0.709).

Graphoderus zonatus

Four *G. zonatus* were captured in three stations (3% of all sampled stations), of which three males and one female, between May 17th and May 30th. One specimen was captured in the Grèves de Cheseaux reserve and three were captured in the Motte reserve. The habitat types in which *G. zonatus* was captured are listed in Table 1. The measurements of the three stations in which the species was captured were, respectively, as following: helophyte cover 60%; 50%; 90%, hydrophyte cover 0%; 3%; 0% and depth 15 cm; 40 cm; 24 cm. Given the low number of individuals captured, we did not include the species in further analysis.

Niche analyses

The PCA results did not reveal a clear clustering between *G. bilineatus* and *G. cinereus*, which largely overlap (Table 2, Figure 5). The first principal component (PC1), explain-

Table 2. Factor loadings of the three principal components (PC) based on habitat measures for *G. bilineatus* and *G. cinereus*. The highest loadings for each component are in bold.

Measurement	PC1	PC2	PC3
Helophyte cover	0.556	**-0.790**	-0.256
Hydrophyte cover	**-0.598**	-0.168	**0.783**
Depth	-0.576	-0.589	-0.566
Standard deviation	1.328	0.816	0.754
Proportion of variance	0.588	0.222	0.190
Cumulative variance	0.588	0.810	1

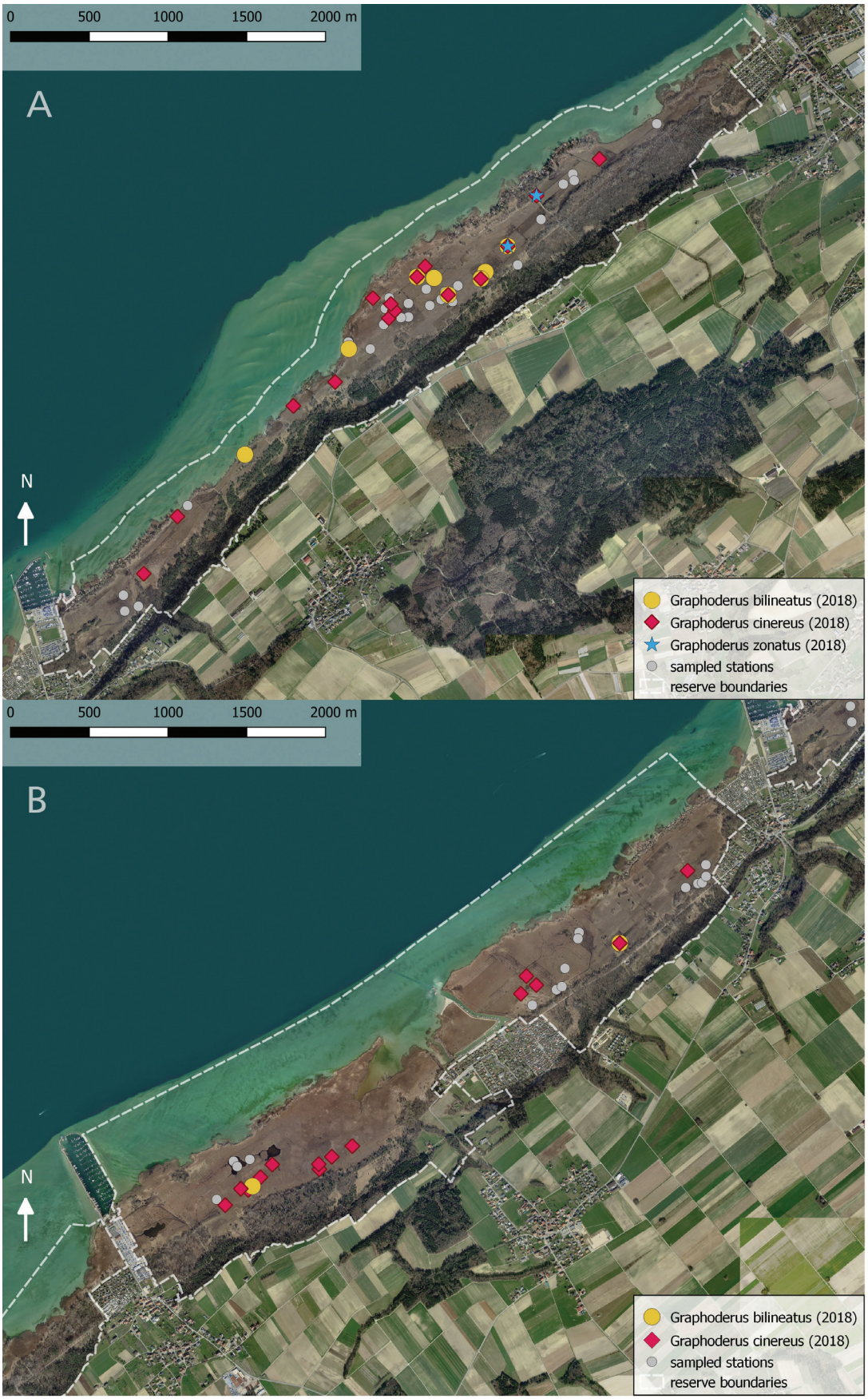


Figure 4. Stations in which *Graphoderus bilineatus* (yellow), *G. cinereus* (red) and *G. zonatus* (blue) were captured: A) in the Motte reserve and B) in the Ostende reserve in 2018. The dotted lines represent the reserve boundaries and the grey points the sampled stations in which no *Graphoderus* were captured. Background picture obtained from the Swiss Federal Office of Topography swisstopo.

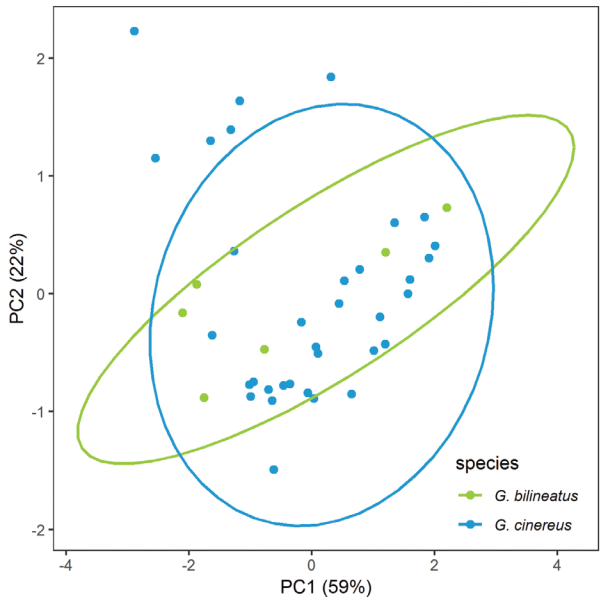


Figure 5. Principal component (PC) for habitat depth, helophyte cover and hydrophyte cover for *G. bilineatus* (green) and *G. cinereus* (blue). The first principal component (PC1) explains 59% of the variance. The first two components (PC1 and PC2) explain 81% of the total variance. While factor loads of habitat depth, helophyte cover and hydrophyte cover for PC1 are similar, helophyte cover and depth strongly negatively influence PC2. Circles represent 95% probability ellipses.

ing 59% of total variance, was negatively correlated with depth and hydrophyte cover, while being positively correlated with helophyte cover. PC2, explaining 22% of total variance, was negatively correlated with helophyte cover as well as with depth and hydrophyte cover. The third PC, explaining 19% of the variance, was positively correlated with hydrophyte cover. The standardized niche breadths (NB) indicate that *G. cinereus* has a wider habitat niche than *G. bilineatus* ($NB_{G.\ cinereus} = 0.511$, $NB_{G.\ bilineatus} = 0.292$). Niche overlap between both species is high ($O = 0.68$).

Discussion

Within the Grande Cariçaie, the main pool of *G. bilineatus* seems to be limited to the Motte reserve. Historical data suggests there might have been small populations in the south western part of the lake's shore, even though misidentification cannot be excluded. While we captured 11 *G. bilineatus*, 26 *G. cinereus* and 4 *G. zonatus* in the Motte reserve, Brancucci (1979, 1980) in his inventory of the same reserve mentions high densities of *G. bilineatus* in the sampled area, with 174 individuals captured from mid-March to mid-August 1974 (Brancucci 1978). The same goes for *G. cinereus* with 162 captured individuals, while no *G. zonatus* were captured. Brancucci (1980) classifies both *G. bilineatus* and *G. cinereus* as frequent and abundant in ponds. Given the protocols between Brancucci's study and ours are different, it is not possible to estimate population trajectory during the last 40 years. Indeed, Brancucci's study consisted of continuous trapping throughout the whole sampling period, in five ponds (area 200–500 m^2). In each of the studied ponds he set ten baited cage traps (five of surface entry = 225 cm^2 and five of surface entry = 100 cm^2), which were emptied every third day.

Since Brancucci's study (1979, 1980), the natural maturation of the habitat led to siltation of several water bodies or humid areas – among which the ponds he sampled. The reduction or disappearance of these areas could impact the already very localised populations of *Graphoderus*. Vegetation succession and biocenotic evolution are indeed mentioned as one of the principal threats or pressures to *G. bilineatus* in the report on the species drawn from the European Environment Agency 2007–2012 (EIONET 2012). In response to the loss of waterbodies, soil stripping – the action of removing the organic layer over approximatively 30 centimetres – might be considered to maintain favourable habitats for the beetle by restoring flooded areas. However, in some areas of the Motte reserve, this solution raises management conflicts for the conservation of another priority species as diggings could also favour the expansion of the invasive *Pelophylax* (Fitzinger, 1843) frogs, which supposedly compete with the protected Green tree frog *Hyla arborea* (Linnaeus, 1758). The Motte reserve is the only reserve from the Grande Cariçaie to be almost free of the *Pelophylax* frogs (Leuenberger 2013). Therefore, it should be avoided to support their expansion by creation of new water bodies in those areas. Invasive alien species are another threat stated in EIONET (2012) which should be monitored in the Grande Cariçaie in the future. The decimation of 98% of the diving beetle species by the Louisiana crawfish *Procambarus clarkii* (Girard, 1852) in the Perges marsh in France, including that of *G. bilineatus* (Bameul 2013), perfectly illustrates the importance of regular control and surveillance of exotic species for rare species conservation. Finally, dispersal of fish, potential predators of *Graphoderus* beetles, from Lake Neuchâtel to ponds that are or might become linked to the lake will be monitored in the near future.

G. bilineatus and *G. cinereus* supposedly share the same diet (Deding 1988, Cuppen et al. 2006) and phenology (Brancucci 1980), but otherwise little is known about their ecology. Both species were described as sedentary through a mark-recapture study by Brancucci (1980), in which they also shared a similar spatial distribution, and do not show significant differences in flight ability (Iversen et al. 2017). Our results reveal a segregation of *G. bilineatus* and *G. cinereus* in the adjacent Motte and Grèves d'Ostende et de Chevroux reserves. Both species supposedly share similar needs in terms of habitat types (high niche overlap) and measures (depth, helophyte and hydrophyte cover, Figure 5) and show comparable dispersal abilities (Iversen et al. 2017). Two hypotheses might explain this difference in distribution: (1) a level of competition for an ecological niche between both species, highlighted by the rarefication of vital habitats, *G.*

cinereus being more successful than *G. bilineatus*, or possibly (2) a difference in sensitivity to habitat reduction. *G. bilineatus* might have shared *G. cinereus*' habitats in both reserves at some point but being more sensitive to habitat loss its population shrank at a faster pace than that of *G. cinereus*. In our study, *G. bilineatus* indeed showed a narrower habitat niche than *G. cinereus*. However, our knowledge on *Graphoderus* ecology needs to be developed in order to make further assumptions.

Iversen et al. (2013) investigated the wide geographical distribution of *G. bilineatus* in Sweden, Estonia and Poland, linked to its low dispersal ability. The authors suggest that specificity of habitat characteristics is not vital for the species, which shows a wider ecological niche than previously thought - also illustrated by the large variety of habitats in which the species was captured in the Grande Cariçaie. The presence of the species rather depends on landscape connectivity, distance to a possible source habitat as well as stability of the site (Iversen et al. 2013). Given the low dispersal ability of *G. bilineatus* (Brancucci 1980, Iversen et al. 2017), the species is likely to depend on the availability of dispersal corridors to widen its distribution. It would then, as suggested by Iversen et al. (2013), be wise to concentrate conservation efforts not only on creating and maintaining favourable habitats, but also towards the problematics of landscape structure, through linear dispersal corridors, which showed greater success than stepping stones.

Switzerland nowadays probably lies on the south-eastern limit of *G. bilineatus*' distribution range (EIONET 2012) and shows very fragmented wetland habitats due to intensification of agriculture and high demographic density. Since 1950, about 90% of wetland areas have disappeared (Klaus 2007). This results in all wetland habitats being classified as vulnerable (Delarze et al. 2016). In Switzerland, given the low habitat connectivity on a large scale, priority lies in preserving and reinforcing local populations of *G. bilineatus*. In the Grande Cariçaie, connectivity between reserves is interrupted by the presence of villages or towns on the shore of the lake. Furthermore, the Motte reserve differentiates from the others by a higher amount of permanently flooded zones of little depth (e.g. flooded meadows). Interestingly, recent records (after 2000) of *G. bilineatus* originate from the same locations as some of another rare priority invertebrate species, *Nehalennia speciosa* (Charpentier, 1840; Odonata): the Motte reserve and Wetzikon (Gander 2010; Info fauna - CSCF). The similar localised distribution of both species in the Grande Cariçaie can eventually support the idea of the Motte reserve differing from the rest of the Grande Cariçaie regarding habitat suitability for the two species. This hypothesis is additionally supported by the localised presence of the rare *G. zonatus* (Carron 2005) in the same reserve. Hence, further investigations would need to be done in order to appreciate the suitability of other reserves' habitats for *G. bilineatus* and understand how dispersal can be encouraged.

A national inventory combined with inventories of museum collections could be used to describe the largely under-studied Dytiscidae fauna in Switzerland (Carron 2005). A thorough knowledge of *G. bilineatus'* distribution is essential to establish an appropriate conservation management plan for the beetle. Given the ecological niche of the species is relatively wide and the central pool of its distribution lies at higher latitudes (i.e. Sweden, Latvia; EIONET 2012), prospection should not disregard mountainous areas. As of today, the closest known location where the species is established lies in the French Jura, at 850 m of altitude, 40 km away from our study site (Lambert 2017). The *G. bilineatus* population of the Grande Cariçaie is possibly one of the last residual pool from the ancestral Seeland population and the above mentioned factors need to be considered for the preservation of the population.

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References

Bameul F (2013) Disparition de *Graphoderus bilineatus* (Degeer, 1774) (Coleoptera, Dytiscidae) des marais de la Perge causée par l'Ecrevisse américaine à pattes rouges. Bulletin de la Société entomologique de France 118: 133–136.

Brancucci M (1978) Méthodes de capture de Coléoptères aquatiques. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 28: 7–12.

Brancucci M (1979) Considérations sur la faune des Dytiscidae de la grève de Cudrefin (VD) (Insecta: Coleoptera). Bulletin de la Société Vaudoise des Sciences Naturelles 74: 301–311.

Brancucci M (1980) Observations sur l'écologie des Dytiscides dans les points d'eau de la rive sud du lac de Neuchâtel (Coleoptera: Dytiscidae). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 53: 365–378.

Carron G (1999) Les Coléoptères aquatiques de quelques étangs d'Ajoie (Commune de Bonfol, JU). Bulletin romand d'entomologie 17: 127–146.

Carron G (2005) Kommentierte Checkliste der Dytiscidae und Noteridae (Coleoptera) der Schweiz. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 55: 1–17.

Carron G (2009) Les coléoptères aquatiques des marais du lac de Pfäffikon (canton de Zürich), avec première mention pour la Suisse

de *Hydroporus scalesianus* Stephens, 1828 et recommandations pour la conservation. Entomo Helvetica 2: 239–253.

Carron G, Paillex A, Castella E (2007) Les coléoptères aquatiques de la zone alluviale du Rhône à Belley (France: Ain, Savoie): inventaire et observations préliminaires sur les effets des mesures de restauration. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 80: 191–210.

Council of Europe (1979) 104 European Treaty Series. The Bern Convention on the Conservation of European Wildlife and Natural Habitats, 24 pp. https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/104

Cuppen J, Koese B, Sierdsema H (2006) Distribution and habitat of *Graphoderus bilineatus* in the Netherlands (Coleoptera: Dytiscidae). Nederlandse faunistische mededelingen 2006: 29–40.

Deding J (1988) Gut content analysis of diving beetles (Coleoptera; Dytiscidae). Natura Jutlandica II: 177–184.

Delarze R, Eggenberg S, Steiger P, Bergamini A, Fivaz F, Gonseth Y, Guntern J, Hofer G, Sager L, Stucki P (2016) Liste rouge des milieux de Suisse. Abrégé actualisé du rapport technique 2013 sur mandat de l'Office fédéral de l'environnement (OFEV). Berne, 33pp. https://www.infoflora.ch/fr/milieux/liste-rouge.html

Duelli P, et al. (1994) Listes rouges des espèces animales menacées en Suisse. Office fédéral de l'environnement, des forêts et du paysage, Berne. https://www.bafu.admin.ch/bafu/fr/home/themes/biodiversite/publications/publications-biodiversite/listes-rouges-especes-animales-menacees-suisse.html

EIONET (2012) *Graphoderus bilineatus*. European Environment Agency, 1–9. https://bd.eionet.europa.eu/article17/reports2012/species/summary/?group=Arthropods&period=3&subject=Graphoderus+bilineatus

Foster G (1996) *Graphoderus bilineatus*. The IUCN Red List of Threatened Species 1996 e.T9494A12995416. https://doi.org/10.2305/IUCN.UK.1996.RLTS.T9494A12995416.en [September 27, 2018]

Gander A (2010) *Nehalennia speciosa* (Charpentier, 1840) dans la Grande Cariçaie: une population singulière d'importance internationale (Odonata: Coenagrionidae). Entomo Helvetica 3: 189–203.

Hilsenhoff WL (1987) Effectiveness of Bottle Traps for Collecting Dytiscidae (Coleoptera). The Coleopterists Bulletin 41: 377–380.

Hilsenhoff WL, Tracy BH (1985) Techniques for Collecting Water Beetles from Lentic Habitats. Proceedings of the Academy of Natural Sciences of Philadelphia 137(1): 8–11. www.jstor.org/stable/4064875

Holmgren S, Angus R, Jia F, Chen Z, Bergsten J (2016) Resolving the taxonomic conundrum in Graphoderus of the east Palearctic with a key to all species (Coleoptera, Dytiscidae). Zookeys 574: 113–142. https://doi.org/10.3897/zookeys.574.7002

Holmen M (1993) Fredede insekter i Danmark. Del 3: Biller knyttet til vand. Entomologiske meddelelser 66: 117–134.

Hurlbert SH (1978) The Measurement of Niche Overlap and Some Relatives. Ecology 59: 67–77. https://doi.org/10.2307/1936632

Info fauna – Centre Suisse de Cartographie de la Faune (CSCF), distribution des espèces. https://lepus.unine.ch/carto/ [September 26, 2018]

Iversen LL, Rannap R, Briggs L, Sand-Jensen K (2017) Time-restricted flight ability influences dispersal and colonization rates in a group of freshwater beetles. Ecology and Evolution 7: 824–830. https://doi.org/10.1002/ece3.2680

Iversen LL, Rannap R, Thomsen PF, Kielgast J, Sand-Jensen K (2013) How do low dispersal species establish large range sizes? The case of the water beetle *Graphoderus bilineatus*. Ecography 36: 770–777. https://doi.org/10.1111/j.1600-0587.2013.00001.x

Kalnins M (2006) Protected Aquatic Insects of Latvia – *Graphoderus bilineatus* (De Geer, 1774) (Coleoptera: Dytiscidae). Latvijas entomologs 43: 132–137.

Klaus G (2007) État et évolution des marais en Suisse. Résultats du suivi de la protection des marais. Office fédéral de l'environnement, Berne État de l'environnement n° 0730: 97.

Koese B, Cuppen J (2006) Sampling methods for *Graphoderus bilineatus* (Coleoptera: Dytiscidae). Nederlandse Faunistische Mededelingen 24: 42–47.

Lambert J-L (2017) Localisation de la population de *Graphoderus bilineatus* en Franche-Comté, bilan des connaissances fin 2017. Agence Française pour la Biodiversité, service départemental du Doubs, 14pp.

Leuenberger J (2013) Monitoring the invasion of the marsh frog (*Pelophylax ridibundus*) within the population of native water frogs in the natural reserve of the Grande Cariçaie using genetic tools. Master thesis. Université de Lausannne. https://www.unine.ch/files/live/sites/karch/files/Doc_a_telecharger/Diplomarbeiten/Masterthesis_Julien%20Leuenberger_2013.pdf

Levins R (1968) Evolution in changing environments. Princeton University Press. Princeton, N.J., 120 pp.

OFEV (2011) Liste des espèces prioritaires au niveau national. Espèces prioritaires pour la conservation au niveau national, état 2010. Office fédéral de l'environnement, OFEV, Berne, 132 pp. https://www.bafu.admin.ch/bafu/fr/home/themes/biodiversite/publications/publications-biodiversite/liste-especes-prioritaires-nationales.html

R Core Team (2018) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/

Scheers K (2015) *Dytiscus latissimus* Linnaeus, 1758 and *Graphoderus bilineatus* (Degeer, 1774) in Belgium: a detailed account of the known records (Coleoptera: Dytiscidae). Bulletin de la Société royale belge d'Entomologie 151: 34–39.

Zhang J (2016) Spaa: SPecies Association Analysis. https://cran.r-project.org/web/packages/spaa/spaa.pdf

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PENSOFT

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Revision der *Nematopogon adansoniella*-Artengruppe mit Beschreibung einer neuen Art aus den Bergregionen Süditaliens (Lepidoptera, Adelidae)

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Zusammenfassung

Das ursprünglich aus den Südwestalpen beschriebene Taxon *Nematopogon adansoniella* (de Villers, 1789) wird neu bewertet. Auf Grund von DNA-Barcodeuntersuchungen sowie morphologischen Merkmalen wird *Nematopogon prolai* Hartig, 1941 aus dem Apennin (Mittelitalien) als eigenständige Art anerkannt und ein Lectotypus wird festgelegt. Als weitere, kryptische Art wird *Nematopogon garganellus* **sp. nov.** vom Monte Gargano (Puglia) und aus der Basilicata (Süditalien) neu beschrieben. Die morphologischen und genitalmorphologischen Unterscheidungsmerkmale der drei Arten werden aufgezeigt und, soweit bekannt, Angaben zu Verbreitung, Lebensraum und Bionomie gemacht.

Abstract

The taxon *Nematopogon adansoniella* (de Villers, 1789), originally described from the south-western Alps, is re-evaluated. Based on DNA barcode examinations and morphological characters *Nematopogon prolai* Hartig, 1941 from the Apennines (central Italy) is recognized as a separate species and a lectotype is designated. Another cryptic species is *Nematopogon garganellus* **sp. nov.** from Monte Gargano (Puglia) and from Basilicata (southern Italy). Diagnostic morphological characters of the three species are outlined and, as far as known, information on distribution, habitat and bionomy is added.

Einleitung

Im Rahmen einer Forschungsarbeit über die Adelidae Europas wurde im April 2016 auch das für seine spezielle Flora und Fauna bekannte Gebiet des Monte Gargano, Apulien (Italien) untersucht. Dabei wurde bei Tag- und Lichtfang eine Serie von Faltern gesammelt, welche auf Grund ihrer hell und dunkel geringelten Fühler vorerst als die ursprünglich aus den Südwestalpen beschriebene *Nematopogon adansoniella* (de Villers, 1789) determiniert wurden. Die nachfolgende DNA-Barcode-Untersuchung zeigte dann aber eine genetische Differenz zu *N. adansoniella*. Ein weiteres zu prüfendes Taxon war daher die von Hartig (1941) als ssp. *prolai* von *Nematopogon pilella* (Denis & Schiffermüller, 1775) beschriebenen Unterart aus Mittelitalien (Apennin, Latium, Abruzzen). Der Status dieser Adelidae schwankte je nach Autor zwischen eigenständiger Art *Nematopogon prolai* Hartig, bis hin zu einem Synonym von *N. pilella* oder *N. adansoniella*. Es galt also zu klären, welchen Status das Taxon «*prolai*» tatsächlich hat und ob die «Gargano-Tiere» dasselbe oder etwas Drittes sind. In die Überprüfung mit einbezogen wurden auch die verfügbaren genetischen Daten der anderen europäischen Vertreter der Gattung *Nematopogon*.

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Material und Methoden

Belegtiere aus folgenden Sammlungen wurden untersucht:

NHMK	Kärntner Landesmuseum, Klagenfurt, Österreich.
TLMF	Sammlung des Tiroler Landesmuseums, Hall in Tirol, Österreich.
ZMUC	Zoological Museum, University of Copenhagen, Dänemark.
ZSM	Zoologische Staatssammlung München, Deutschland.
cCZ	Privatsammlung Christof Zeller, Thalgau, Österreich.
cRB	Privatsammlung Rudolf Bryner, Biel/Bienne, Schweiz.
cWS	Privatsammlung Willibald Schmitz, Bergisch Gladbach, Deutschland.

Für die Fotografien kamen unterschiedliche Aufnahmetechniken zur Anwendung: Die Falterpräparate wurden mit einer Canon Spiegelreflexkamera und dem Makro-Objektiv MP-E 65 mm bei diffusem Tageslicht mit Hilfe eines Stativs und längeren Belichtungszeiten fotografiert. Die Fotos der Genitalpräparate wurden unter dem Mikroskop Leica DME in der Technik der manuellen Schichtfotografie hergestellt und anschliessend mit dem Programm HELIKON FOCUS 4.80 zusammengerechnet. Die meisten Fotografien wurden abschliessend mit dem Bildbearbeitungsprogramm ADOBE PHOTOSHOP ELEMENTS 9 nachbearbeitet. Sofern keine anderen Angaben gemacht werden, stammen die Aufnahmen vom Erstautor.

Die Genitalpräparation (GP) erfolgte durch Mazeration mit 10%iger Kalilauge (KOH) und Dehydrierung in der Alkoholreihe (Robinson 1976 und Nielsen 1980). Die Flachpräparate wurden in Alkohol unter einem Deckglas fotografiert und anschliessend in Euparal eingebettet.

Insgesamt wurden 160 Sequenzen europäischer *Nematopogon* mit >500 bp ausgewertet, 60 davon entstammen originärem Material, 100 aus unterschiedlichen öffentlich verfügbaren sowie wenigen privaten Quellen in BOLD, insbesondere der ZSM München.

Gewebeproben (Bein- oder Teil eines Beines) der vorselektierten Exemplare wurden in Well Plates à 95 Proben überführt und an das Canadian Center for DNA Barcoding (CCDB, University of Guelph, Ontario, Kanada) versendet. Die DNA Isolation, PCR Amplifikation sowie die anschließenden Sequenzierung erfolgten am CCDB nach den bei deWaard et al. (2008) beschriebenen Standardprotokollen. Mit Hilfe dieser Methoden wurde eine 658 Basenpaare umfassende Region der mitochondrialen Cytochrom C Oxidase I (COI, Barcodefragment 5) isoliert und vervielfältigt.

Objektspezifische Informationen einschliesslich der vollständigen geographischen Daten der Belege samt Fotos und zugehöriger Sequenzen finden sich im öffentlichen Dataset Lepidoptera – Nematopogon [DS-LEPINEMA] in der Datenbank BOLD (Barcode of Life Data Systems www.boldsystems.org; Ratnasingham und Hebert 2007).

Intra- und interspezifische Distanzen wurden mit dem Kimura2-Parameter-Modell (K2P) mit Hilfe der Analyse Tools von BOLD v.4 berechnet. Der abgebildete Neighbor-Joining Tree basiert ebenfalls auf dem K2P-Berechnungsmodell und wurden mit dem Programm MEGA 6 (Tamura et al. 2013) graphisch umgesetzt.

Untersuchungsraum

Der Monte Gargano (Puglia) ist der Typenfundort der hier neu beschriebenen Adelidae-Art *Nematopogon garganellus* sp. nov. Die Halbinsel Gargano ragt als «Sporn» am Stiefelabsatz der Halbinsel Italien in die Adria, besteht aus Apenninenkalk und wird vom Bergrücken des Monte Gargano gebildet. Dieser erreicht mit dem Monte Calvo eine Höhe von 1065 Metern. Weite Teile des Gebietes liegen im Parco nazionale del Gargano und stehen unter Naturschutz. Begünstigt durch ein spezielles Klima mit häufiger Nebelbildung an den Berghängen gedeiht in den höheren Lagen ein eindrücklicher Laubwald aus Buchen, Eichen und Ahorn: die Foresta Umbra. Die Kernzone ist selbst für Wanderer völlig gesperrt. Der Berg ist berühmt für seine grosse Zahl an endemischen Arten. Hier werden die letzten Garganischen Rehe vor dem Aussterben bewahrt. Besonders eindrücklich ist die Flora; so können im Gargano beispielsweise 60% der europäischen Orchideenarten angetroffen werden. Zum Zeitpunkt des Aufenthalts im Gebiet in der ersten Aprilwoche 2016 sind die Buchenwälder auf Höhen über 700–800 Metern noch nicht belaubt. Adelidae fliegen in diesen Höhen noch keine. Die untersuchten Bereiche beschränken sich daher auf die unteren Höhenlagen zwischen 114–650 Metern, liegen im südöstlichen Teil der Halbinsel innerhalb eines Dreiecks San Giovanni Rotondo – Mattinata – Vieste und befinden sich alle ausserhalb der geschützten Bereiche.

Material der weiteren untersuchten Arten stammt aus unterschiedlichen Gebirgsregionen des südlichen Europas, aus den Alpen und dem Jura.

Resultate

Die taxonomische Neubewertung dieser Studie beschränkt sich auf Arten des *Nematopogon adansoniella*-Komplexes.

Nematopogon Zeller, 1839
Nematopogon adansoniella (de Villers, 1789)
Nematopogon prolai (Hartig, 1941)
Nematopogon garganellus sp. nov.

DNA Barcoding

Die 12 untersuchten Arten weisen intraspezifische Distanzen zwischen min. 0% und max. 3.12% auf, bei einem Durchschnittswert von 0.51%. Eine Barcode-Gap Analyse zeigt innerhalb der Gattung mittlere Distanzen zum jeweils nächsten Nachbarn von 4.98% bei einem Maximum von 8.52% und einem Minimum von 0%

Tabelle 1. Intra- und interspezifische Distanzen europäischer *Nematopogon*-Arten (Quelle: BOLD).

Taxon	Mean Intra-Sp	Max Intra-Sp	Nearest Species	Distance NN
Nematopogon adansoniella	0.12	0.31	*Nematopogon garganellus*	3.95
Nematopogon argentellus	0	0	*Nematopogon swammerdamella*	5.6
Nematopogon caliginella	N/A	0	*Nematopogon pilella*	0
Nematopogon magna	0.09	0.37	*Nematopogon pilella*	7.72
Nematopogon metaxella	0.11	0.62	*Nematopogon pilella*	7.43
Nematopogon pilella	0.46	1.13	*Nematopogon caliginella*	0
Nematopogon prolai	0.2	0.32	*Nematopogon garganellus*	1.34
Nematopogon robertella	1.69	3.12	*Nematopogon pilella*	7.81
Nematopogon schwarziellus	0.39	1.87	*Nematopogon metaxella*	7.61
Nematopogon sericinellus	0.1	0.15	*Nematopogon schwarziellus*	8.52
Nematopogon garganellus	0.07	0.15	*Nematopogon prolai*	1.34
Nematopogon stenochlora	0.1	0.15	*Nematopogon pilella*	7.79
Nematopogon swammerdamella	0.33	2.18	*Nematopogon argentellus*	5.6

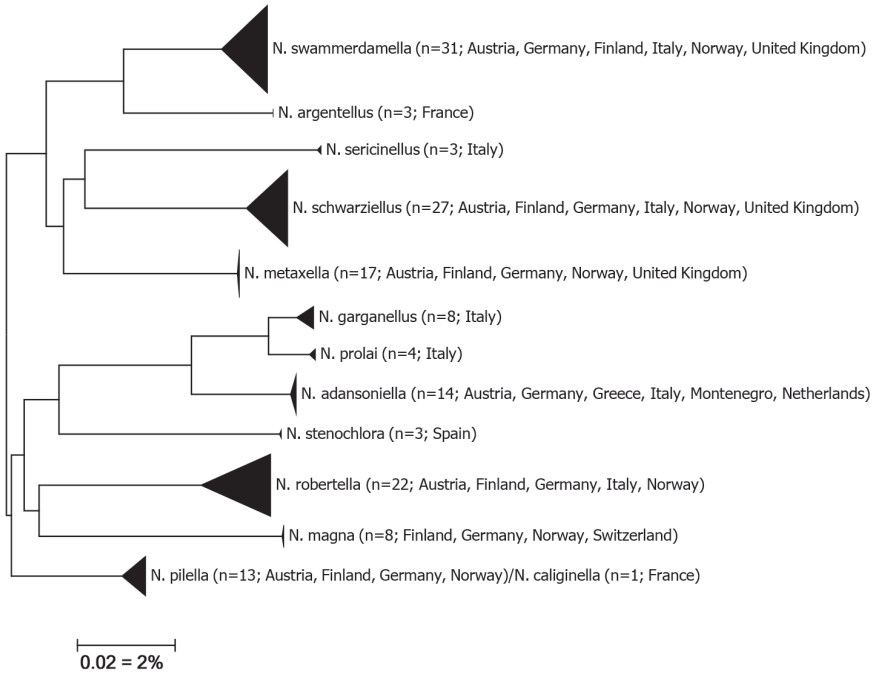


Abbildung 1. Neighbour Joining Tree der Gattung *Nematopogon* (Kimura 2 Parameter, produziert mit MEGA 6; cf. Tamura et al. 2013), basierend auf Barcodesequenzen > 500 bp. Die Breite der Dreiecke repräsentiert den Stichprobenumfang, die Tiefe die genetische Variation innerhalb des Clusters. Quelle: DNA-Barcodesequenzen aus BOLD (Barcode of Life Database, cf. Ratnasingham und Hebert 2007).

(Tab. 1). Letzteres betrifft allerdings das umstrittene Artenpaar *N. pilella* und *N. caliginella* Varenne & Nel, 2018 und deutet auf eine Konspezifität beider Taxa (Bryner in Vorbereitung). Alle Arten mit Ausnahme der beiden zuletzt genannten sowie des Artenpaares *N. prolai* und der hier beschriebenen *N. garganellus* lassen sich einer Barcode Index Nummer (BIN) zuordnen (siehe Ratnasingham und Hebert 2013), lediglich die intraspezifisch besonders variable *N. robertella* (Clerck, 1759) (Abb. 1) weist zwei BINs auf und sollte daher jedenfalls auf potentielle kryptische Diversität geprüft werden.

N. garganellus ist somit vermutlich die einzige europäische *Nematopogon*-Art, die ihren BIN mit einer anderen Art, nämlich *N. prolai*, teilt. Allerdings clustern beide Arten bei einer durchschnittlichen genetischen Distanz im Barcode von 1.34% deutlich separat, was in Kombination mit der unterschiedlichen Morphologie einen Artstatus unterstützt (Abb. 1).

Der *Nematopogon-adansoniella*-Komplex

Ein äusseres Merkmal der drei nahe verwandten Arten des *Nematopogon-adansoniella*-Komplexes sind die hell und dunkel geringelten Fühler (Abb. 2). Die übrigen *Nematopogon*-Arten besitzen einfarbig weissliche bis graue Fühler, die höchstens auf der Unterseite fein dunkel punktiert sind. Eine Ausnahme bildet *Nematopogon magna* (Zeller, 1878). Bei dieser Art treten gelegentlich ebenfalls Exemplare mit mehr oder weniger deutlich grau-weiss geringelten Fühlern auf. Die Färbung der Vorderflügel und der Thoraxbehaarung ist bei *N. magna* jedoch düster graubraun. In den männlichen und weiblichen Genitalien bestehen zudem deutliche Unterschiede zu jenen des *Nematopogon-adansoniella*-Komplexes.

Nematopogon adansoniella (de Villers, 1789)

Phalaena Tinea adansoniella de Villers 1789: 527
Typenfundort: EUROPA. Verwahrungsort unbekannt.
Tinea panzerella Fabricius, 1794
Lectotypus ♂: ITALY (Allioni*). Zoological Museum, University of Copenhagen, ZMUC (Abb. 3).
Nemophora sabulosella Walker, 1863
Holotypus ♂: PALAEARCTIC REGION. British Museum, Natural History, London, BMNH.
Nemophora annulatella Ragonot, 1876
Lectotypus ♀: FRANKREICH: environs de Paris. Muséum national d'histoire naturelle, Paris, MNHN.
Nemophora pseudopilella Peyerimhoff, 1877
Typenfundort: FRANKREICH: Provence, Hyères et Cannes, iv. [genauere Datumsangabe fehlt]. Verwahrungsort unbekannt.
Angaben gemäss Nielsen 1985:34f.

Für diese Publikation speziell untersuchtes Material.

2♂♂, 1♀: Schweiz, Bern, Biel-Vingelz, 600 m, 47°08'01"N, 7°13'09"E, 07.05.2015. Davon 1 ♂: GP 2016-099 (cRB).

1♂, 2♀♀: Schweiz, Bern, La Neuveville, 780 m, 47°04'33"N, 7°05'19"E, 17.05.2017 (cRB).

1♂: Schweiz, Bern, Sigriswil, Justistal, 1250 m, 46°43'16"N, 7°46'38"E, 26.05.2018 (cRB).

1♂: Schweiz, Bern, Twann, 490 m, 47°05'38"N, 7°09'07"E, 21.04.1990 (cRB).

1♂: Schweiz, Bern, Twann, 500 m, 47°05'53"N, 7°09'37"E, 23.04.1990, GP 2013-179 (cRB).

1♀: Schweiz, Bern Twann, 600 m, 47°06'11"N, 7°10'07"E, 30.04.2012, GP 2016-102 (cRB).

1♂: Schweiz, Bern, Walperswil, 445 m, 47°03'09"N, 7°12'32"E, 25.09.2014, e.l. 18.03.2015 (cRB).

2♂♂: Schweiz, Graubünden, Ilanz, 710 m, 46°46'01"N, 9°12'31"E, 12.05.2018. Davon 1 ♂: GP 2018-030 (cRB).

2♀♀: Schweiz, Neuchâtel, Cornaux, 490 m, 47°01'36"N, 7°00'15"E, 16.05.1985, GP 2016-103 + 2016-108 (cRB).

1♂: Schweiz, Neuchâtel, Cornaux, 600 m, 47°01'36"N, 6°59'53"E, 17.04.2017 (cRB).

1♀: Schweiz, Neuchâtel, Cressier, 550 m, 47°03'14"N, 7°01'59"E, 18.04.1990, GP 2016-166 (cRB).

1♂, 2♀: Schweiz, Neuchâtel, Cressier, 670 m, 47°02'57"N, 7°00'53"E, 12.05.2015. Davon 1 ♂: GP 2016-098 (cRB).

1♂: Schweiz, Neuchâtel, Le Landeron, 620 m, 47°04'05"N, 7°03'55"E, 19.05.1985, GP 1992-007 (cRB).

1♂: Schweiz, Solothurn, Burgäschi, 465 m, 47°10'19"N, 7°40'19"E, 10.05.2014, GP 2014-131 (cRB).

2♀♀: Italien, Trieste, Basovizza, Draga S. Elia, 350 m, 45°37'12"N, 13°53'22"E, 05.-06.05.2017, leg. R. Bryner & M. Fluri. – DNA Barcode TLMF Lep 23895 (cRB) + TLMF Lep 23896 (TLMF).

1♂: Montenegro, Bar, Sutormann Pass (S), 750 m, 42°08'47"N, 19°06'00"E, 22.04.2018. – DNA Barcode TLMF Lep 25890 (cRB).

2♀♀: Griechenland, Meteora, 800 m, 10.04.2016, leg. J. Viehmann. – DNA Barcode TLMF Lep 22475 (GP 2016-127) und TLMF Lep 22476 (cWS).

Diagnose. Flügelspannweite: ♂ 16.5–20 mm, Durchschnitt 18.0 (n=16); ♀ 15–18 mm, Durchschnitt 16.1 (n=11).

Kopfbehaarung abstehend, orange- bis ockergelb. Stirnbehaarung anliegend, kräftig goldgelb. Fühlerbasis verdickt, gelblich. Fühler fadenförmig, beim ♂ rund 2.5mal, beim ♀ 2mal länger als die Vorderflügel; im inneren Drittel kräftig dunkelgrau oder schwarz und weiss geringelt, Ringelung distal undeutlicher hellgrau und weiss. Rückenplatte glänzend goldbraun beschuppt, Tegulae kaum dunkler.

Vorderflügeloberseite: die glänzende Grundfärbung der ♂♂ elfenbeinfarbig, jene der ♀ ♀ strohgelb bis goldgelb; die dunkler ockerbraune Aderung und unregelmässig angeordnete, dunklere Querlinien bilden über die ganze Flügelfläche ein kräftig ausgebildetes Gittermuster. Fransen wie die Grundfärbung. Hinterflügeloberseite grau, schwach ockerfarbig getönt, mit perlmuttartigem Glanz. Flügelunterseite zeichnungslos, Vorderflügel braungrau, die Hinterflügel grau.

Hauptunterschiede zu den beiden Nachbararten sind die kräftigere Hell-Dunkel-Ringelung auf der ganzen Länge der Fühler, die markante Gitterzeichnung der Vorderflügel und gegenüber *N. prolai* der insgesamt mehr ockergelb-rötliche Farbton der Körperbehaarung und der Flügel.

Genitalien ♂ (Abb. 8, 10): Valven mit einer ununterbrochenen Kammreihe mit rund 30 Zähnen. Valveninnenrand ohne zusätzliche Zähne. Phallusspitze abgeknickt, mit spitzwinkliger, wimpelförmiger Struktur.

Genitalien ♀ (Abb. 9): Es konnten keine zuverlässigen Unterschiede zu *N. garganellus* festgestellt werden.

DNA Barcodes. BIN BOLD:AAV4673 (n=14). Die intraspezifische Divergenz der Barcode-Region ist mit 0.11% im Mittel und maximal 0.32% sehr gering. Die p-Distanz zum Nächsten Nachbarn *N. garganellus* ist mit 3.85% hingegen wesentlich größer.

Verbreitung und Lebensraum. In Europa von Spanien über Mitteleuropa bis Schweden und Russland sowie in den Balkanstaaten und Nordgriechenland weit verbreitet (Karsholt und Razowski 1996) (s.auch Abb. 12), besonders in warmen Buchen- und Eichenmischwäldern. Eine spezielle Bindung an *Vaccinium* spp., wie dies in der Literatur mehrfach erwähnt wird, lässt sich nicht erkennen. Die Hauptvorkommen liegen auf Höhen unter 1000 m.

Bionomie. Die Flugzeit beginnt im April und erstreckt sich in höheren Lagen bis Anfang Juli. Die ♂♂ schwärmen hauptsächlich bei Tagesanbruch ab etwa einer Stunde vor Sonnenaufgang bis kurz danach. Die ♀ ♀ bohren die Eier in die Stängel verschiedener krautiger Pflanzen. Rund drei Wochen nach der Eiablage schlüpfen die Räupchen

* Carlo Ludovico Allioni (1728–1804) lebte in Turin und war Arzt, Zoologe, Paläontologe und Botaniker. Es ist anzunehmen, dass der Lectotypus von *Tinea panzerella* aus der Umgebung von Turin stammt, wo bisher nur *N. adansoniella* s. str. nachgewiesen worden ist. Der Name „*panzerella*" ist somit für die von *N. adansoniella* abweichenden Taxa aus Mittel- und Süditalien mit grosser Wahrscheinlichkeit nicht verfügbar.



Abbildung 2. Kopf- und Thoraxbehaarung sowie Fühleransatz: *Nematopogon adansoniella*, *N. prolai* und *N. garganellus*.



Abbildung 3. *Tinea panzerella* Fabricius, 1794. **A.** Lectotypus, ohne Abdomen (Foto: Anders Illum, The Natural History Museum of Copenhagen). **B.** Etiketten (Foto: Ole Karsholt, ZMUC).

und lassen sich sogleich zu Boden fallen, wo sie ihre Gehäuse aus Segmenten von vertrocknetem Falllaub bauen und sich von Detritus ernähren. Die Entwicklung dauert ein bis zwei Jahre, die letzte Überwinterung erfolgt im Puppenstadium (Beobachtungen des Erstautors).

Nematopogon prolai (Hartig, 1941)

Nemophora pilella F. [sic!] ssp. *prolai* Hartig 1941: 162.
Syntypen: ITALIEN, Abruzzi, Monti Simbruini, Monte Aurore, 3 ♂♂, 1 ♀, 300 m, 15.v.1938; 6 ♂♂, 1500 m, 12.vi.1893, (Hartig); W. of Roma, Tivoli, 1 ♂, 13.iv. (Dannehl) (not found), (Nielsen 1985:25).

Nemophora castellanii (in litt. Nielsen 1985:25, Fussnote):
"Since this paper went to press the type-series of *prolai* Hartig has been made available to me. It appears that *prolai* represents an additional species of *Nematopogon* closely related to *adansoniella*. *N. prolai*, stat. nov., is only known from central Italy. *N. castellanii* is a manuscript name intended for *prolai*. A separate note on this finding is being prepared and will appear in *Ent. scand.*".

Untersuchtes Material. Lectotypus [hier festgelegt]. ♂: "Cotypus ♂ | *Nemophora* | v. *castellanii*" – "*Nemophora* | *pilella* | *Prolai* Htg. ♂" – "Marano Laz.| Acqua Marcia | 300 m, 15.V.38 | Hartig legit" – "Lectotypus *Nemophora pilella prolai* Hartig Design. Bryner & Huemer, 2019"; DNA Barcode ZSM Lep 103181 (ZSM).

Paralectotypus. 1♂: "Italia central | Tivoli (Roma) | 25.IV.1927 | coll. Dannehl" – "Mti. Sabini" – "coll. Osthelder" – "25.4."; GP 2016-152 (ZSM).

Weiteres Material. 1 ♂: "Italia, Abruzzo, Gran | Sasso, Campo Imperatore, | Vado di Sole, 1680 m | 42°23,719'N, 13°47,203'E ± 50 m | 1680m ± 20m | 2017.05.26 09.00h ± 30min. | leg. Zeller Christof " – "BOLD 2018 | KLM Lep 12292 | leg. Dr. C. Wieser | Kärntner Landesmuseum" – "ID-Nummer | CZ-Z47268 | www.nkis.info" (KLM).

1♂: "Italia, Abruzzo, Gran | Sasso, Campo Imperatore, | Rifugio Montecristo, 1200 m | 42°24,346'N, 13°32,903'E ± 20 m | 1200m ± 20m | 2017.05.26 11.00h ± 30min. | leg. Zeller Christof " – "DNA Barcode | TLMF Lep 26994" – "ID-Nummer | CZ-Z47275 | www.nkis.info" – GP 2018-040 (cCZ).

1♀: "Italia, Abruzzo, Gran | Sasso, Campo Imperatore, | Rifugio Montecristo, 1200 m | 42°24,346'N, 13°32,903'E ± 20 m | 1200m ± 20m | 2017.05.26 11.00h ± 30min. | leg. Zeller Christof " – "DNA Barcode | TLMF Lep 26995"– "ID-Nummer | CZ-Z47272 | www.nkis.info" – GP 2018-041 (cCZ).

Fotobeleg (Falter- und Genitalpräparat, www.nkis.info, Michael Kurz):

1♂: Italien, "Marche, Ascoli Piceno, Monti Sibillini, Forca Canapine, 1500 m, 1993.05.19 – Observer: Thalgauer Entomologen-Gesellschaft" (coll. Michael Kurz).

[Anmerkung: Das in der Bestimmungshilfe des Lepiforums (siehe "Internetquellen")unter der "Diagnose" von *Nematopogon adansoniella* abgebildete Präparat eines Männchens aus der Sammlung Klimesch, ZSM, Foto Michel Kettner, hält der Erstautor ebenfalls für *Nematopogon prolai*. Angegebene Funddaten: "Italia Lucania | Vulture Val d›O- | fanto 2-10 5 1966 | J. Klimesch".]

Das Taxon *prolai* Hartig ist lange Zeit umstritten gewesen. Nielsen (1985:25) führt *N. pilella* ssp. *prolai* als Synonym von *N. pilella* auf. In einer Fussnote kündigt er allerdings eine spezielle Publikation zu *N. prolai* stat. nov. an, da er zwischenzeitlich zur Überzeugung gelangte, dass *N. prolai* eine eigene, *N. adansoniella* nahestehende Art sein muss (siehe oben). Diese angekündigte spezielle Publikation in Entomologica Scandinavica zur Stellung von *N. prolai* ist jedoch nie realisiert worden. Somit bleibt unklar, was Nielsen zu seiner Neueinschätzung veranlasst hat, auch wenn er in der erwähnten Fussnote den Artstatus offiziell festgelegt hat.

In Karsholt et al. (1995:9), in Karsholt und Razowski (1996:29, Nr. 386) und in Fauna Europaea (Internetquelle) erscheint *N. prolai* als eigenständige Art.

Gerstberger (2010:131) ordnet das Taxon nach einem Genitalpräparat aus der Typenserie in coll. Hartig, Universität Rom, eindeutig *N. adansoniella* zu (Cotypus: Hartig leg., Abruzzi 12.6.1938, slide no. 911: Zilli).

Die DNA-Untersuchung eines weiteren Syntypus aus der Zoologischen Staatssammlung München (ZSM) ("Cotypus ♂ | *Nemophora* | v. *castellanii* " – "*Nemophora* | *pilella* | *Prolai* Htg. ♂" – "Marano Laz.| Acqua Marcia | 300 m, 15.V.38 | Hartig legit" – DNA Barcode ZSM Lep 103181) ergibt, dass *N. prolai* mit einer genetischen Distanz von rund 4% zur nahe verwandten *N. adansoniella* mit einiger Wahrscheinlichkeit eine eigene Art darstellt (Segerer A., persönliche Mitteilung).

Diagnose. Flügelspannweite: ♂ 17–19 mm, Durchschnitt 17.8 (n=3); ♀ 16 mm (n=1).

Kopfbehaarung abstehend, fahlgelb. Stirnbehaarung anliegend, heller gelblich. Fühlerbasis verdickt, weisslich. Fühler fadenförmig, beim ♂ rund 2.5mal, beim ♀ 2mal länger als die Vorderflügel; im inneren Drittel grau und weiss geringelt, distal einfarbig weissgrau. Rückenplatte hell ockergelb beschuppt, Tegulae dunkler gelbbraun.

Vorderflügeloberseite bräunlich silbergrau, stark glänzend; im äusseren Drittel bilden die dunkler graue Aderung und unregelmässig angeordnete, feine dunklere Querlinien ein mehr oder weniger deutliches Gittermuster. Fransen von gleicher Farbe oder minimal dunkler als die übrige Flügelfläche. Hinterflügeloberseite wenig heller, mit perlmuttartigem Glanz. Flügelunterseite zeichnungslos grau, die Hinterflügel mit Ausnahme der Costa weisslich aufgehellt.

Hauptunterschiede zu den beiden Nachbararten sind die fahlgelbe Kopfbehaarung und die glänzend graue Flügelfärbung ohne den ockergelben Farbton.

Genitalien ♂ (Abb. 8, 10, 11): Valven mit einer ununterbrochenen Kammreihe mit rund 30 Zähnen. Valveninnenrand im Gegensatz zu den beiden Nachbararten mit einer oder zwei Gruppen zusätzlicher Zähne. Phallusspitze abgeknickt, mit dreieckiger, wimpelförmiger Struktur.

Genitalien ♀ (Abb. 9): Da zur Untersuchung nur ein ♀ zur Verfügung stand, kann keine zuverlässigen Angabe über Unterschiede zu den beiden Nachbararten gemacht werden.

DNA Barcodes. BIN BOLD:ADE0207 (n=4). Die intraspezifische Divergenz der Barcode-Region ist mit 0.2% im Mittel und maximal 0.32% sehr gering. Die p-Distanz zum Nächsten Nachbarn *N. garganellus* ist mit 1.34% zwar nur mäßig groß, jedoch ohne Überlappung und mit einem eindeutigen Barcode-Gap.

Verbreitung. Karsholt et al. (1995:9) bezeichnen *N. prolai* als auf Süditalien beschränkt vorkommenden Endemiten. Die wenigen bisher durch DNA-Barcode sicher als *N. prolai* ermittelten Belege stammen aus Mittelitalien (Latium, Abruzzen, Marken) aus Höhenlagen von 300–1680 m (Abb. 12).

Bionomie. Über die Lebensweise und die Jugendstadien ist nichts bekannt. Gemäss den wenigen verfügbaren Daten erstreckt sich die Flugzeit von Ende April bis Ende Mai.

Anmerkung. Um die Identität der Art zu fixieren und nomenklatorische Stabilität zu gewährleisten wird hier in Anlehnung an Artikel 74 des ICZN (1999) das oben bezeichnete Exemplar der Typenserie als Lectotypus designiert.

Nematopogon garganellus sp. nov.

http://zoobank.org/42E095E2-FB36-4AD0-BFE8-64BD3E296CC2

Untersuchtes Material. Holotypus: ♂ (Abb. 4): Italia, Puglia, Gargano, San Giovanni Rotondo, 600–650 m, 07.04.2016, 41°43'04"N, 15°52'38"E, leg. R. Bryner – Rote Etikette:"Holotypus *Nematopogon garganellus* spec. nov. Bryner & Huemer, 2019"; GP 2016-070 (cRB).

Paratypen: 6♂♂, 1♀: Italia, Puglia, Gargano, Vieste-Mattinata, 400 m, 41°48'33"N, 16°06'35"E, 03.04.2016 , leg. R. Bryner. Davon 3♂♂: DNA Barcode TLMF Lep 20495 (TLMF), TMLF Lep 20496 (GP 2016-073) (cRB) und TLMF Lep 20497 (cRB); 1♀: DNA Barcode TMLF Lep 20498 (cRB).

2♂♂, 1♀: Italia, Puglia, Gargano, Mattinata Baja delle Zagare, 114 m, 41°44'49"N, 16°08'02"E, 04.04.2016, leg. R. Bryner. Davon 1♂: GP 2016-068; 1♀: DNA Barcode TLMF Lep 20501 (cRB).

6♂♂: Italia, Puglia, Gargano, San Giovanni Rotondo, 600–650 m, 41°43'04"N, 15°52'38"E, 07.04.2016, leg.

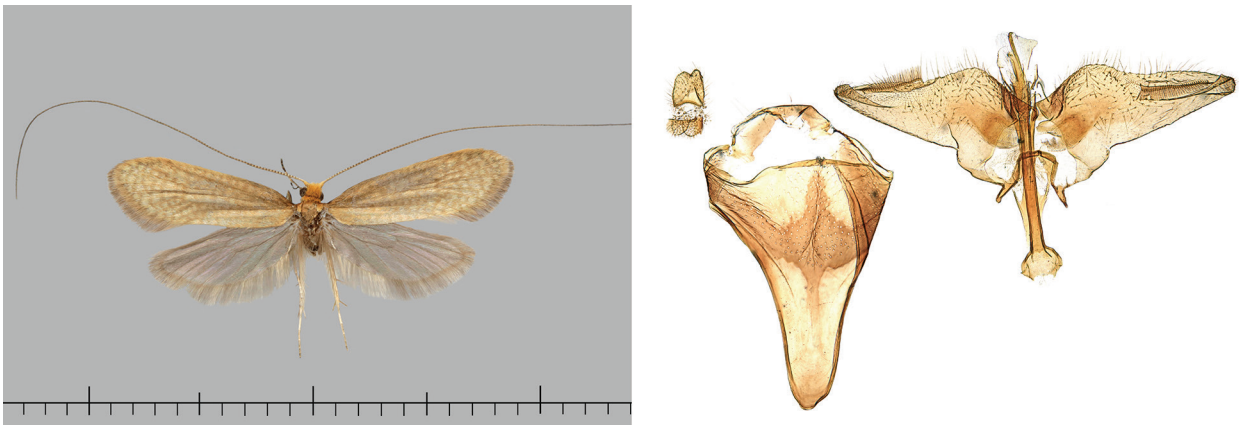


Abbildung 4. *Nematopogon garganellus*. Holotypus. **A.** ♂, Habitus. **B.** ♂, Genitalien. Italien, Puglia, Monte Gargano, San Giovanni Rotondo, 650 m, 7.4.2016, GP 2016-070.



Abbildung 5. *Nematopogon garganellus*, ♂. Italien, Puglia, Monte Gargano, Vieste–Mattinata, 400 m, 3.4.2016.



Abbildung 6. *Nematopogon garganellus*. Typenfundort. Italien, Puglia, Monte Gargano, San Giovanni Rotondo, 650 m, 7.4.2016.

R. Bryner. Davon 1♂: DNA Barcode TLMF Lep 20499 (TLMF); 2♂♂: GP 2016-067 + 2017-096/rbr (cRB).

1♂, 1♀: Italia, Puglia, Gargano, San Giovanni Rotondo, 540 m, 41°42'19"N, 15°51'28"E, 07.04.2016, leg. R. Bryner (cRB).

2♂♂, 1♀: Italia Puglia, Gargano, Vieste-Mattinata, 366 m, 41°49'03"N, 16°06'27"E, 07.04.2016, leg. R. Bryner. Davon 1♂: GP 2016-101 (cRB).

2♂♂, 5♀♀: Italia, Puglia, Gargano, Mte. Sant'Angelo, 567 m, 41°41'11"N, 15°52'55"E, 08.04.2018, leg. R. Bryner. Davon 1 ♂: DNA Barcode TLMF Lep 20500 (TLMF); 1♂: GP 2016-072, und 3♀♀: GP 2016-100, + 2016-104 + 2016-167 (cRB).

1♂: Italia, Puglia, Gargano, San Giovanni Rotondo, 555 m, 41°42'18"N, 15°51'55"E, 08.04.2018, leg. R. Bryner (cRB).

Alle Paratypen sind mit roter Etikette «Paratypus *Nematopogon garganellus* spec. nov. Bryner & Huemer, 2019» versehen.

3 Expl. (Fotobeleg): "Italy, Basilicata, Fme Noce, Aue, nr. Parutta [sic!], 40.0036,15.7983, 110 m, 15-Apr-2018, leg. Axel Hausmann" – DNA Barcode ZSM Lep 102409 (ZSM).

Diagnose. Flügelspannweite: ♂ 17–20 mm, Durchschnitt 18.2 (n=18); ♀ 15–18 mm, Durchschnitt 16.2 (n=13).

Kopfbehaarung abstehend, ockergelb. Stirnbehaarung anliegend, wenig heller goldgelb. Fühlerbasis verdickt, gelblich. Fühler fadenförmig, beim ♂ rund 2.5mal, beim ♀ 2mal länger als die Vorderflügel; im inneren Drittel grau und weiss geringelt, Ringelung distal abnehmend, vor allem bei den ♂♂, Fühlerenden glänzend graubraun. Rückenplatte glänzend ockergelb beschuppt, Tegulae kaum dunkler.

Vorderflügeloberseite: Grundfärbung glänzend strohgelb, bei den ♀♀ mehr goldgelb; die dunklere Gitterzeichnung in der Ausprägung variabel, meistens wenig deutlich bis fast ganz fehlend. Fransen wie die Grundfärbung.

Hinterflügeloberseite gelblichgrau, mit schwachem perlmuttartigem Glanz. Flügelunterseite zeichnungslos, Vorderflügel braungrau, die Hinterflügel grau.

Hauptunterschiede zu *N. adansoniella* sind die auf das innere Fühlerdrittel beschränkte Hell-Dunkel-Ringelung und die schwächer ausgebildete Gitterzeichnung der Vorderflügel. Gegenüber *N. prolai* fällt der deutlich ockergelb-rötliche Farbton von Thorax und Vorderflügeln auf.

Genitalien ♂ (Abb. 4, 8, 10): Valven mit einer ununterbrochenen Kammreihe mit rund 30 Zähnen. Valveninnenrand ohne zusätzliche Zähne. Im Gegensatz zu den beiden Nachbararten ist die Phallusspitze nicht abgeknickt. Die wimpelförmige Struktur der Vesica ist breit dreieckig und nicht spitzwinklig wie bei *N. adansoniella* und *N. prolai.*

Genitalien ♀ (Abb. 9): Es konnten keine zuverlässigen Unterschiede *N. adansoniella* festgestellt werden.

DNA Barcodes. BIN BOLD:ADE0207 (n=8). Die intraspezifische Divergenz der Barcode-Region ist mit 0.22%

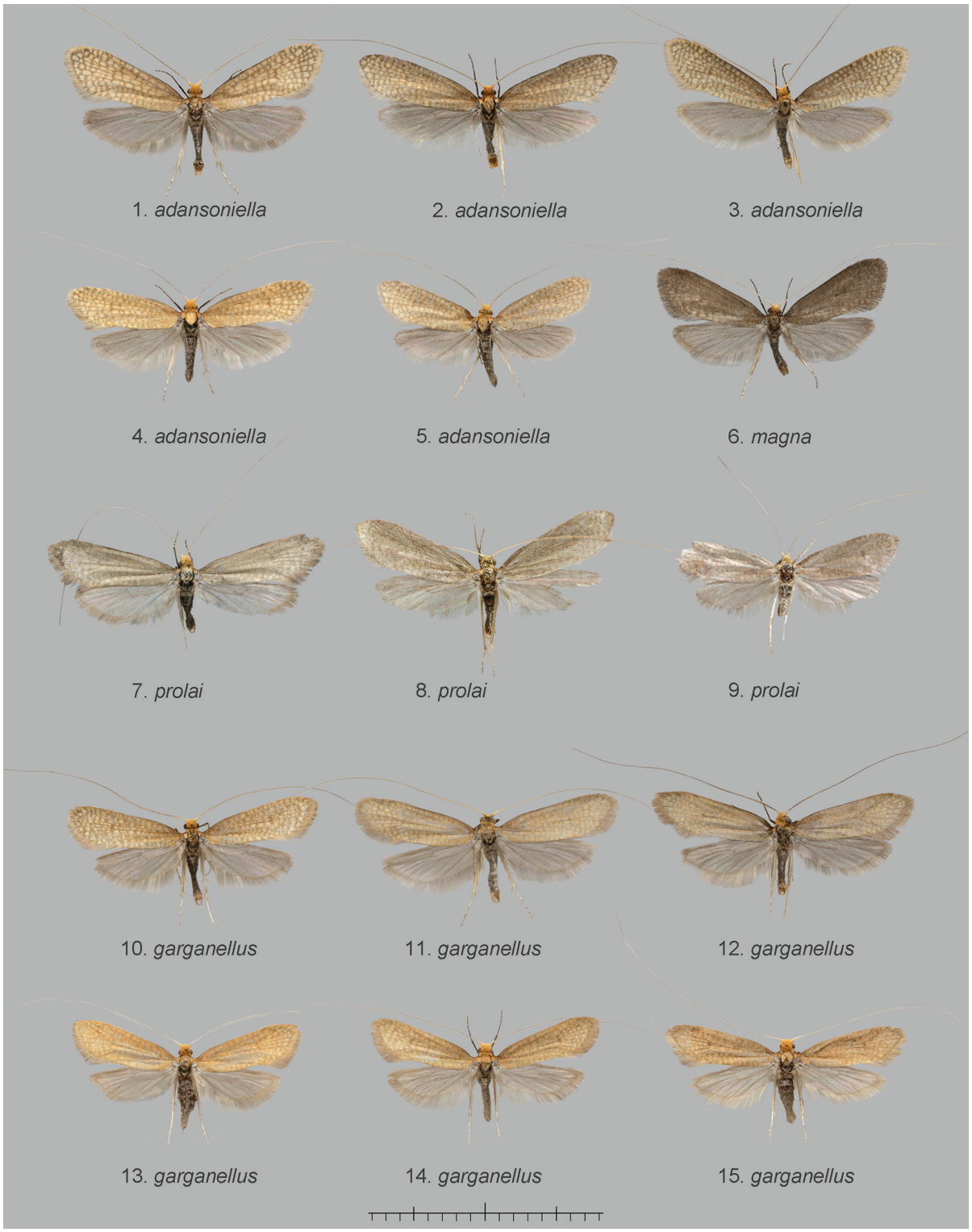
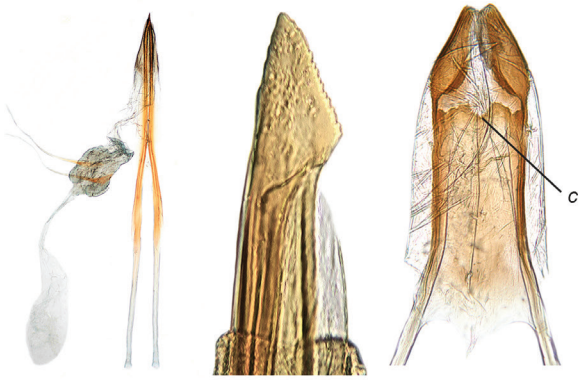


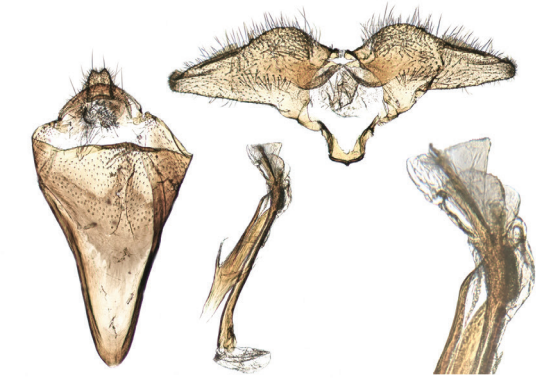
Abbildung 7. Imagines mit hell und dunkel geringelten Fühlern. Arten des *Nematopogon-adansoniella*-Komplexes und *N. magna*. *Nematopogon adansoniella:* **1.** ♂. Schweiz, Bern, La Neuveville, 17.5.2017; **2.** ♂. Schweiz, Graubünden, Ilanz, 12.5.2018; **3.** ♂. Schweiz, Bern, Sigriswil, 26.5.2018; **4.** ♀. Schweiz, Bern, La Neuveville, 17.5.2017; **5.** ♀. Italien, Trieste, Basovizza, 5.5.2017, DNA-Barcode TLMF Lep 23895. *Nematopogon magna:* **6.** ♂. Schweiz, Graubünden, Ilanz, 12.5.2018. *Nematopogon prolai*: **7.** ♂. Italien, Apennino Abruzzese, Gran Sasso, 26.5.2017, DNA-Barcode KLM Lep 12292; **8.** ♂. Italien, Apennino Abruzzese, Gran Sasso, 26.5.2017, DNA-Barcode TLMF Lep 26994; **9.** ♀. Italien, Apennino Abruzzese, Gran Sasso, 26.5.2017, DNA-Barcode TLMF Lep 26995. *Nematopogon garganellus*: **10.** ♂. Italien, Puglia, Monte Gargano, Monte Sant'Angelo, 8.4.2016; **11.** ♂. Italien, Puglia, Monte Gargano, Vieste, 3.4.2016; **12.** ♂. Italien, Puglia, Monte Gargano, Vieste, 3.4.2016, DNA-Barcode TLMF Lep 20496; **13.** ♀. Italien, Puglia, Monte Gargano, Monte Sant'Angelo, 8.4.2016; **14.** ♀. Italien, Puglia, Monte Gargano, Vieste, 7.4.2016; **15.** ♀. Italien, Puglia, Monte Gargano, Mattinata, Baja delle Zagare, 4.4.2016, DNA-Barcode TLMF Lep 20501.



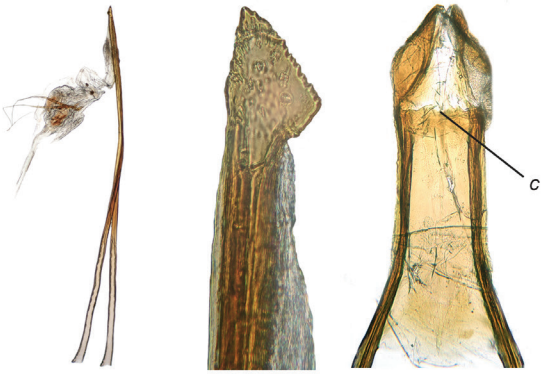
adansoniela



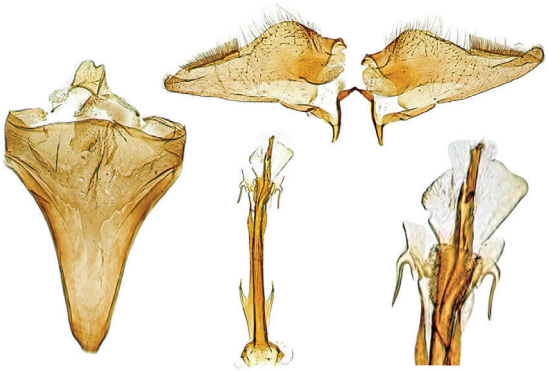
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prolai



prolai



garganellus



garganellus

Abbildung 8. Männliche Genitalien: Uncus-Tegumen-Vinculum-Komplex, Valven, Phallus und Phallusspitze (stark vergrössert).

Abbildung 9. Weibliche Genitalien: Gesamtansicht, Ovipositorspitze lateral (stark vergrössert) und VIII. Segment mit Caudalband (c).

im Mittel und maximal 0.77% gering. Die p-Distanz zum Nächsten Nachbarn *N. prolai* ist mit 1.34% zwar nur mäßig groß, jedoch ohne Überlappung und mit einem eindeutigen Barcode-Gap.

Verbreitung und Lebensraum. Bis jetzt nur aus Italien bekannt: Apulien, Monte Gargano, wo sie mindestens lokal nicht selten ist (Abb. 12). Weitere Exemplare liegen aus der Provinz Basilicata, Parrutta vor (Hausmann, DNA Barcode ZSM 102409, BOLD). Die bisher bekannte Höhenverbreitung erstreckt sich von 110 bis 650 m. Auf der Halbinsel Gargano wurde die Art in lichten Laubwäldern, an besonnten Waldrändern, um Gehölze und Baumgruppen in offenem Gelände und in der Macchia gefunden.

Bionomie. Die Jugendstadien sind unbekannt. Die Falter fliegen bei Tage im Sonnenschein meistens mehr oder weniger gesellig, lassen sich auch leicht aufscheuchen und fliegen nachts zum Licht (Abb. 5, 6). Die bisher bekannten Falterbeobachtungen liegen in der ersten Hälfte des Monats April.

Derivatio nominis. Der Name *garganellus* ist vom Fundort der Art am Monte Gargano, Puglia, Italia, hergeleitet.

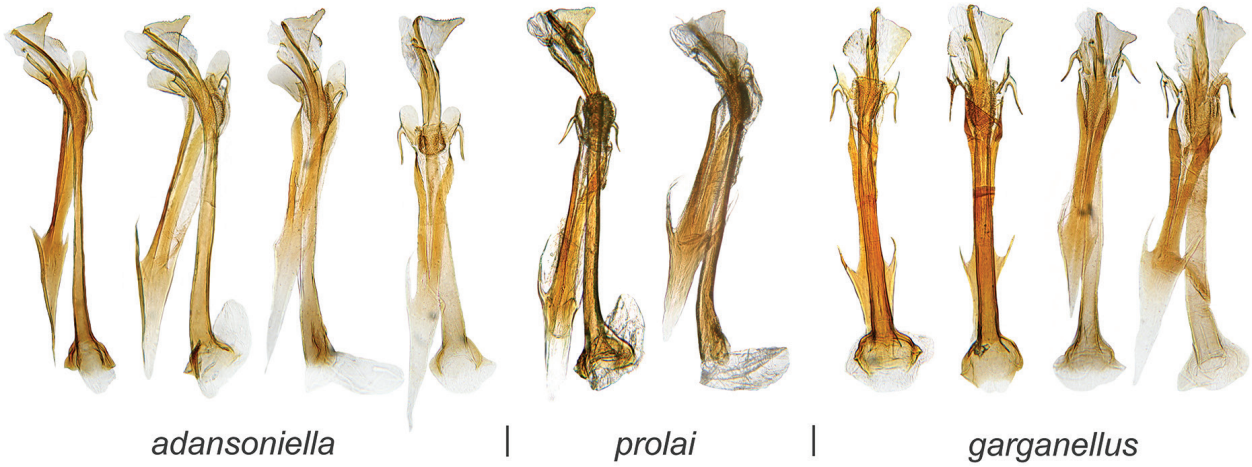


Abbildung 10. Phallus. *Nematopogon adansoniella*, *N. prolai* und *N. garganellus*.



Abbildung 11. Zusätzliche Bedornung der Valven von *Nematopogon prolai*. **A.** Italien, Apennino Abruzzese,, Gran Sasso, 1200 m, 26.5.2017, leg. Zeller (DNA Barcode TLMF Lep 26994, GP 2018-040). **B.** Italien, Tivoli (Roma), Mti. Sabini, 25.6.1927 (GP 2016-152, coll. Dannehl, ZSM).



Abbildung 12. Verbreitungskarte von *Nematopogon adansoniella*, *N. prolai* und *N. garganellus* basierend auf genetisch untersuchten Proben. Kartenproduktion mit SimpleMappr (http://www.simplemappr.net).

Diskussion

Zusammen mit *Nematopogon sericinellus* Zeller, 1847 bilden die beiden hier beschriebenen Arten *N. prolai* und *N. garganellus* eine Gruppe von drei endemischen Arten, welche die Gebirgszüge Mittel- und Süditaliens bewohnen. *N. sericinellus* wird zudem auch auf Sizilien gefunden. Die Verbreitung von *N. prolai* und *N. garganellus* ist jedoch gegenwärtig noch nicht abschliessend geklärt (Abb. 12).

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Literatur

deWaard JR, Ivanova NV, Hajibabaei M, Hebert PDN (2008) Assembling DNA Barcodes: Analytical Protocols. In: Martin Cristofre C (Ed.) Methods in Molecular Biology: Environmental Genomics. Humana Press Inc., Totowa, 364 pp. https://doi.org/10.1007/978-1-59745-548-0_15

de Villers C (1789) Caroli Linnaei entomologia, faunae suecicae descriptionibus aucta; DD. SCOPOLI, GEOFFROY, DE GEER, FABRICII, SCHRANK, &c. speciebus vel in Systemate non enumeratis, vel nuperrime detectis, vel speciebus Galliae Australis locupletata, generum specierumque rariorum iconibus ornata 2: I–XVI, 1–656, pl. IV–VI. Lugdunum [Lyon] (Piestre et Delamolliere).

Evenhuis NL (2019) The insect and spider collections of the world website. [Abruf: 21.3.2012] http://hbs.bishopmuseum.org/codens/

Fabricius JC (1794) Entomologia systematica emandata et aucta, secundum classes, ordines, genera, species, adjectis synonimis, locis, observationibus, descriptionibus, 3(2): 339. [Copenhagen (Hafnia), Impensis Christ. Gottl. Proft]

Fauna Europaea (2018) *Nematopogon prolai*. [Abruf: 9.12.2018] https://fauna-eu.org/cdm_dataportal/search

ICZN (1999) International Code of Zoological Nomenclature. Fourth edition. The International Trust for Zoological Nomenclature, London. http://www.iczn.org/iczn/index.jsp

Gerstberger M (2010) Beitrag zur Kenntnis der Langhornfalter in Europa (Lepidoptera, Adelidae). Entomologische Nachrichten und Berichte 54: 131–132.

Hartig F (1941) Neue Microlepidopteren. Mitteilungen der Münchner Entomologischen Gesellschaft 31: 154–163.

Karsholt O, Razowski J (1996) The Lepidoptera of Europe. A Distributional Checklist. Apollo Books, Stenstrup, 380 pp.

Karsholt O, van Nieukerken E, Whitebread S, Zangheri S (1995) Checklist delle specie della fauna italiana. Lepidoptera Zeugloptera, Dacnonypha, Exoporia, Monotrysia (= Micropterigoidea, Eriocranioidea, Hepialoidea, Nepticuloidea, Incurvarioidea, Tischerioidea). Edizioni Calderini, Bologna: Fasc. 80: 9–10.

Lepiforum (2018) *Nematopogon adansoniella*. [Abruf: 9.12.2018] http://www.lepiforum.de

Naturkundliches Informationssystem, Michael Kurz (2018) *Nematopogon prolai*. [Abruf: 9.12.2018] http://www.nkis.info/nkis/ausidrecnoshow.cgi?uid=CZ&uid2=MK&id=7.193&lang=e

Nielsen ES (1980) A cladistic analysis of the Holarctic genera of adelid moths (Lepidoptera: Incurvarioidea). Entomologica scandinavica 11: 161–178. https://doi.org/10.1163/187631280X00491

Nielsen ES (1985) A taxonomic review of the Adelid genus *Nematopogon* Zeller (Lepidoptera: Incurvarioidea). Entomologica Scandinavica, Supplement 25, 66 pp.

Peyerimhoff H de (1877) Diagnoses de Microlépidoptères nouveaux ou peu connus. Petites Nouvelles Entomologiques 2:102.

Ragonot E-L (1876) Annales de la Société entomologique de France. 1876: LXVI.

Ratnasingham S, Hebert PDN (2007) BOLD: The Barcode of Life Data System. Molecular Ecology Notes 7: 355–364. https://doi.org/10.1111/j.1471-8286.2007.01678.x

Ratnasingham S, Hebert PDN (2013) A DNA-based registry for all animal species: the Barcode Index Number (BIN) system. PLoS ONE 8: e66213. https://doi.org/10.1371/journal.pone.0066213

Robinson GS (1976) The preparation of slides of Lepidoptera genitalia with special reference to the Microlepidoptera. Entomologist's Gazette 27: 127–132.

Tamura K, Stecher G, Peterson D, Filipski A, Kumar S (2013) MEGA6: Molecular Evolutionary Genetics Analysis Version 6.0. Molecular Biology and Evolution 30(12): 2725–2729. https://doi.org/10.1093/molbev/mst197

Walker (1863) List of the Specimens of Lepidopterous Insects in the Collection of the British Museum. List Specimens Lepid. Insects Coll. British Museum 28: 287–562.

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PENSOFT

Alpine Entomology

Nesting in bark – the peculiar life history of the rare boreoalpine osmiine bee *Osmia* (*Melanosmia*) *nigriventris* (Hymenoptera, Megachilidae)

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pollen analysis
X-raying

Abstract

Osmia (*Melanosmia*) *nigriventris* (Zetterstedt) is a predominantly boreoalpine megachilid bee species, whose biology is poorly known due to its pronounced rarity all over Central Europe. The discovery of 19 nests in the Grisons and Valais (Switzerland) allowed for the investigation of its nesting biology and prompted the assessment of the species' host-plant spectrum, phenology and distribution. All nests were in thick bark pieces of *Larix decidua*, which lay in grassy vegetation on sun-exposed ground of open subalpine forests dominated by larch. The nests contained 1–26 brood cells constructed within one to several burrows tunneled out by the female bees with their specialized mandibles, which are distinctly stronger than those of related *O.* (*Melanosmia*) species known to nest in preexisting cavities or loose soil. The linearly arranged brood cells were separated from each other by three-layered partitions consisting of an interlayer of densely packed small bark particles sandwiched between two thin layers of chewed green leaves ("leaf pulp"). DNA metabarcoding of several nest plugs revealed that *Potentilla* (Rosaceae) and *Helianthemum* (Cistaceae) served as source of the leaf pulp. *Anthrax anthrax* (Bombyliidae) and *Sapyga similis* (Sapygidae) parasitized the brood cells of *O. nigriventris* as shown by DNA barcoding of prepupae overwintering in the host's nests. *O. nigriventris* is mesolectic and harvests pollen almost exclusively on Fabaceae (e.g. *Lotus, Hippocrepis*), Ericaceae (*Rhododendron, Vaccinium*) and Cistaceae (*Helianthemum*). Depending on the altitude, *O. nigriventris* emerges from the beginning of May to the first decade of June and thus qualifies as an early flying bee active in spring and early summer similar to the other European *O.* (*Melanosmia*) species. It likely needs two years for its development in the subalpine zone of the Alps and overwinters as prepupa in the first and probably as imago in the second winter. *O. nigriventris* has a Holarctic distribution, its disjunct Palaearctic range encompasses the boreal zone from Scandinavia eastwards to the Russian Far East, the Caucausus, the Alps as well as scattered locations at lower altitudes throughout Central Europe, where it is regarded as a glacial relict and has probably suffered strong declines during the last decades.

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Introduction

The osmiine bees (Megachilidae) are famous for their often spectacular and highly diverse nesting biology (Malyshev 1937, Cane et al. 2007, Cane 2012, Westrich 2018, Müller 2019 and references therein). The majority of species build their brood cells within preexisting cavities, such as insect borings in dead wood, hollow plant stems, rock crevices or empty snail shells. Other species glue their nests freely to a substrate or excavate them in the pith of plant stems or in the ground, occasionally also in dry dung pads. While nesting in self-excavated burrows in pithy stems or in the ground is widespread among osmiine bees and has each independently evolved in several groups (Sedivy et al. 2013), tunneling out nests in wooden substrate seems to be surprisingly rare, which strongly contrasts with the widespread use of dead wood as nesting substrate by the numerous osmiine bees that colonize borings of saproxylic insects. Self-excavation of nests in dead wood is known so far only from the Palaearctic *Osmia* (*Melanosmia*) *pilicornis* Smith, which was recently found to gnaw out its nests in branches lying on the ground (Prosi et al. 2016), and from the Nearctic *O.* (*Melanosmia*) *bucephala* Cresson, which was recorded to tunnel out burrows in a maple tree (Packard 1868). A similar behaviour was also suspected for the Holarctic *O.* (*Melanosmia*) *nigriventris* (Zetterstedt), which was observed to at least partly excavate its nests in wooden substrate (Giraud 1861, Frey-Gessner 1881, Amiet et al. 2004).

In summer 2017, a female of *Osmia leaiana* (Kirby) was observed entering a small piece of bark of larch (*Larix decidua* Mill.) lying on the ground of a subalpine larch forest near Brienz (Grisons, Switzerland). The dissection of the bark piece revealed that the female of *O. leaiana* had built several brood cells within a preexisting burrow, which was part of a larger burrow system excavated by an unknown osmiine bee species probably the year before. The large size of the burrows, which measured about 7 mm in diameter, the composition of remnants of the last year's larval provisions, which consisted of pollen of *Hippocrepis* and *Lotus* (both Fabaceae), and the presence of a dead specimen of the sapygid wasp *Sapyga similis* (Fabricius), which mainly parasitizes *Osmia* species of the subgenus *Melanosmia* (Stoeckhert 1933, Zanden 1982, Westrich 2002, 2018, Amiet 2008), all pointed to *Osmia nigriventris* as the original nest owner. DNA barcoding of a dead larva found in the old part of the bark nest later confirmed this identification (C. Praz and A. Müller, unpublished data). These findings are in line with observations made by Frey-Gessner (1881) and F. Amiet (personal communication), who each discovered a single nest of *O. nigriventris* in a small piece of thick bark of pine (*Pinus sylvestris* L.) lying on the ground, and by Stöckhert (1933), who observed two females of *O. nigriventris* nesting in the thick bark of a pine stump. These anecdotal observations suggest that the construction of nests in self-excavated burrows in bark might be the preferred nesting habit of *O. nigriventris* in Central Europe.

Osmia nigriventris is a predominantly boreoalpine megachilid bee of 10–14 mm length (Figs 26, 27). In Switzerland, it is a rare species restricted to the western and eastern Central Alps, where it inhabits open forests, windfalls and forest edges of the upper montane and subalpine zone between 1200 m a.s.l. and the timber line (SwissBeeTeam 2019). Its biology is only fragmentarily known and has never been the subject of a detailed study. In the present publication, we describe nesting site, nest architecture and nesting behaviour of *O. nigriventris* based on the recent discovery of 19 nests in the Grisons and Valais (Switzerland), identify nest building material and brood parasites by DNA analysis, apply a biomechanical model to assess the female mandibular strength and investigate the species' host-plant spectrum by microscopical analysis of female pollen loads and brood cell provisions. Furthermore, we characterize the phenology of *O. nigriventris* in Central Europe and present a distribution map of the species' entire range.

Materials and Methods

In summer 2017 and fall 2018, six sites in the Swiss Alps, where *O. nigriventris* was known to occur, were searched for its nests, i.e. Brienz/Grisons (46°40'25"N, 9°34'55"E, 1280 m a.s.l.; larch-meadow forest, Fig. 2), Schmitten/Grisons (46°41'30"N, 9°41'50"E, 1300 m a.s.l.; larch-meadow forest, Fig. 3), Curaglia/Grisons (46°39'58"N, 8°50'30"E, 1620 m a.s.l.; windfall, Fig. 5), Pfäfers/St Gallen (46°58'04"N, 9°30'00"E, 1570 m a.s.l.; windfall, Fig. 6), Calfeisen/St Gallen (46°55'27"N, 9°20'43"E, 1580 m a.s.l.; windfall) and Blatten (Lötschen)/Valais (46°26'00"N, 7°50'50"E, 1880 m a.s.l.; open larch forest, Fig. 4). At each site, pieces of larch or pine bark lying on the ground were checked for potential nests of *O. nigriventris* as was the thick bark of coniferous tree stumps or still living trees up to a height of 1.5 m. Bark pieces containing potential nests as suggested by circular holes of about 7 mm in diameter or nest plugs built from masticated green leaves (= "leaf pulp") were transported back to the lab. Nests collected in 2017 were directly dissected with a pocket knife, whereas those collected in 2018 were X-rayed first at the Animal Hospital of the University of Zurich using a Bucky Diagnost CS/TH X-Ray (Philips) combined with a Profect CS Mammo-Reader (Fujifilm), before they were opened.

To identify the source of the nest building material used by *O. nigriventris*, DNA metabarcoding of nest plugs consisting of leaf pulp was performed by the ISO 9001:2008 certified and ISO 17025:2005 accredited laboratory of Eurofins Medigenomix GmbH (Ebersberg, Germany). DNA of a sample of 5 g plant material including nine walls of six nest plugs from Blatten (Lötschen)/Valais was extracted with the Maxwell 16 FFS nucleic acid extraction kit (Promega) following the manufacturer's manual. From the extracted DNA, barcoding sequences of the nuclear marker ITS2 and the chloroplast marker

trnL were PCR amplified using target specific next-generation sequencing primers and analysed by amplicon sequencing on the Illumina MiSeq platform. The amplified sequences were sorted into sequence sets according to their similarity, each represented by a master sequence. The master sequences were identified to species or genus level by comparing them with known plant sequences made available by the NCBI database.

To compare the female mandibular strength of *O. nigriventris* with that of eight related European *Osmia* species of the subgenus *Melanosmia* with differing nesting biologies, we adapted a biomechanical model used to estimate the mandibular strength of grasshoppers (Ibanez et al. 2013) to bees (see Suppl. material 1). In contrast to the grasshopper model, the bee model does not differentiate between the incisive and the molar strength of the mandible as the bee mandible does not possess a distinct molar region, which the grasshoppers use to chew the leaf fragments they have cut with the incisive region. The bee model is described by $F = F_A \times (L_A/L_M) \times 1/R_C$, where F is the force of the mandible, F_A the force of the adductor muscle, L_A the lever of the adductor muscle, L_M the lever of the mandible and R_C the width of the cutting margin. As the force of the adductor muscle cannot be measured directly, F_A was estimated by the mandible section area expected to be correlated with the volume of the adductor muscle. The model translates into: the stronger the adductor muscle and the greater the length of L_A relative to L_M, the greater the mechanical advantage and the larger the force that can be generated at the mandible tip. Measurements were done on photographs of amputated mandibles taken with the digital microscope Keyence VHX-2000 using the free software ImageJ version 1.52a (http://imagej.nih.gov/ij). For each bee species, the force of the right mandible of three females was assessed except for *O. alticola* Benoist, *O. maritima* Friese and *O. steinmanni* Müller, for which only one or two specimens were available.

To identify brood parasites of *O. nigriventris*, DNA barcoding of 17 prepupae originating from five nests discovered near Blatten/Valais was performed. DNA was extracted with a "NucleoSpin Tissue" kit (Macherey-Nagel) following the manufacturer's protocol. The 658 base-pair-long barcoding fragment of the mitochondrial gene Cytochrome Oxidase I was amplified using the primers LepF and LepR (Hebert et al. 2004). PCR products were purified enzymatically using a mix of the enzymes Exonuclease and FastAP Thermosensitive Alkaline Phosphatase (Fermentas). Sequencing was performed in only one direction with the primer LepR by Microsynth AG. Chromatograms were edited in Geneious R6 (Kearse et al. 2012) and the exported fasta sequences were compared to existing DNA barcode libraries on BOLD (www.boldsystems.org).

To assess the pollen host spectrum of *O. nigriventris*, the scopal pollen contents of 50 females from museum and private collections originating from 41 different localities distributed across the Alps and the larval provisions in four brood cells of three nests from two different localities were microscopically analysed. The methodology for pollen removal, manufacture of pollen samples, pollen identification and data evaluation follows Müller (2018). For each brood cell, the proportions of the different pollen types were estimated to the nearest 5%.

To clarify the phenology and distribution of *O. nigriventris*, we conducted a comprehensive literature survey, gathered unpublished records from public and private entomological collections and retrieved distributional data from several public databases. For details see Acknowledgments and Suppl. material 3, which contains a complete list of all distributional data. For the phenology, only records from Central Europa (Austria, Czech Republic, France, Germany, Italy, Poland, Switzerland and Slovakia) were considered.

Results

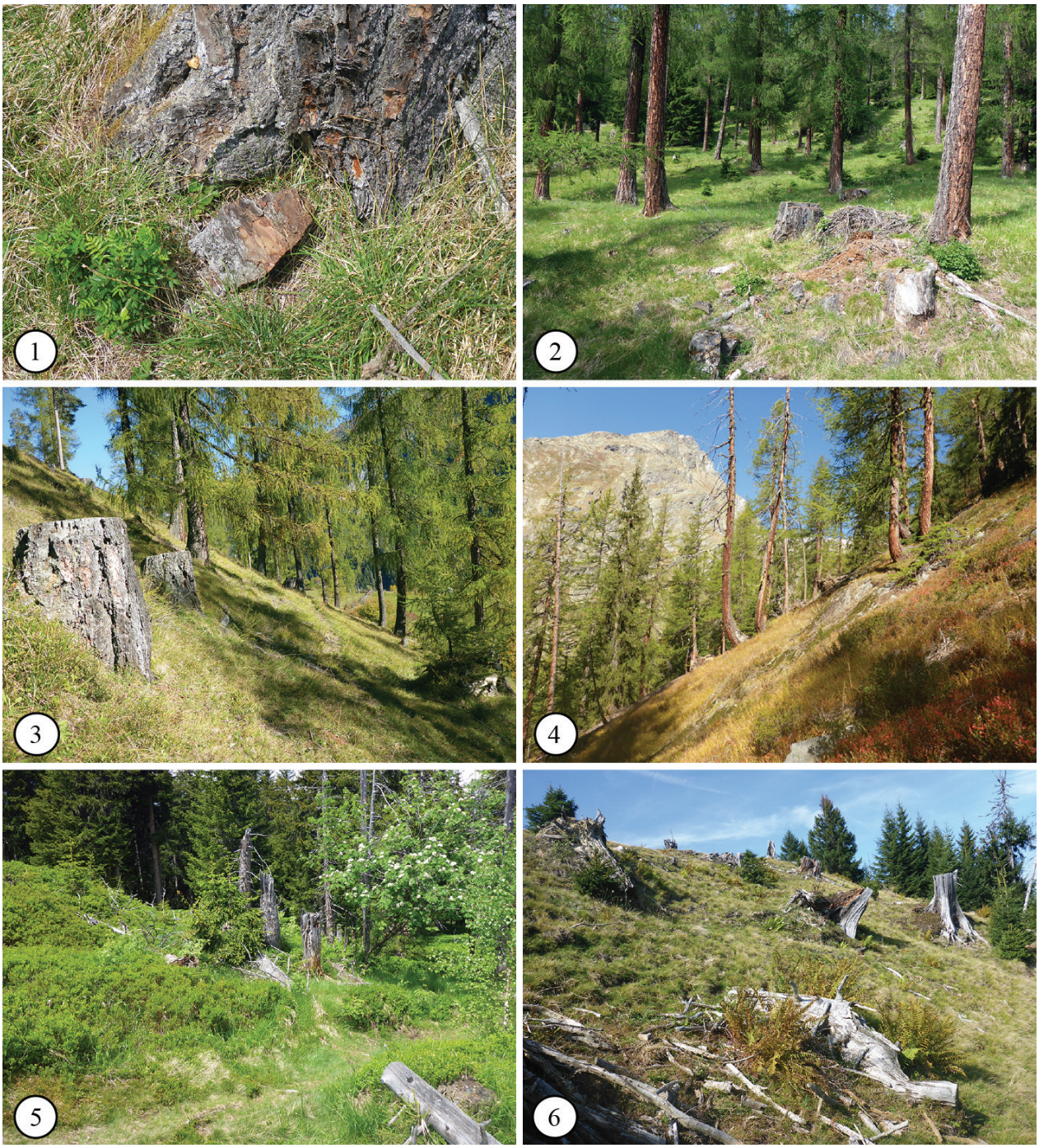
Nesting biology

Nesting site

At three study sites – all open larch forests or larch-meadow forests (Figs 2–4) –, a total of 19 nests of *O. nigriventris* was found, 13 of which were abandoned and at least one year old, whereas six contained bee immatures upon discovery (Tab. 1). Some of the old nests were used as nesting sites by other aculeate hymenopterans in the year of discovery, such as the osmiine bee *Osmia leaiana* and the eumenine wasp *Euodynerus quadrifasciatus* (Fabricius) (Figs 22–24). All 19 nests were in bark pieces of *Larix decidua*, which lay in grassy vegetation on sun-exposed ground (Figs 1, 7, 17, 19). The bark pieces measured 13–73 cm in length, 8.5–34 cm in width and 3–8 cm in thickness (Tab. 1). Eight bark pieces contained one nest, four pieces two nests and one piece three nests. No nests were found in the thick bark of coniferous tree stumps or still living trees. The three study sites where no nests were found were all windfalls lacking thick-barked conifers, such as *Larix* or *Pinus* (Figs 5, 6).

Nest architecture

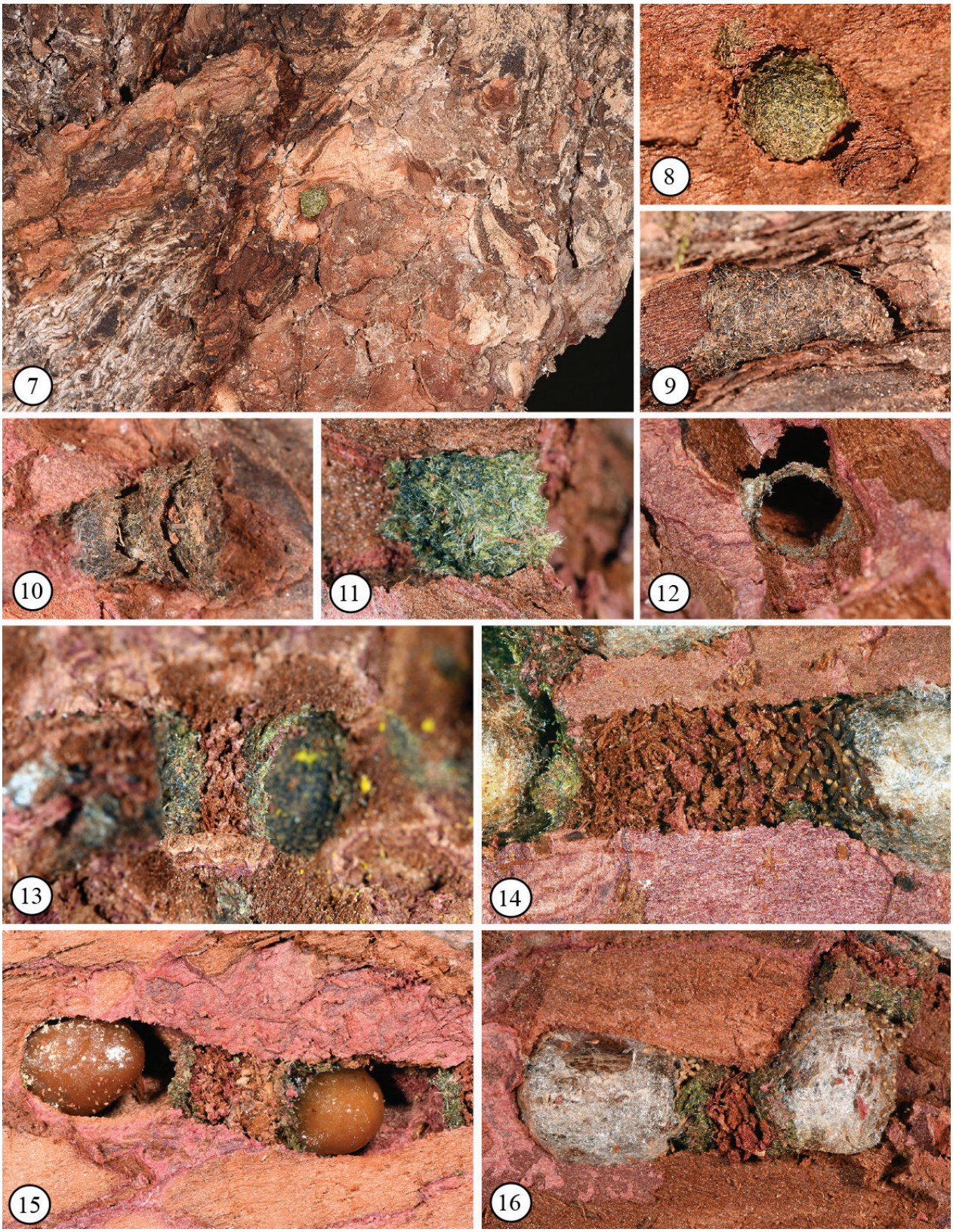
The 19 nests were all tunneled out by the female bees with no indication that preexisting burrows e.g. of cerambycid beetle larvae were used. The nesting burrows were carefully carved out and measured 6–7 mm in diameter. They were neither lined with glandular secretions nor with leaf pulp except for several small areas of few mm^2 covered with a thin layer of leaf pulp, which was probably applied to smooth out irregularities or to fill small cracks. The nest entrances, which were circular in shape (Fig. 8) and had a diameter of 6.5–7 mm, were either on the lateral side of the bark piece (n = 12; Fig. 9), on the upper side, i.e. facing upwards (n = 6; Fig. 7), or on the underside, i.e. facing to the ground (n = 1; Fig. 8, Tab. 1). In the latter case, the space between the ground and the



Figures 1–6. Habitats of *Osmia nigriventris* in the Swiss Alps. **1, 2)** Larch-meadow forest near Brienz/Grisons with nesting site - a small piece of larch bark lying on the ground (left). **3)** Larch-meadow forest near Schmitten/Grisons. **4)** Open larch forest near Blatten (Lötschen)/Valais. **5)** Windfall near Curaglia/Grisons. **6)** Windfall near Pfäfers/St Gallen.

nest entrance was relatively large, granting easy access for the nesting bee. The entrances of those seven nests, which did not start on the lateral side of the bark piece, were on the scaly exterior surface of the bark (n = 4; Fig. 7) or on the smooth interior surface (n = 3; Fig. 8).

The nests consisted either of a single linear to curved burrow (n = 9; Figs 17, 18, 21), or of a burrow system comprising 2–4 mostly linear fingers (n = 10; Figs 19, 20, 22–24, Tab. 1), which were usually excavated in roughly the same plane and often ran more or less parallel to each



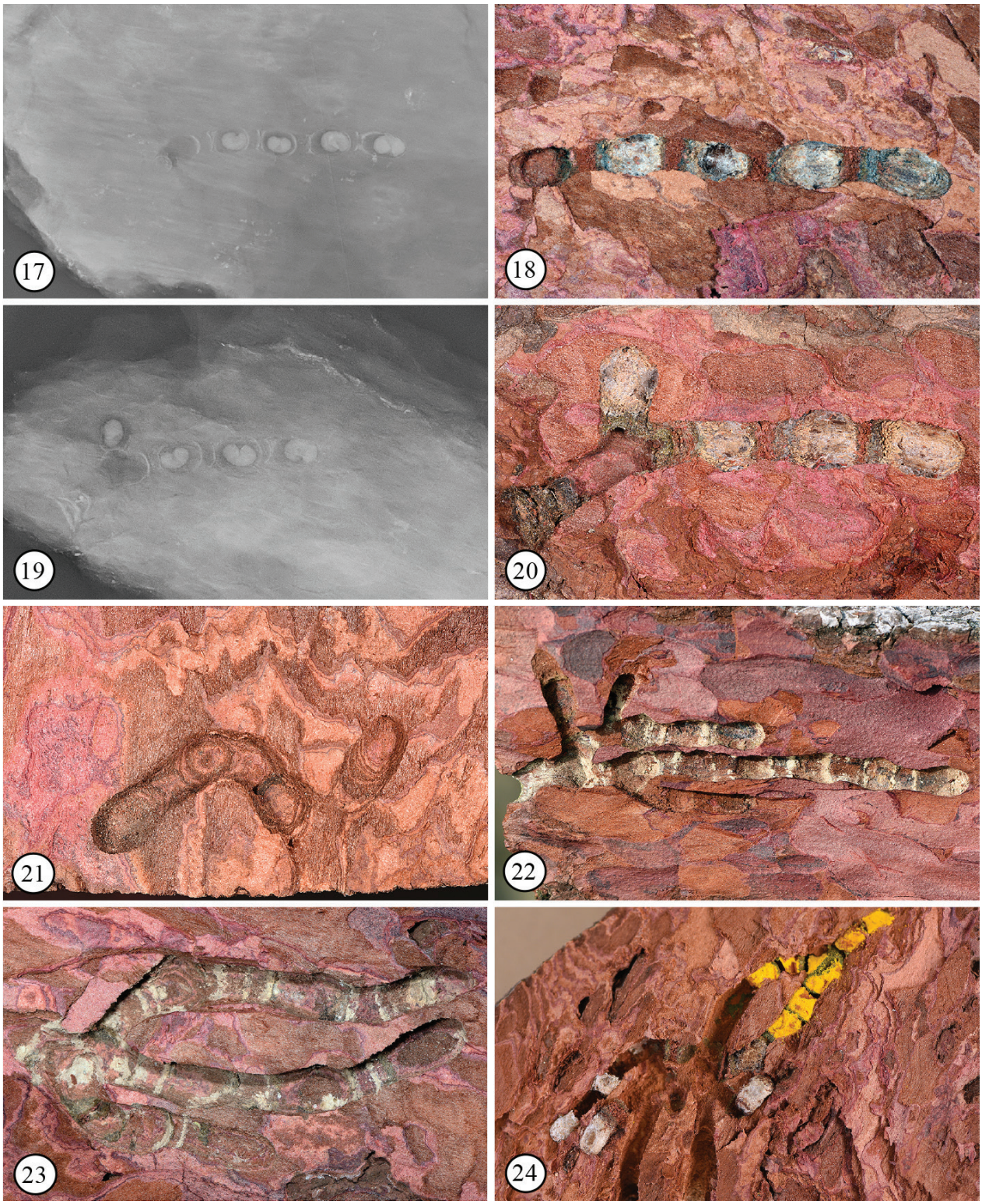
Figures 7–16. Nest architecture of *Osmia nigriventris*. **7–9)** Nest seals of nests 19, 16 and 18. **10)** Five-layered nest plug of nest 18. **11)** Single-layered nest plug of nest 17. **12)** Ring-shaped threshold. **13, 14)** Three-layered cell partitions. **15)** Brood cells with larval provisions. **16)** Brood cells with larval cocoons.

Table 1. Characteristics of 19 nests of *Osmia nigriventris* discovered in 13 bark pieces of *Larix decidua* lying on the ground at three different localities in the Swiss Alps. GR = Grisons, VS = Valais; * = nest probably built by more than one female during one or several consecutive years; b = short blind burrow without cell, suggesting that the nest was not yet finalized.

Nesting site no	Locality	Year of discovery	Maximal length × maximal width × maximal thickness of bark piece	Nest no	Nest status upon discovery	Localization of nest entrance in lying piece of bark (side of bark)	Number of brood cells	Number of burrow fingers	Number of brood cells per burrow finger	Total length of the burrow system
1	Brienz/GR	2017	29 × 13.5 × 7 cm	1	old	lateral (·)	12	5	1/1/3/3/4	27.6 cm
2	Brienz/GR	2017	31 × 28 × 5 cm	2	old	lateral (·)	10	5	1/1/2/2/4	25.5 cm
3	Brienz/GR	2017	40 × 20 × 6.5 cm	3*	old	lateral (·)	26	9+b	1/2/2/2/3/3/4/4/5	67.5 cm
				4	old	lateral (·)	7	4	1/1/2/3	15.3 cm
				5	old	lateral (·)	4	1	4	8.8 cm
4	Brienz/GR	2017	32 × 19 × 7 cm	6	old	lateral (·)	8	3	2/3/3	17.8 cm
				7	old	lateral (·)	3	1	3	6.5 cm
5	Brienz/GR	2017	13 × 8.5 × 4.5 cm	8	old	lateral (·)	2	1+b	2	6.4 cm
6	Schmitten/GR	2017	36.5 × 10.5 × 3 cm	9	old	above (exterior side)	11	5	1/2/2/2/4	29.8 cm
7	Blatten (Lötschen)/VS	2018	27 × 13.5 × 3.5 cm	10	old	lateral (·)	1	1+b	1	3.4 cm
8	Blatten (Lötschen)/VS	2018	27 × 13 × 5 cm	11	old	lateral (·)	7	?	?	?
9	Blatten (Lötschen)/VS	2018	36 × 32 × 6 cm	12	old	above (exterior side)	1	1+b	1	6.5 cm
				13	old	above (exterior side)	6	3	1/1/4	11.9 cm
10	Blatten (Lötschen)/VS	2018	54 × 20.5 × 6.5 cm	14	occupied	above (interior side)	2	1	2	6.7 cm
				15	occupied	above (interior side)	2	1	2	5.3 cm
11	Blatten (Lötschen)/VS	2018	51 × 29 × 3.5 cm	16	occupied	below (interior side)	4	1	4	9.2 cm
12	Blatten (Lötschen)/VS	2018	26 × 16 × 8 cm	17	occupied	lateral (·)	3	1	3	6.0 cm
				18	occupied	lateral (·)	4	2	1/3	8.3 cm
13	Blatten (Lötschen)/VS	2018	73 × 34 × 6 cm	19	occupied	above (exterior side)	4	2	1/3	9.5 cm

other. Except for the 9–14 mm long and almost vertical entrance burrow of those nests that did not start on the lateral side of the bark piece, the nesting burrows ran more or less parallel to the upper and under surface of the bark. The total length of the excavated burrows per nest was correlated with the number of brood cells and ranged from 3.4–29.8 cm (Tab. 1). The nests contained 1–12 brood cells, which were either constructed singly in short burrows (Figs 19, 20) or in a linear series of 2–4 in longer burrows (Figs 15–24, Tab. 1). The brood cells had a length of 10–14 mm and were widest in the middle (6.5–9 mm) and slightly constricted at both ends (6–7 mm). Nest 3 was an exception in that its burrow system had a total length of 67.5 cm and comprised 26 brood cells distributed in nine fingers, which were tunneled out in three different planes within the bark and contained up to five linearly arranged cells (Tab. 1). In contrast to all the other nests, which were most probably constructed by a single female only, the high number of brood cells suggests that nest 3 was likely built by several females, either in the same or in consecutive years.

Three types of partitions were recorded in the nests of *O. nigriventris*: i) partitions that separate the brood cells from each other ("inner cell partitions"); ii) partitions that seal the outermost brood cell towards the nest entrance or a finger towards its mouth ("outer cell partitions"), and iii) partitions that close the nest at the entrance ("nest plug"). The inner cell partitions, which ranged in length from 4–12 mm, were invariably three-layered (n = 24; Figs 13–16), consisting of a central layer of densely packed small bark particles (2–9 mm long) sandwiched between two layers of leaf pulp (marginally 1–2 mm thick). As revealed by two thresholds of leaf pulp at the entrance of two still empty brood cells (Fig. 12), the females mark the position of the later cell partition before they begin to provision a brood cell; these two thresholds were ring-shaped, which seems to be typical also for other *Osmia* species of the subgenus *Melanosmia*, such as *O. parietina* (A. Müller, unpublished data). The construction of the outer cell partitions, which ranged in length from 2–10 mm, was slightly more variable than that of the inner cell partitions: most of them were three-layered as the inner cell partitions and had similar dimensions (n = 9), whereas some partitions at the mouth of a finger were either five-layered with three layers of leaf pulp (marginally 1–2 mm thick) enclosing two layers of small bark particles (1–2 mm long; n = 3) or consisted of a single leaf pulp layer only (marginally 2 mm thick; n = 3). The construction of the nest plugs, which were usually flush with the nest opening, considerably varied between the different nests (Figs 10, 11): the plugs ranged from 3–11 mm in length and consisted either of a single layer of leaf pulp (marginally 3–5 mm thick; n = 3), of two layers of leaf pulp (marginally 1.5–3.75 mm thick) enclosing a 1 mm long layer of small bark particles (n = 1), of three layers of leaf pulp (marginally 2–3 mm thick) enclosing two slightly less than 1 mm long layers of bark particles (n = 1), or of five layers of leaf pulp (marginally 1.5–2



Figures 17–24. Nests of *Osmia nigriventris*. **17, 18)** Nest 16 X-rayed (left) and dissected (right). **19, 20)** Nest 18 X-rayed (left) and dissected (right). **21)** Old nest 8 with short blind burrow on the right. **22–23)** Old nests 2 and 6 later used by *Euodynerus quadrifasciatus* as nesting site. **24)** Old nest 1 with brood cells of *Osmia leaiana* in the upper half and remnants of the old nest of *O. nigriventris* in the lower half.

mm thick) enclosing four 1–3 mm long layers of bark particles (n = 1). The length of the vestibule, i.e. the distance between the interior side of the nest plug and the outermost layer of the outer cell partition, ranged from 0.5–2.8 cm.

DNA metabarcoding revealed that the plugs of nests 14–19 were constructed from masticated leaves of *Potentilla* spec. (Rosaceae) and *Helianthemum nummularium* (Cistaceae) (Tab. 2). In addition, a low proportion of reads corresponded to *Lotus corniculatus* (Fabaceae).

Table 2. Origin of the masticated green leaves used by *Osmia nigriventris* to build the nest plugs based on DNA metabarcoding of a sample of nine walls from nests 14–19 (see Tab. 1).

Plant taxon	% sequence reads
Potentilla spec. (Rosaceae)	76.3
Helianthemum nummularium (Cistaceae)	22.5
Lotus corniculatus (Fabaceae)	1.2

Although the percentage of sequence reads obtained by next-generation sequencing is only a rough indication for the relative amount of a plant taxon in the extracted DNA, this low proportion might be due to a contamination e.g. with pollen of *Lotus*, which is the most important pollen host of *O. nigriventris* in the Alps (see below).

Female mandibular strength

The assessment of the mandibular strength revealed a low intraspecific variability indicating that the shape and the force of the female mandibles are species-specific traits (Suppl. material 2). Among the nine *O.* (*Melanosmia*) species examined, *O. nigriventris* and *O. pilicornis*, which both excavate their nests in wooden substrate, possess by far the strongest mandibles (Fig. 25, Suppl. material 2). In contrast, the mandibles of those species, which either nest in preexisting cavities (*O. inermis, O. parietina*, *O. uncinata*) or in loose soil and litter (*O. alticola, O. maritima, O. xanthomelana*), are distinctly weaker. Compared with these species, the mandibles of *O. nigriventris* are relatively shorter, have less diverging margins and are apically only slightly curved inwards resulting in a compact and chisel-like shape that appears to be well suited to tunnel out burrows in bark or dead wood (Figs 28, 29).

Brood parasites

The obtained sequences of the barcoding gene Cytochrome Oxidase I were all clean and readable. Comparison with BOLD databases indicate that 13 out of the 17 overwintering prepupae belong to *O. nigriventris*, whereas two prepupae each from the nests 15 and 19 were brood parasites, i.e. three specimens of the bombyliid fly *Anthrax anthrax* (Schrank) and one specimen of the sapygid wasp *Sapyga similis* (Fabricius). From the latter species, a dead imago was also found in a brood cell of nest 1. The percentage of match between the barcoding sequences of the 17 prepupae and the BOLD reference sequences exceeded 99% in all cases.

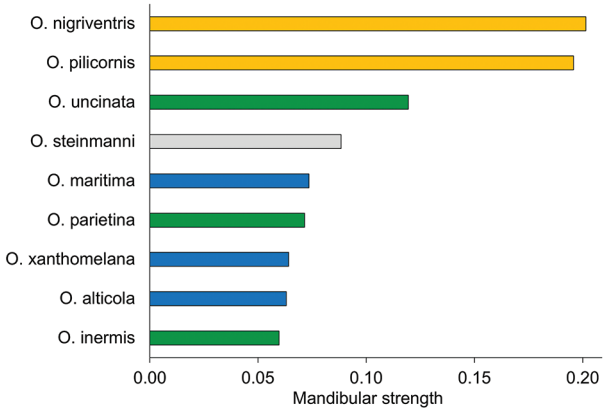


Figure 25. Mandibular strength of nine European *Osmia* species of the subgenus *Melanosmia*. For each species, the force of the right mandible of three females was averaged except for *O. alticola*, *O. maritima* and *O. steinmanni*, for which only one or two specimens were available. Orange = nesting in self-excavated burrows in wooden substrate, green = nesting in preexisting cavities, blue = nesting in loose soil or litter, grey = nesting unknown (after Müller 2019 and references therein).

Pollen hosts

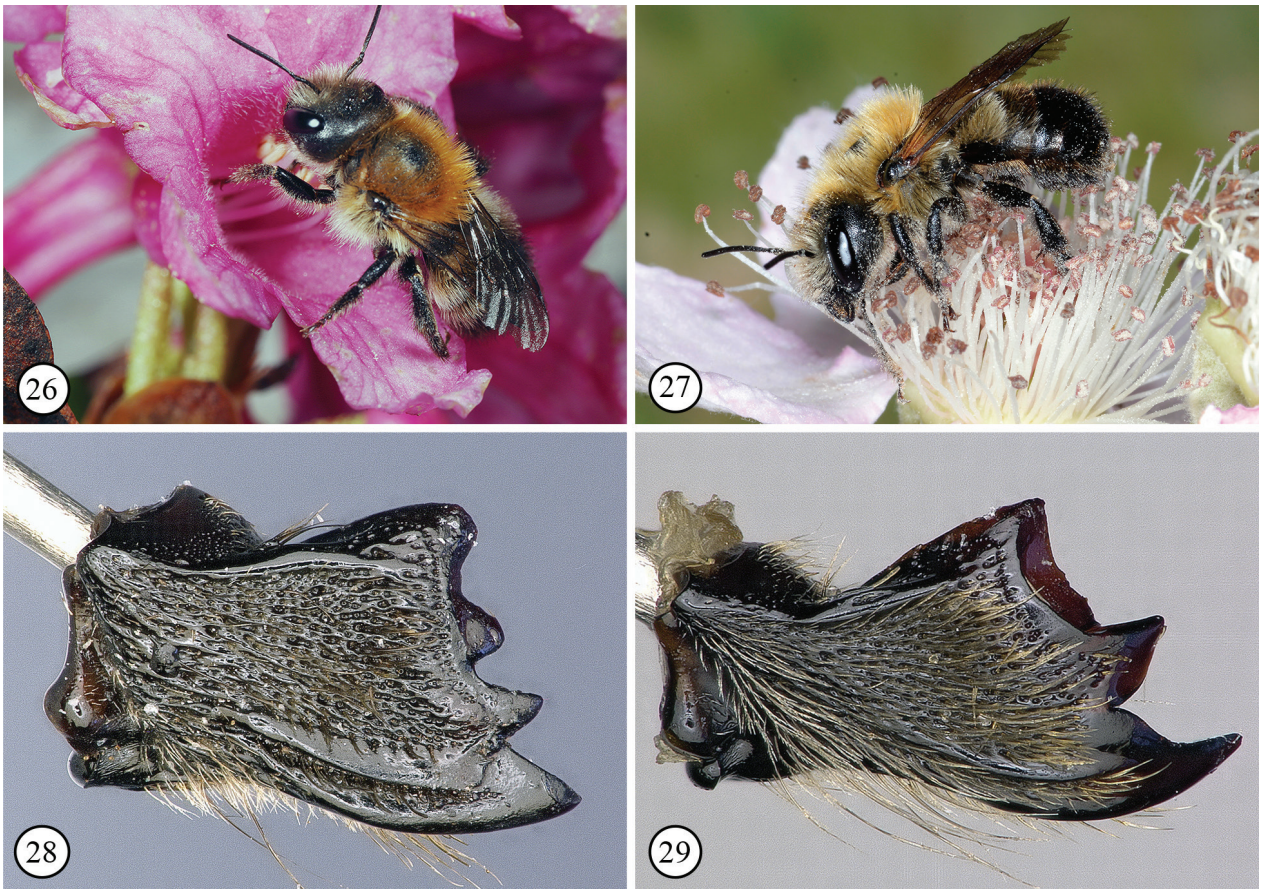
Osmia nigriventris collected the pollen almost exclusively from flowers of Fabaceae, Ericaceae and Cistaceae (Tab. 3, Figs 26, 30). Pollen of these three plant families constituted 96.6% of the total pollen grain volume. Among the Fabaceae, *Lotus* was by far the most important pollen host. Its pollen was represented by 55.8% of the total pollen grain volume and was recorded in 42 out of 50 pollen loads. Among the Ericaceae, both *Rhododendron* and *Vaccinium* were exploited. Their pollen contributed 18.1% and 8.5%, respectively, to the total

Table 3. Pollen composition of female pollen loads of *Osmia nigriventris*. n = total number of pollen loads, N = number of pollen loads from different localities. Countries: CH = Switzerland, F = France. Plant families: BOR = Boraginaceae, CIS = Cistaceae, FAB = Fabaceae, ERI = Ericaceae. Definitions of bee host range after Müller and Kuhlmann (2008).

n	N	Origin (and number) of pollen loads	% pollen grain volume (number of loads)	Preferred host	% pollen grain volume of preferred host	% pure loads of preferred host	% loads with preferred host	Host range
50	41	CH (48), F (2)	FAB (*Lotus*) 55.8% (42), FAB (*Hippocrepis*) 5.4% (7), FAB (*Anthyllis*) 1.6% (3), FAB (*Trifolium*) 1.2% (3), FAB (*Vicia/Lathyrus*) 0.5% (2), ERI (*Rhododendron*) 18.1% (10), ERI (*Vaccinium*) 8.5% (7), CIS (*Helianthemum*) 5.6% (5), GEN (*Gentiana*) 2.1% (1), BOR (*Echium*) 0.9% (1), unknown 0.3% (2)	Fabaceae, Ericaceae and *Helianthemum* (Cistaceae)	96.7%	96.0%	100%	mesolectic on Fabaceae, Ericaceae and *Helianthemum* (Cistaceae)

Table 4. Pollen composition of larval provisions in four brood cells of *Osmia nigriventris* from three nests.

Locality	Nest no	Brood cell no	Fabaceae: *Lotus*	Fabaceae: *Hippocrepis*	Ericaceae
Brienz/GR	nest 3	brood cell	95%	5%	
Blatten (Lötschen)/VS	nest 13	brood cell	70%	5%	25%
Blatten (Lötschen)/VS	nest 14	brood cell 1	50%	5%	45%
		brood cell 2	80%		20%
			73.75%	**3.75%**	**22.5%**



Figures 26–29. 26, 27) Females of *Osmia nigriventris* collecting pollen on *Rhododendron ferrugineum* (left, photo H. Wiesbauer) and sucking nectar on *Rubus* (right, photo S. Kühne). **28)** Female mandible of *Osmia nigriventris*. **29)** Female mandible of *Osmia inermis*.

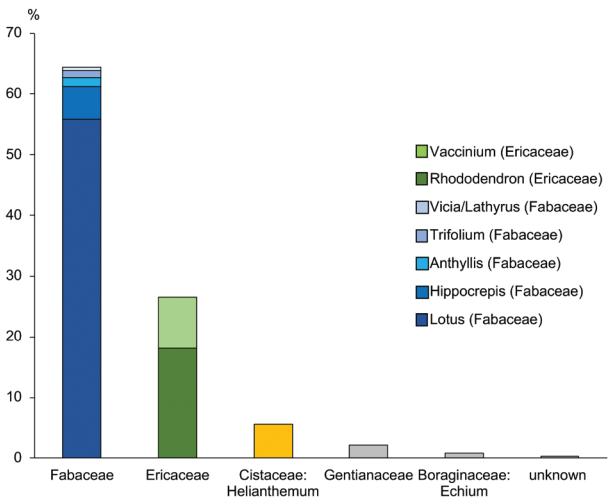


Figure 30. Pollen host spectrum of *Osmia nigriventris* based on the microscopical analysis of 50 scopal loads from 41 different localities in the Swiss and French Alps.

pollen grain volume and was found in 10 and 7 loads, respectively, rendering these two genera the second and third most important host taxon of *O. nigriventris*. *Helianthemum* (Cistaceae) was the fourth most important host taxon. Its pollen constituted 5.6% of the total pollen grain volume and was recorded in 5 loads.

The larval provisions of four brood cells originating from three nests contained only pollen of Fabaceae and Ericaceae (Tab. 4). One provision exclusively consisted of Fabaceae pollen, whereas the other three provisions were mixtures of the pollen of both families. *Lotus* was the most important pollen host in each of the four provisions.

Phenology and overwintering stage

In Central Europe, the imaginal period of *O. nigriventris* extends from May to August (Fig. 31). At the lowest extra-alpine occurrences at elevations below 900 m a.s.l., the flight activity might start as early as the beginning of

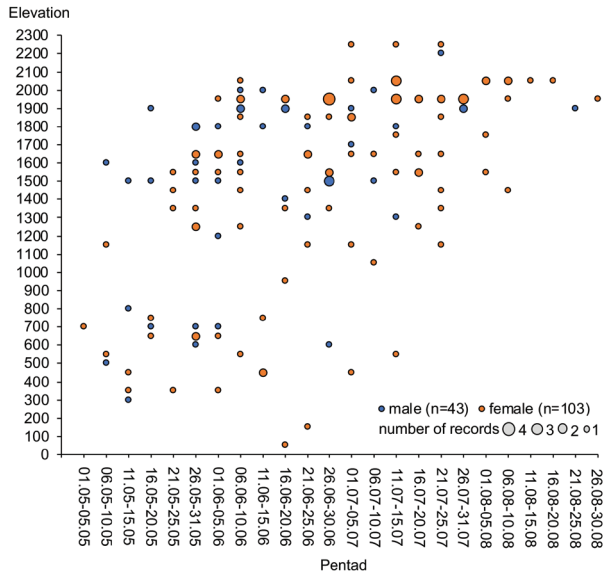


Figure 31. Phenology of *Osmia nigriventris* in Central Europe. For each pentade, the number of female and male records per elevation is given. For a given locality and date, only one record per sex was considered.

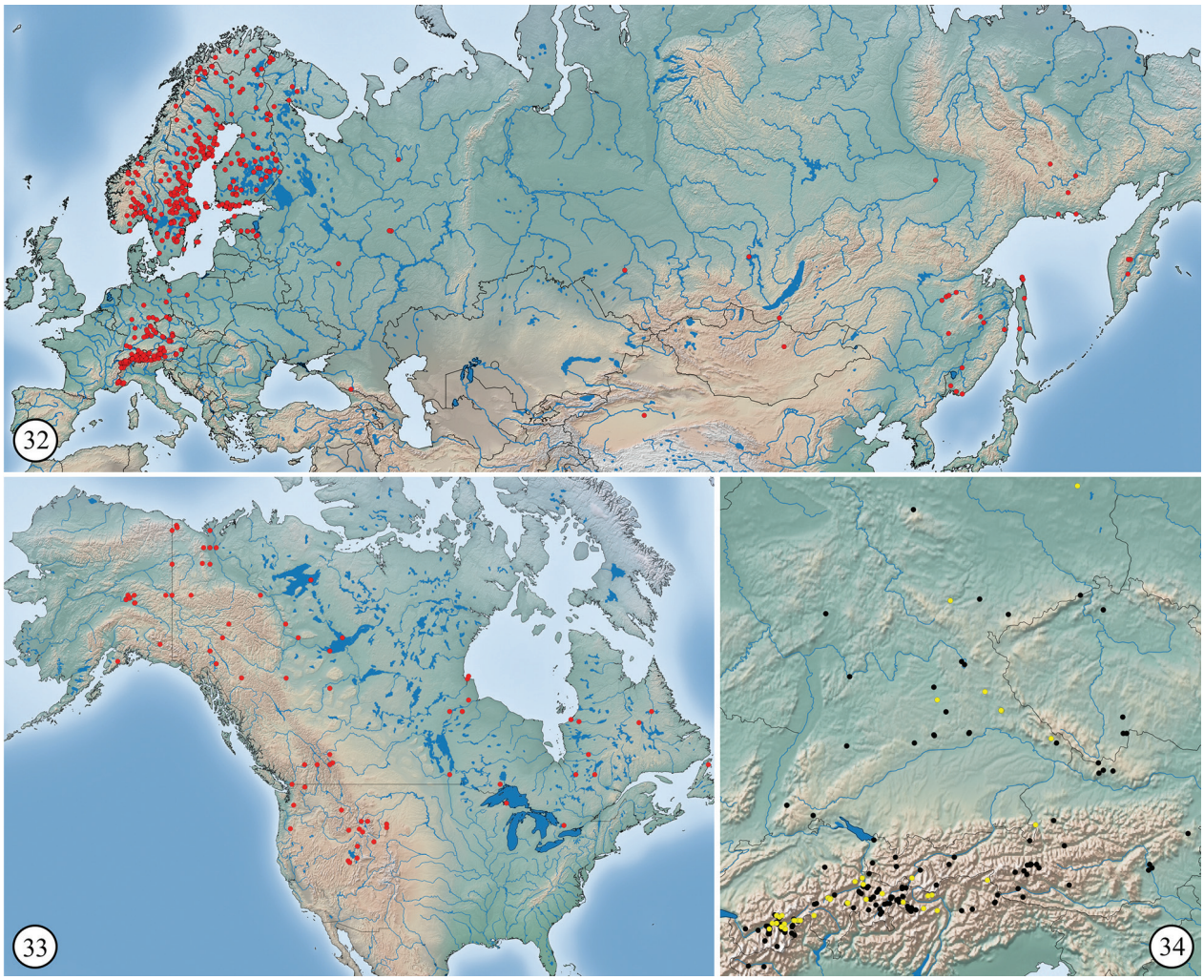
May and does not extend beyond the first decade of June, whereas near the timberline in the subalpine zone of the Alps the imagines do not emerge before the end of May and fly till the end of August.

X-raying of the nests 14–19 performed in November 2018 revealed that 13 out of the 19 brood cells contained prepupae of *O. nigriventris* spun in a cocoon (Figs 16–20), suggesting that *O. nigriventris* passes at least its first winter in the prepupal stage (see Discussion). In two cells, the eggs or the freshly eclosed larvae had died leaving behind the entire larval provisions (Fig. 15), and the remaining four cells contained prepupae of *Anthrax anthrax* and *Sapyga similis* (see above).

In one brood cell each of three abandoned nests, the adult bee had left its cocoon in spite of the fact that the cell partitions were still intact, suggesting that the imagines occasionally leave their natal nest through a new burrow gnawed across the bark rather than through the nest entrance.

Distribution

O. nigriventris has a vast Holarctic distribution (Figs 32–34, Suppl. material 3). In the Nearctic, *O. nigriventris* oc-



Figures 32–34. Distribution of *Osmia nigriventris* in **32)** the Palaearctic, **33)** the Nearctic and **34)** Central Europe. For Central Europe, records before 2000 are given in black, those from 2000 to the present in yellow. See Suppl. material 2 for a complete list of all distributional data. Made with Natural Earth (www.naturalearthdata.com).

curs in the western and northern United States (Colorado, Wyoming, Idaho, Montana, Oregon, Washington, Alaska, Minnesota, Michigan) and Canada (Alberta, British Columbia, Yukon, Northwest Territories, Manitoba, Ontario, Quebec, Newfoundland and Labrador) within a belt that extends from 40° to 69° northern latitude (see also Rightmyer et al. 2010 and Ascher and Pickering 2019). In the Palaearctic, its range is split into three main parts: i) Alps (France, Switzerland, Italy, Germany, Austria) from 1200 m a.s.l. up to the timberline at 2300 m a.s.l., ii) Caucasus and iii) the boreal zone from Scandinavia (Norway, Sweden, Finland), the Baltic (Lithuania, Latvia, Estonia) and European Russia eastwards over Siberia, northwestern China and Mongolia to northeasternmost China and the Russian Far East between 41° and 70° northern latitude. Widely scattered outposts of its distribution exist in the lowlands of northern Germany and Poland as well as in some low mountain ranges in Germany, the Czech Republic and Slovakia, where the species is regarded as a glacial relict (Figs 32, 34). Among the 53 records of *O. nigriventris* north of the Alpine arc, which range in altitude from 55 m to 730 m a.s.l., 43 (81.1%) date from before 1995, suggesting that numerous former Central European occurrences outside the Alps no longer exist.

Discussion

Nesting biology

At three different localities in the Grisons and the Valais, numerous nests of *Osmia nigriventris* were discovered, which were all constructed in thick bark pieces of *Larix decidua* lying on sun-exposed ground of open subalpine forests. Nests of *O. nigriventris* were also detected by Frey-Gessner (1881) and F. Amiet (personal communication) in pieces of *Pinus sylvestris* bark at the Alp Ponchet above Chandolin/Valais and near Samedan/Grisons, respectively, and by Stöckhert (1933) in the thick bark of a *Pinus* stump in Franken (Germany). Furthermore, a female of *O. nigriventris* was observed to fly off from its putative nest in a bark piece lying at the base of a *Pinus sylvestris* stump in Brandenburg/Germany (Saure 2017, personal communication). Lastly, L. Gyllenhall, a Swedish entomologist living from 1752 to 1840, found *O. nigriventris* nesting in the bark of a pine in Vastergötland (Sweden), which later prompted Gerstaecker (1869) to give this species the name *O. corticalis* (cortex = bark), now regarded as a junior synonym of *O. nigriventris* (Nilsson, 2009). These records of bark nests at five different localities in the Swiss Alps and at one locality each in central Germany, northern Germany and southern Sweden indicate that the construction of nests in the bark of thick-barked conifers is a typical trait of *O. nigriventris*. As numerous conifers including *Larix* and *Pinus* seal injuries of the bark with resin (Krokene 2015 and references therein), *O. nigriventris* is expected to nest only in bark which adheres to dead stumps or is detached from the stems and lies on the ground. However, *O. nigriventris* is not strictly specialized to bark as nesting substrate, as is revealed by its occurrence at localities, where no thick-barked conifers occur, such as the three windfalls investigated in the present study. Here, the species is supposed to excavate its nests in dead wood of *Picea abies* stumps. In fact, Giraud (1861) observed several females of *O. nigriventris* nesting in self-excavated burrows in a thick board of *Abies alba*, which formed part of a pasture fence. This shows that while *O. nigriventris* might have a pronounced preference for nesting in bark, it is capable of constructing its nests also in dead wood.

Among the osmiine bees, bark appears to be only exceptionally used as nesting substrate. Apart from *O. nigriventris*, reports for nesting in bark exist only for the Palaearctic species *O. uncinata* Gerstaecker and the three Nearctic species *O. atriventris* Cresson, *O. densa* Cresson and *O. cahuilla* Cooper, all belonging to the subgenus *Melanosmia*. The first three species differ from *O. nigriventris* in that they colonized already existing beetle burrows in bark and also use preexisting linear cavities in other substrates, such as dead wood or stems (Graenicher 1906, Stoeckhert 1933, Linsley and MacSwain 1951, Cane et al. 2007, Else and Edwards 2018). This suggests that the selection of bark for nesting was rather accidental in these three species. In *O. cahuilla*, 21 individuals emerged from a single nest within the bark of a pine stump (Cooper 1993). As *O. cahuilla* is hypothesized to be related to the Palaearctic *O. pilicornis* (Cooper 1993), which nests in self-excavated burrows in dead wood (Prosi et al. 2016), the bark nest might possibly have been gnawed out by the nesting female as in *O. nigriventris*.

The inner cell partitions, which consist of an interlayer of bark particles sandwiched between two thin layers of leaf pulp, are diagnostic for the nests of *O. nigriventris*. Doubtlessly, the interlayer is constructed by amassing bark particles that accumulated within the burrow during the process of nest excavation. Among the osmiine bees, which usually separate linearly arranged brood cells by one-layered walls, such three-layered cell partitions are otherwise known only from the Palaearctic *Hoplitis tuberculata* Nylander and its North American relatives (Müller 2015). In these *Hoplitis* species, the interlayer consists of pebbles, wood chips, earth crumbs, fragments of conifer needles or particles of pith. These strong cell partitions are hypothesized to impede mobile larvae of predators, which already infested a brood cell before the nest was closed, from invading adjacent cells, such as larvae of *Trichodes* beetles (Cleridae). The same function might also apply to the massive cell partitions of *O. nigriventris*.

The mandibles of *O. nigriventris* and *O. pilicornis* turned out to be the strongest among the European *O.* (*Melanosmia*) species. This finding corresponds well to the habit of both species to tunnel out their nests in hard wooden substrate and supports the view that both species are specialized excavators and do not colonize preexisting cavities for nesting, such as insect borings in dead wood. Such a specialization also explains why the repeated attempts to establish these two species in trap nests composed of drilled borings in dead wood all have failed (A. Müller and R. Prosi, unpublished data).

Anthrax anthrax (Bombyliidae) and *Sapyga similis* (Sapygidae) were recorded as brood parasites of *O. nigriventris* in the present study. Most species of *Anthrax* are ectoparasitoids of above-ground nesting aculeate Hymenoptera attacking the full-grown larvae of their hosts (Yeates 1997). *A. anthrax* was found to parasitize the crabronid wasp *Pemphredon lugens* Dahlbom, the megachilid bees *Megachile nigriventris* Schenck, *Hoplitis adunca* (Panzer), *Osmia bicornis* (Linnaeus) and *O. cornuta* (Latreille) as well as the apid bee *Anthophora retusa* (Linnaeus), revealing a wide host range (Brechtel 1986, Litt 1996, Krunić et al. 2005, Peeters et al. 2012, Westrich 2018). In contrast to *A. anthrax*, *S. similis* was already known to be an antagonist of *O. nigriventris* (Stoeckhert 1933, Amiet 2008). It develops in the nests of other *O.* (*Melanosmia*) species, such as *O. inermis* (Zetterstedt), *O. parietina* Curtis, *O. uncinata* and probably also *O. maritima* Friese and *O. xanthomelana* (Kirby) (Stoeckhert 1933, Zanden 1982, Westrich 2002, 2018), suggesting a preference for *Osmia* species of the subgenus *Melanosmia* as hosts. However, *S. similis* was also reared from nests of *Chelostoma grande* (Nylander) (Westrich 2002) and might thus be expected to parasitize further osmiine bee species occurring in the Alps and the Jura Mountains, where *S. similis* has its main distribution in Switzerland (Amiet 2008). *Chrysura hirsuta* (Gerstaecker) (Chrysididae) is most probably a further brood parasite of *O. nigriventris* (Berland and Bernard 1938, Trautmann 1927, Stoeckhert 1933, Paukkunen et al. 2014), although no proof for its development within the nests of *O. nigriventris* exists so far. As in *S. similis*, *Osmia* species of the subgenus *Melanosmia* appear to be the main hosts of *C. hirsuta* (Prosi et al. 2016, Westrich 2018).

Pollen hosts

Microscopic analysis of both female pollen loads and larval provisions revealed that *Osmia nigriventris* is mesolectic, restricting pollen harvesting almost exclusively to flowers of Fabaceae, Ericaceae and to a lesser extent *Helianthemum* (Cistaceae). Known pollen host species are *Lotus corniculatus* L. and *Hippocrepis comosa* L. among the Fabaceae, *Rhododendron ferrugineum* L., *R. hirsutum* L., *Vaccinium myrtillus* L. and *V. vitis-idaea* L. among the Ericaceae and *Helianthemum nummularium* (L.) Mill. among the Cistaceae (Frey-Gessner 1899–1907, Stoeckhert 1933, Westrich 2018, Dylewska 1993, this study). In contrast to the literature, no preference for *Vaccinium* over Fabaceae was evident in the present study as assumed by Stoeckhert (1933) and Westrich (2018), and pollen of *Potentilla* (Rosaceae), which is listed as an additional pollen source by Westrich (2018), was never recorded in any pollen load.

The pollen host spectrum of *O. nigriventris* is similar to that of other predominantly alpine *Osmia* (*Melanosmia*) species, for which pollen of Fabaceae also plays a crucial role for larval development (Müller 2018). Compared with these *O.* (*Melanosmia*) species, which comprise narrow Fabaceae specialists collecting pollen only on two closely related genera as well as generalists harvesting pollen on up to eleven different plant families, *O. nigriventris* occupies an intermediate position with respect to its degree of host plant specialization. The combined exploitation of Fabaceae and Ericaceae found to be typical for *O. nigriventris* in the Alps has also been observed in other Palaearctic *O.* (*Melanosmia*) species inhabiting Ericaceae-rich alpine and boreal habitats, such as *O. disjuncta* Tkalců, *O. inermis* (Zetterstedt) and *O. steinmanni* Müller (Hicks 2009, Müller 2018, 2019) and might possibly also apply to *O. laticeps* Thomson currently considered to be oligolectic on *Vaccinium* (Nilsson 2009).

Phenology and overwintering stage

Similar to the other European *Osmia* species of the subgenus *Melanosmia*, which are early flying bees active in spring and early summer (Westrich 2018, SwissBee-Team 2019), *O. nigriventris* already emerges in phenological spring, i.e. between the beginning of May at low altitudes and the first decade of June at high altitudes. As the nests of *O. nigriventris* from Blatten/Valais (1880 m a.s.l.) contained prepupae upon examination in winter 2018, it seems improbable that the time span between the end of winter and the onset of the early flight period is sufficiently long to allow for the entire metamorphosis to the imaginal stage. We therefore hypothesize that *O. nigriventris* needs two years for its development in the subalpine zone of the Alps and that it overwinters here as prepupa in the first and as imago in the second winter. This hypothesis is supported by observations made on other *O.* (*Melanosmia*) species: *O. inermis* needs at least two years for its development on the German Swabian Alb and in Scotland, where the first winter is passed as prepupa and the second as diapausing adult (Else and Edwards 1996; Westrich 2002), and *O. parietina* was found to emerge not until two years after egg deposition in the Valais at 1430–1800 m a.s.l. (Westrich 2002).

Distribution

O. nigriventris belongs to the few bee species that have an autochthonous Holarctic distribution (Ebmer 2011). Although the species is not threatened at the European scale due to its wide distribution and large population size in Scandinavia (Nieto et al. 2014), it is scarce and locally distributed throughout the Alps and appears to have disappeared from many of its former Central European extra-alpine glacial refugia at low altitudes. Though this decline at low altitudes might have been caused by habitat deterioriation, it might also be a first indication that climate warming is increasingly negatively affecting population survival of this cold-adapted species, which raises concern about the species' future in the upper montane and lower subalpine zone of the Alps.

Conclusions

The nesting biology of *O. nigriventris* is exceptional among the osmiine bees in that the females excavate their nests in wooden substrate, preferentially in thick bark of *Larix* and *Pinus*, which either lies on the ground or adheres to dead tree stumps. The finding that five out of 13 bark pieces used as nesting sites contained two or more nests and that at least one nest was most probably owned by several females suggests that suitable bark might be a limiting resource for *O. nigriventris* in the Alps. In fact, the search for nests of *O. nigriventris* in the course of the present study revealed that bark pieces of thick-barked conifers lying on the ground are rare by nature and - moreover - are often removed by the farmers from the floor of grazed forests, such as larch-meadow forests. Given the rarity of *O. nigriventris* throughout the Alpine arc and its supposed decline at low and mid altitude due to climate warming, we urge land owners, foresters, farmers and local authorities to leave sufficient amounts of thick bark on the ground of open subalpine larch and pine forests.

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References

Amiet F (2008) Mutillidae, Sapygidae, Scoliidae, Tiphiidae (Hymenoptera, Vespoidea). Fauna Helvetica 23, Centre Suisse de Cartographie de la Faune (CSCF) and Schweizerische Entomologische Gesellschaft (SEG), 85 pp.

Amiet F, Herrmann M, Müller A, Neumeyer R (2004) Apidae 4: *Anthidium, Chelostoma, Coelioxys, Dioxys, Heriades, Lithurgus, Megachile, Osmia, Stelis*. Fauna Helvetica, 9. Centre Suisse de Cartographie de la Faune (CSCF) and Schweizerische Entomologische Gesellschaft (SEG), 274 pp.

Ascher JS, Pickering J (2019) Discover Life bee species guide and world checklist (Hymenoptera: Apoidea: Anthophila). http://www.discoverlife.org/mp/20q?guide=Apoidea_species [accessed 24.1.2019]

Berland L, Bernard F (1938) Hyménoptères vespiformes III (Cleptidae, Chrysidae, Trigonalidae). Faune de France 34: 1–145.

Brechtel F (1986) Die Stechimmenfauna des Bienwaldes und seiner Randbereiche (Südpfalz) unter besonderer Berücksichtigung der Ökologie kunstnestbewohnender Arten. Pollichia-Buch 9: 1–282.

Cane JH, Griswold T, Parker FD (2007) Substrates and materials used for nesting by North American *Osmia* bees (Hymenoptera: Apiformes: Megachilidae). Annals of the Entomological Society of America 100: 350–358. https://doi.org/10.1603/0013-8746(2007)100[350:SAMUFN]2.0.CO;2

Cane JH (2012) Dung pat nesting by the solitary bee, *Osmia* (*Acanthosmioides*) *integra* (Megachilidae: Apiformes). Journal of the Kansas Entomological Society 85: 262–264. https://doi.org/10.2317/JKES120531a.1

Cooper KW (1993) Description of *Osmia cahuilla*, n. sp., recognition of the male of *O. gabrielis* Sandhouse and the likely female of *O. bridwelli* Sandhouse (Apoidea, Megachilidae). Proceedings of the Entomological Society of Washington 95: 532–540.

Dylewska M (1993) Apoidea (except Apidae) on the northern slopes of the Hohe Tauern Mts. Acta Zoologica Cracoviensia 35: 509–564.

Ebmer AW (2011) Holarktische Bienenarten – autochthon, eingeführt, eingeschleppt. Linzer biologische Beiträge 43: 5–83.

Else G, Edwards M (1996) Observations on *Osmia inermis* (Zetterstedt) and *Osmia uncinata* Gerstäcker (Hym., Apidae) in the central Scottish Highlands. Entomologist's Monthly Magazine 132: 291–298.

Else G, Edwards M (2018) Handbook of the bees of the British Isles. Volume 2. The Ray Society, London, 775 pp.

Frey-Gessner E (1881) Meine Excursionen im Sommer 1880. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 6: 105–118

Frey-Gessner E (1899–1907) Hymenoptera, Apidae. Fauna insectorum Helvetiae. Vol. I. Körber, Schaffhausen, 392 pp.

Fye RE (1965) Biology of Apoidea taken in trap nests in northwestern Ontario. The Canadian Entomologist 97: 863–877. https://doi.org/10.4039/Ent97863-8

Gerstaecker A (1869) Beiträge zur näheren Kenntniss einiger Bienen-Gattungen. Entomologische Zeitung 30: 315–367.

Giraud J (1861) Fragments entomologiques. I. Description de plusieures Apides nouvelles et observations sur quelques espèces connues. Verhandlungen der Zoologischen und Botanischen Gesellschaft in Wien 11: 447–470.

Graenicher S (1906) On the habits and life-history of *Leucospis affinis* (Say), a parasite of bees. Bulletin of the Wisconsin Natural History Society 4: 153–159.

Hebert PDN, Penton EH, Burns JM, Janzen DH, Hallwachs W (2004) Ten species in one: DNA barcoding reveals cryptic species in the neotropical skipper butterfly *Astraptes fulgerator*. Proceedings of the National Academy of Sciences 101: 14812–14817. https://doi.org/10.1073/pnas.0406166101

Hicks B (2009) Observations of the nest structure of *Osmia inermis* (Hymenoptera: Megachilidae) from Newfoundland, Canada. Journal of the Acadian Entomological Society 5: 12–18.

Horn S, Hanula JL (2004) A survey of cavity-nesting bees and wasps in loblolly pine stands of the Savannah River Site, Aiken County, South Carolina. Journal of Entomological Science 39: 464–469. https://doi.org/10.18474/0749-8004-39.3.464

Ibanez S, Lavorel S, Puijalon S, Moretti M (2013) Herbivory mediated by coupling between biomechanical traits of plants and grasshoppers. Functional Ecology 27: 479–489. https://doi.org/10.1111/1365-2435.12058

Kearse M, Moir R, Wilson A, Stones-Havas S, Cheung M, Sturrock S, Buxton S, Cooper A, Markowitz S, Duran C, Thierer T, Ashton B, Meintjes P, Drummond A (2012) Geneious Basic: an integrated and extendable desktop software platform for the organization and analysis of sequence data. Bioinformatics 28: 1647–1649. https://doi.org/10.1093/bioinformatics/bts199

Krokene P (2015) Conifer defense and resistance to bark beetles. In: Vega FE, Hofstetter RW (Eds) Bark Beetles. Biology and Ecology of Native and Invasive Species. Elsevier, Amsterdam, 177–207. https://doi.org/10.1016/B978-0-12-417156-5.00005-8

Krunić M, Stanisavljevic L, Pinzauti M, Felicioli A (2005) The accompanying fauna of *Osmia cornuta* and *Osmia rufa* and effective measures of protection. Bulletin of Insectology 58: 141–152.

Linsley EG, MacSwain JW (1951) Notes on the biology of *Tricrania stansburyi* Haldeman (Coleoptera: Meloidae). Bulletin of the southern California Academy of Sciences 50: 92–95.

Litt R (1996) Nouvelles observations sur *Anthophora retusa*. Lambillionea 96: 155–158.

Malyshev SI (1937) Lebensgeschichte der Osmien (*Osmia*, Latr.) (Hymen. Apoidea). Zoologische Jahrbücher. Abteilung für Systematik, Geographie und Biologie der Tiere 69: 107–176.

Müller A (2015) Nest architecture and pollen hosts of the boreoalpine osmiine bee species *Hoplitis* (*Alcidamea*) *tuberculata* (Hymenoptera, Megachilidae). Journal of Hymenoptera Research 47: 53–64. https://doi.org/10.3897/JHR.47.7278

Müller A (2018) Pollen host selection by predominantly alpine bee species of the genera *Andrena*, *Panurginus*, *Dufourea*, *Megachile*, *Hoplitis* and *Osmia* (Hymenoptera, Apoidea). Alpine Entomology 2: 101–113. https://doi.org/10.3897/alpento.2.29250

Müller A (2019) Palaearctic Osmiine Bees, ETH Zürich. http://blogs.ethz.ch/osmiini [accessed 24.10.2018]

Nieto A, Roberts SPM, Kemp J, Rasmont P, Kuhlmann M, García Criado M, Biesmeijer JC, Bogusch P, Dathe HH, De la Rúa P, De Meulemeester T, Dehon M, Dewulf A, Ortiz-Sánchez FJ, Lhomme P, Pauly A, Potts SG, Praz C, Quaranta M, Radchenko VG, Scheuchl E, Smit J, Straka J, Terzo M, Tomozii B, Window J, Michez D (2014) European Red List of bees. Publication Office of the EU.

Nilsson LA (2009) The type material of Swedish bees (Hymenoptera, Apoidea) III. Entomologisk Tidskrift 130: 43–59.

Packard AS (1868) The home of the bees. American Naturalist 1: 364–378. https://doi.org/10.1086/270104

Paukkunen J, Rosa P, Soon V, Johansson N, Ødegard F (2014) Faunistic review of the cuckoo wasps of Fennoscandia, Denmark and the Baltic countries (Hymenoptera: Chrysididae). Zootaxa 3864: 1–67. https://doi.org/10.11646/zootaxa.3864.1.1

Peeters TMJ, Nieuwenhuijsen H, Smit J, Van der Meer F, Raemakers IP, Heitmans WRB, Van Achterberg K, Kwak M, Loonstra AJ, De Rond J, Roos M, Reemer M (2012) De Nederlandse Bijen (Hymenoptera: Apidae s.l.). Natuur van Nederland 11, Naturalis Biodiversity Center and European Invertebrate Survey, Leiden.

Prosi R, Wiesbauer H, Müller A (2016) Distribution, biology and habitat of the rare European osmiine bee species *Osmia* (*Melanosmia*) *pilicornis* (Hymenoptera, Megachilidae, Osmiini). Journal of Hymenoptera Research 52: 1–36. https://doi.org/10.3897/jhr.52.10441

Rightmyer MG, Griswold T, Arduser MS (2010) A review of the non-metallic *Osmia* (*Melanosmia*) found in North America, with additional notes on palearctic *Melanosmia* (Hymenoptera, Megachilidae). ZooKeys 60: 37–77. https://doi.org/10.3897/zookeys.60.484

Saure C (2017) Wildbienen und Wespen als Bewohner von Dünen, Heiden und Trockenrasen im Dahme-Seengebiet (Brandenburg). Naturschutz und Landschaftspflege in Brandenburg 26: 34–54.

Sedivy C, Dorn S, Müller A (2013) Molecular phylogeny of the bee genus *Hoplitis* (Megachilidae: Osmiini) – how does nesting biology affect biogeography? Zoological Journal of the Linnean Society 167: 28–42. https://doi.org/10.1111/j.1096-3642.2012.00876.x

Stöckhert FK (1933) Die Bienen Frankens. Beiheft der Deutschen Entomologischen Zeitschrift, 1932: 1–294.

SwissBeeTeam (2019) Online Atlas of the Swiss Wild Bees. InfoFauna, Neuchâtel. https://species.infofauna.ch/groupe/1 [accessed 10.2.2019]

Trautmann W (1927) Die Goldwespen Europas. Weimar, 194 pp.

Yeates DK (1997) The evolutionary pattern of host use in the Bombyliidae (Diptera): a diverse family of parasitoid flies. Biological Journal of the Linnean Society 60: 149–185. https://doi.org/10.1111/j.1095-8312.1997.tb01490.x

Westrich P (2002) Über das Nest der Scherenbiene *Osmia grandis* (Nylander) (Hymenoptera, Apidae). Stapfia 80: 517–523.

Westrich P (2018) Die Wildbienen Deutschlands. Ulmer Stuttgart, 821 pp.

Zanden G van der (1982) Tabel en verspreidingsatlas van de Nederlandse niet-parasitaire Megachilidae (Hymenoptera: Apidae). Nederlandse Faunistische Mededelingen 3: 1–48.

Supplementary material 1

Biomechanical model used to compare the mandibular strength among *Osmia* species of the subgenus *Melanosmia*

Authors: Andreas Müller, Rainer Prosi, Christophe Praz, Henning Richter

Data type: PDF file

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Link: https://doi.org/10.3897/alpento.3.34409.suppl1

Supplementary material 2

Mandibular strength of nine European *Osmia* species of the subgenus *Melanosmia*

Authors: Andreas Müller, Rainer Prosi, Christophe Praz, Henning Richter

Data type: PDF file

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Link: https://doi.org/10.3897/alpento.3.34409.suppl2

Supplementary material 3

List of distributional data of *Osmia nigriventris*

Authors: Andreas Müller, Rainer Prosi, Christophe Praz, Henning Richter

Data type: XLS file

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PENSOFT

Alpine Entomology

Review of the endemic New Zealand genus *Arctesthes* Meyrick (Lepidoptera, Geometridae, Larentiinae), with descriptions of two new range-restricted species

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Abstract

The genus *Arctesthes* Meyrick (Geometridae: Larentiinae: Xanthorhoini), endemic to the South Island of New Zealand, is revised. Four species are recognised, including two new species, as follows: *Arctesthes catapyrrha* (Butler, 1877), *A. siris* (Hudson, 1908), *A. titanica* **sp. nov.** and *A. avatar* **sp. nov.** All except *A. catapyrrha* are restricted to subalpine and alpine localities. Adults and genitalia are fully described and illustrated for all species; larvae of *A. catapyrrha* are also briefly described and illustrated. Only *Arctesthes catapyrrha* is widespread; *A. siris* is restricted to a few mountain ranges of Central Otago; *A. titanica* is only known from two wetland localities in the Von Valley of the Otago Lakes district, and *A. avatar* is only known from a few wetlands in a restricted area of north-west Nelson. The two new species are considered of very high priority for conservation.

Introduction

New Zealand has a relatively diverse and almost entirely endemic fauna of Geometridae, with Larentiinae by far the best represented subfamily (e.g., Dugdale 1988). Within Larentiinae, Xanthorhoini contains a few endemic genera (e.g., *Notoreas* Meyrick, *Asaphodes* Meyrick) that have radiated extensively in the alpine areas of the South Island; there are also genera (e.g., *Aponotoreas* Craw) that are shared with Australia. The larentiine fauna remains largely unrevised, and much further work is needed at both genus and species level. Craw (1987) usefully summarised the history of the genus classification of New Zealand Xanthorhoini. We here revise the small, endemic xanthorhoine genus *Arctesthes*.

Butler (1877) described the attractive little diurnal *Arctesthes catapyrrha* (as *Fidonia* (?) *catapyrrha*), from specimens brought to England by J. Hector and J.D. Enys. It was made the type and only species of a new genus *Stratonice* by Meyrick (1884); he later replaced this preoccupied name with *Arctesthes* (Meyrick 1885a). He also (Meyrick 1885b) incorrectly synonymised *catapyrrha* with a superficially similar Australian species, *Coremia euclidiata* Guenée (now *Chrysolarentia euclidiata*: see, e.g., McQuillan and Edwards 1996), and this was followed by subsequent authors (Fereday 1898, Hudson 1898), until Longstaff (1912: 114) pointed out the error.

Ironically, the only species hitherto assigned to the genus *Arctesthes* in its original description is *A. chrysopeda*,

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described by Meyrick (1888) (under *Arcteuthes*, a misspelling). This species is not an *Arctesthes*; it was transferred to its current placement in *Notoreas* by Craw (1986). Hudson (1898) referred *catapyrrha* (as *euclidiata*) and *chrysopeda* to the European genus *Lythria* (actually a genus of Sterrhinae: Õunap et al. 2008), presumably on the advice of Meyrick, who adopted the same classification in his later revision of New Zealand Geometridae (Meyrick 1917). The new species *siris* from Central Otago was also described by Hudson (1908) in *Lythria*; the genus name *Arctesthes* had already fallen into disuse. It was resurrected by Craw (1986) in his review of the genus *Notoreas*.

The two *Arctesthes* species described here were discovered in 2004 and 2012, and are therefore the first new species of this genus found since the discovery of *A. siris* in 1906. They are closely related and very similar, but differ from the previously known species in their size and especially in some features of the genitalia, necessitating a broader definition of the genus. Since the two new *Arctesthes* species are readily identifiable and clearly distinct based on morphological characters, both external and genitalic, we have described them here without presenting data on DNA barcodes. However, molecular work is in progress and barcodes will be added to the Barcode of Life Data System (BOLD) when available.

All four *Arctesthes* species are confined to open grassland or wetland habitats of the South Island, and only *A. catapyrrha* has been found in lowland localities (below 600 m), though it is also common in the subalpine and alpine zones.

Materials and methods

Genitalia dissection followed standard techniques for Lepidoptera, as described by e.g. Robinson (1976) and Hoare (2000). Genitalia and abdominal pelts were mounted in Euparal on slides. Staining was with 1% Chlorazol Black E, except for abdominal pelts, which were stained first in Chlorazol Black, and then in a 3% solution of acid fuchsin in 70% ethanol. For some male specimens, the vesica was gently picked out from the phallobase using fine forceps; the diameter of the phallobase is too small to insert a syringe and allow inflation. Abdominal pelts were opened up along one side so that both tergites and sternites could be viewed in a single plane.

Terminology for wing markings follows Patrick et al. (2010). Two-letter abbreviations for regions of New Zealand follow Crosby et al. (1998), but are summarised here for readers unfamiliar with the system (order is roughly north to south through the South Island): NN Nelson; WD Westland; MB Marlborough; KA Kaikoura; MC Mid Canterbury; SC South Canterbury; MK Mackenzie; OL Otago Lakes; CO Central Otago; DN Dunedin; FD Fiordland; SL Southland.

The following acronyms are used for collections where specimens are held:

BLNZ: Brian Lyford private collection, Queenstown, New Zealand
BMNH: British Museum (Natural History), London, England
BPNZ: Brian Patrick private collection, Christchurch, New Zealand
MONZ: Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand
NZAC: New Zealand Arthropod Collection, Manaaki Whenua—Landcare Research, Auckland, New Zealand

Specimens currently in private collections are all destined for eventual deposition in New Zealand museums and research institutions.

Latitude and longitude for type localities was derived from the online gazetteer Topomap NZ (https://www.topomap.co.nz/) and not from GPS readings. We have designated a holotype but only a few paratypes of each new species, as paratypes have no name-bearing status in zoological nomenclature (cf. van Nieukerken et al. 2016: 4).

BHP keeps a record of all Lepidoptera seen by him in notebooks; numbers of records quoted for each species from these notes relate to the number of separate sightings (one sighting = presence on one date at one locality), i.e. a sighting may be of several or many specimens.

Taxonomy

Genus *Arctesthes* Meyrick, 1885

Arctesthes Meyrick, 1885. New Zealand Journal of Science 2: 589. Replacement name for *Stratonice* Meyrick, 1884 (Transactions and proceedings of the New Zealand Institute 16: 64; unavailable, preoccupied by *Stratonice* Malmgren, 1867 (Annelida: Polychaeta)). Type species: *Fidonia catapyrrha* Butler, 1877, by original monotypy.

Arcteuthes Meyrick, 1888. Transactions and proceedings of the New Zealand Institute 20: 47. Incorrect subsequent spelling.

Diagnosis. Based on the redescription by Craw (1986) and on comparison of specimens and genitalia slides in NZAC, *Arctesthes* is closely related to *Notoreas*. It can be distinguished from *Notoreas* by features of the male genitalia, as follows: in *Arctesthes* the juxta is a single tongue-like plate; in *Notoreas*, the base plate is emarginate and separated from a posterior sclerite (the ventral manica pad of Craw (1986)) by membrane; in *Arctesthes*, the labides are short to moderately long and robust (very short in *A. siris*); in *Notoreas*, they are usually long to very long and narrow; the costal sclerite of the valva in *Arctesthes* is small and smooth; in *Notoreas* it is very large and strongly scobinate. The larvae of *Notoreas* are restricted to Thymelaeaceae as host-plants; known larvae of *Arctesthes* are more or less polyphagous on herbaceous plants.

Redescription (updated from Craw (1986)). Small diurnal larentiines with cryptic forewings and black and orange hindwings. Head: male antennae bipectinate, with pectinations 3–5× width of flagellum; female antennae

simple. Male abdominal segments 7–8 reduced; S7 with short, eversible pouch-like coremata. Male genitalia: uncus moderately short to rather long, narrow, digitate, curved; valva more or less oblong, with costa sclerotised for ca ½ valva length and more or less projecting beyond outline; sacculus ending in small weakly scobinate cushion-like (*catapyrrha*, *siris*) or large, curved, spinulose projection (*titanica*, *avatar*); juxta tongue-like; dorsal manica pad strongly scobinate / coarsely spinulose; phallobase tapering; vesica with 2–3 small spine-like cornuti only (*catapyrrha*), with 3 spine-like cornuti and a comb-like group (*siris*) or with 2 comb-like groups of cornuti (*titanica*, *avatar*). Female genitalia : ovipositor lobes (papillae anales) forming compact 'pad', strongly setose throughout; apophyses posteriores long and narrow; apophyses anteriores much shorter and more robust; S8 sclerite narrow, strap-like; ostium very narrow (*catapyrrha*, *siris*) to very broad (*titanica*, *avatar*); ductus bursae variable in sclerotisation and rugosity; ductus seminalis arising dorsally at ductus / corpus bursae junction; corpus bursae weakly membranous, more or less round, without signa.

Distribution. Endemic to the South Island of New Zealand.

Biology. Adults diurnal. Known larvae (*catapyrrha*, *siris*) more or less polyphagous on low herbaceous plants in native and / or modified swards.

Remarks. Craw (1986: 132) included the following characters in his redescription of *Arctesthes*: 'sacculus reduced, no free arm; apex a rounded, low mound...vesica with three cornuti...ostium a narrow circular opening... ductus bursae much longer than wide'. These have been revised in the description above following the discovery of *A. titanica* and *A. avatar*. Males of both new species have a large free arm of the sacculus, and a pair of comb-like groups of cornuti in the vesica; females of both have a very broad ostium and a ductus bursae that is wider than long. Craw (1986) also overlooked the presence in *A. siris* of a set of close-set comb-like cornuti in the vesica; only *A. catapyrrha* has the cornuti reduced to 2 or 3 in number as per his description. In spite of their differences from the previously described species, *A. titanica* and *A. avatar* are referred to *Arctesthes* based on the other morphological characters mentioned in the Diagnosis above; as stated elsewhere, further studies on the phylogeny and genus classification of New Zealand Xanthorhoini are needed.

Arctesthes catapyrrha (Butler, 1877)

Figs 1–6, 14, 18, 20–23, 30, 34 (map)

Fidonia? catapyrrha Butler, 1877. Proceedings of the Zoological Society of London for 1877: 392, pl. 43 fig. 2.

Arctesthes catapyrrha kaikourensis Prout, 1939. In Seitz, A., The Macrolepidoptera of the World (Stuttgart) 12: 247. Described as subspecies; synonymised (by implication) by Dugdale (1988: 171, as 'ab. *kaikourensis*'); synonymy upheld here.

Type material. *Fidonia catapyrrha*: Lectotype: male (here designated), 'Type [red-ringed circular label] / N. Zeal. 77.34 / Fidonia catapyrrha Butler Type' (BMNH) (not examined, but photograph seen).

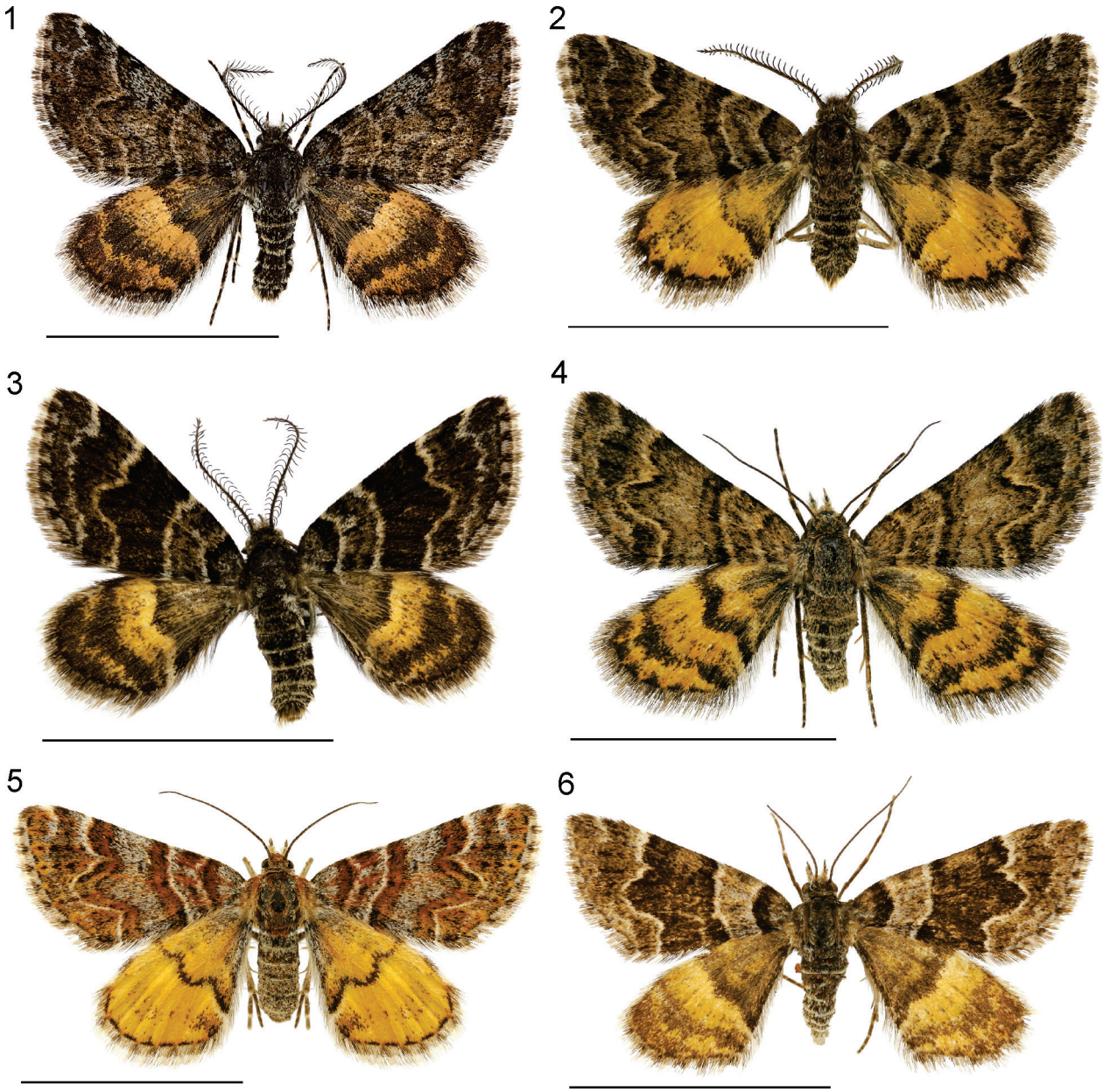
Note. *Fidonia catapyrrha* was described from an unspecified number of specimens, but since Butler (1877) stated that it was in both collections that he had received (from Enys and Hector), he clearly had more than one specimen. There is no mention of type material in the original description, so the type series must be regarded as syntypic (ICZN Article 73.1) and neither the labelling of a specimen by Butler as 'Type' (Dugdale 1988: 171) nor the mention of a holotype by Dugdale constitutes a valid lectotype designation (Article 74.5). The specimen hitherto regarded as holotype is here designated lectotype to prevent further confusion. Hector's collection was probably largely from Otago and Enys' from mid-Canterbury: Dugdale (1988: 171) suspected the lectotype to be from Canterbury based on the strong red flush on the hindwing underside, but this character is not restricted to Canterbury specimens and cannot be relied on as an indication of the type locality.

Arcesthes catapyrrha kaikourensis: Lectotype: male (designated by Dugdale (1988: 171)), 'Mt Tapuae-nuku (slopes of) 1.3.16 / 219z' (MONZ) (not examined but photograph seen).

Note. Prout (1939) clearly described *kaikourensis* as a subspecies rather than an aberration of *catapyrrha*, so the name is available under the Code; Dugdale (1988: 171) incorrectly listed the name as an aberration. The description of *A. c. kaikourensis* runs as follows: 'According to Hudson (1928): "a local variety occurs in the Kaikoura Mountains, having the upperside of the hindwing bright orange."' Based on this, and the lack of specimens under this name in the BMNH (J.S. Dugdale, notebooks), it is very likely that Prout took the remarkable action of describing the subspecies without seeing any material. This does not affect the availability of the name (ICZN Article 13.1). Specimens with bright orange hindwings occur perhaps throughout the range of *A. catapyrrha*, and there appears to us no evidence to support the separation of any populations as subspecies. Therefore the synonymy implied by Dugdale (1988) in indenting this name under *catapyrrha* is upheld here.

Diagnosis. Differences from *A. siris* and *A. titanica* are detailed under those species, below.

Redescription. *Adult male* (Figs 1–3, 14, 18): Wingspan 14–19 mm. Antennal pectinations long, up to ca 4–5× flagellum width. Labial palpi with numerous long erect black hairlike scales laterally and ventrally, mixed with long white hairlike scales ventrally. Head and thorax grey to blackish, with variable admixture of white scales, sometimes with suffusion or overlay of bright orange-brown scaling of varying extent; strip of pure white scales along antero-ventral margin of eye. Forewing ground colour (areas between transverse markings) grey to blackish depending on variable admixture of whitish scales; proximal line white to greyish, with gentle convex curve (away from wing base); antemedian line white to greyish, with gentle convex curve; discal dot black, more



Figures 1–6. *Arctesthes catapyrrha*, uppersides. **1)** Male, Yaldhurst MC; **2)** Male, Harris Mts OL **3)** Male, [locality unknown]; **4)** Female, Dunstan Range CO; **5)** Female, Ben Lomond OL; **6)** Female, Ben Lomond OL. Scale bars: 10 mm.

or less equidistant between antemedian and postmedian lines or closer to antemedian; central fascia usually pallid in central band around discal dot, dark lines or bands either side of this band parallel with antemedian and postmedian lines; postmedian line greyish to white, strongly sinuous, with large V- to U-shaped evagination centrally, section between evagination and costa straight to weakly convex; veins often more or less distinctly lined blackish beyond discal cell; distal line whitish, often indistinct; fringe basally more or less distinctly chequered, distally whitish to grey. Forewing sometimes with suffusion of bright orange-brown scaling, especially along veins and in terminal area. Hindwing ground colour bright orange; basal blotch more or less suffused blackish; antemedian line distinct, weakly W-shaped, blackish; postmedian line very variably developed, sometimes almost obsolete, sometimes more or less continuous with terminal line, leaving only narrow orange area between, blackish, weakly V-shaped; terminal line a blackish suffusion, often obsolete; series of black dashes along termen distinct in specimens with terminal line obsolete; fringe basally blackish, distally greyish to white, sometimes with weakly chequered appearance. Forewing underside (Fig. 14) pale to bright orange; antemedian line indistinct or absent; discal dot distinct, black; postmedian line usually distinct, black, sometimes double centrally, with strong median evagination; white spot on costa between postmedian line and subterminal fascia; subterminal fascia more or less developed as blackish suffusion bordering subterminal line towards costa, sometimes continued as narrower line

to tornus; subterminal line white, usually only distinct towards costa; terminal fascia blackish, often suffused bright reddish brown or rose-brown towards apex, sometimes obsolete (i.e. termen orange as ground-colour). Hindwing underside pale orange (this colour usually confined to a wedge-shaped streak in wing centre); a more or less well-defined strip along costa and around termen bright rose-brown, this colour sometimes extending as suffusion through centre of wing to base; broad white streaks subcostally and along anal margin to 2/3 length of wing; subbasal, antemedian and postmedian lines usually very distinct and rather broad, blackish, sometimes postmedian indistinct or obsolete; antemedian line sometimes preceded by distinct spot above middle; postmedian line with variably defined narrow white distal margin. Abdomen blackish, sprinkled white and with distal margin of each segment white; anal tuft mixed blackish and white.

Male abdomen and genitalia (Figs 21–23): S3-6 moderately elongate (rectangular), either uniformly well sclerotised or rather weakly sclerotised except along caudal margin; T2-6 either evenly sclerotised, or sclerotisation strongest in 2 lateral patches caudally on each segment. Uncus digitate, moderately robust, very blunt apically; labides robust, straight to gently curved, with weakly to strongly hooked apices; dorsal scobinate portion of manica with blunt teeth of various sizes; juxta tongue-shaped to arrowhead-shaped; valva very short, with smoothly rounded apex; basal costal sclerite with straight or concave costal edge, ending in blunt process more or less strongly projecting beyond valval costa; sacculus process a short rounded lobe, not reaching valval costa, finely and evenly scobinate; saccus short to long, blunt, Y-shaped, variably recurved under genital capsule. Phallus (Fig. 23) with tongue-like apical process; vesica with 2 or 3 small, rather weakly to moderately melanised spine-like cornuti.

Adult female (Figs 4–6): Wingspan 14–20 mm. Similar to male, but antennae without pectinations; labial palpi without lateral hairlike scales and with ventral scaling much shorter than in male, usually white without or with few black scales; forewing and hindwing both tending to be slightly narrower than in male; forewing markings tending to be better defined with cross-lines more distinct and central fascia often broader; hindwing upperside with postmedian line usually less distinct than in male.

Female genitalia (Fig. 30): Total length ca 2.4–2.8 mm. Ovipositor lobes subtriangular, apically blunt. S8 with strongly sclerotised, strongly concave, round to lobe-shaped lamella postvaginalis. Ostium round, narrow; antrum a variably distinct flask- or cup-shaped sclerotised chamber; ductus bursae with strongly rugose posterior portion and smoothly sclerotised anterior portion. Corpus bursae membranous, round to oblong.

Distribution. (Fig. 34). Widespread in the central and southern South Island, becoming very local north of mid-Canterbury and not definitely known from the Nelson district. Hudson (1928) gives ‘near Nelson’, but no specimens from this area have been seen in collections and the record requires confirmation.

WD, MB, KA, MC, SC, MK, OL, CO, DN, FD, SL

Biology. This small geometrid is widespread in open low vegetation in the eastern and central South Island, but also near the West Coast in riverbed vegetation. It is found in coastal turfs (i.e., saltmarsh, dune slacks, and river-mouth habitats) as well as riverbeds, river terraces, saltpans, kettleholes, lake-edge turfs and short tussock grasslands of the interior valleys; it also occurs up to 1920 m on the drier eastern and central South Island mountains in cushionfield, snow banks, wetland and open, often depleted grasslands. It can be locally abundant over cushionfield, bare ground or low herbs and grasses, flying by day low to the ground. It often settles and is easily observed as it sunbathes on bare ground or low vegetation, or feeds on flowers (e.g. *Aciphylla aurea* (Apiaceae), *Gentiana* spp. (Gentianaceae)). The species is a survivor and can sometimes be found in quite modified short and open grasslands, some of which are kept short by local management needs, such as at the Saint Clair Golf Course in Dunedin or Waimate Airstrip.

The brightly coloured larvae (Fig. 20) (Patrick and Chisholm 1989) are polyphagous, having been found and reared from various native and exotic plant species including *Trifolium* (exotic clover, Fabaceae), the creeping *Nertera balfouriana*, *Nertera setulosa*, and *Coprosma atropurpurea* (all Rubiaceae), *Scleranthus, Stellaria* and *Colobanthus* (all Caryophyllaceae), *Polygonum plebeium* (Polygonaceae), *Oreomyrrhis rigida* (Apiaceae) and the cushionplant *Raoulia tenuicaulis* (Asteraceae). In captivity the larvae will readily feed on *Plantago* and *Epilobium* and as these plants are present at many of its known sites, they are possible natural hostplants. Interestingly larvae have been observed in captivity to be cannibalistic on fellow larvae that had died. The larvae are active by day, and grow to 16mm. No detailed description of the larva is available, but a drawing of the habitus was provided by Craw (1986: fig. 21) and a brief description is made here from photographs (see Fig. 20): the head is reddish brown with paler marbling; prothorax red-brown dorsally; the body pale grey to rosy pink, with an interrupted broad green dorsal line on the abdominal segments, bordered by oblique subdorsal stripes that are green anteriorly and black posteriorly; there is some white between the dorsal line and the subdorsal stripes; the stripes merge on the thorax into a broad blackish subdorsal line tinged green centrally; anal prolegs brown. Larvae move forward with a quick, repetitive, jerking action.

The adults first appear by mid-September at low altitude sites, and the last records are from early May. Most alpine and high alpine records are between December and March. There appear to be up to three generations per year at lowland and inland montane sites, but perhaps just one at the highest altitudes.

Remarks. This is a common and widespread species: BHP has made 214 records since 1971 (BHP notebooks, Christchurch). There is considerable variation in the form of the saccus in the male genitalia of *A. catapyrrha*. While most specimens have a long saccus that is more or less

aligned with the genital capsule (Fig. 22), a few have a much shorter saccus that is recurved beneath the capsule. Since this character does not seem to align consistently with any other morphological character or any area of distribution, and since one specimen from Mt Maungatua DN (genitalia slide NZAC Geo. 45) has a saccus of intermediate form, no taxonomic significance is accorded to the variation here.

Prout (1939) described ab. *fasciata* as a form of *Arctesthes catapyrrha*. Dugdale (1988: 171) mentions a female 'holotype' collected by Philpott at Ben Lomond OL designated by Prout in the BMNH. Since the original description makes it clear that the name *fasciata* refers to an aberration, it is infrasubspecific and therefore unavailable (ICZN Article 45.6.2). The provisions of the Code do not apply (Article 1.3.4), and no type material was mentioned in the original description, so the 'holotype' mentioned by Dugdale has no nomenclatural status.

Arctesthes siris (Hudson, 1908)

Figs 7, 8, 15, 24, 25, 31, 35 (map)

Lythria siris Hudson, 1908. Transactions and proceedings of the New Zealand Institute 40: 106.

Type material. Lectotype: male (designated by Dugdale (1988: 171)), '725a' [corresponding entry in G.V. Hudson collection register: 'Old Man Range at about 4000 ft. Feb '06 (J.H. Lewis)'] (MONZ) (not examined but photograph seen).

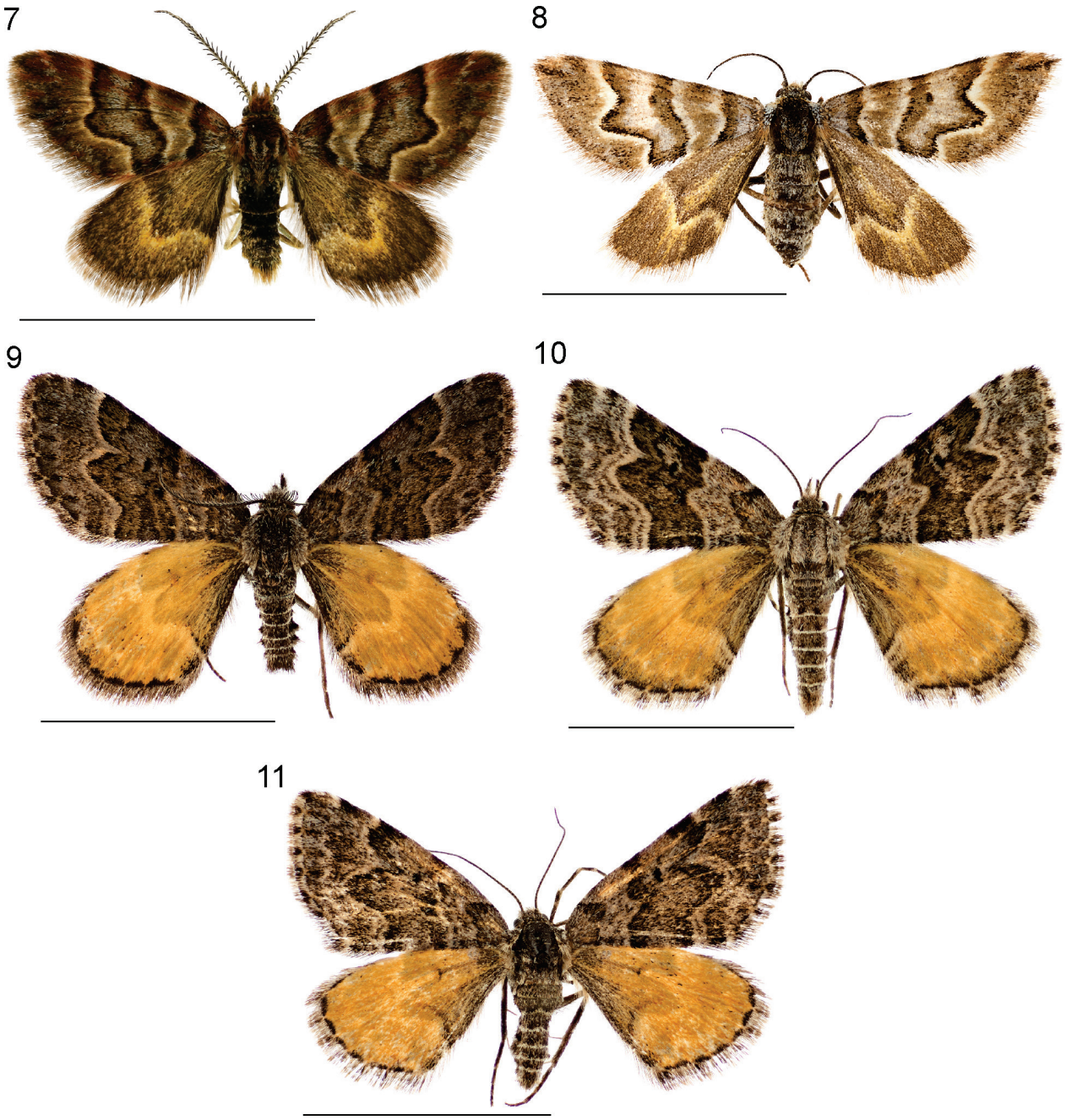
Diagnosis. *Arctesthes siris* is similar to *A. catapyrrha*, but on average smaller. It is easily distinguished by the proximal line of the forewing, which has a distinct concave curve below the middle of the wing; the proximal line in *A. catapyrrha* is convex (bowed away from the wing base). The hindwing pattern also differs strongly from that of *catapyrrha*: in *siris*, the orange coloration is only present as rather narrow V-shaped band beyond the basal blotch and as scattered scales elsewhere; in *catapyrrha*, orange is the dominant hindwing colour. The dark antemedian line that borders the hindwing basal blotch is much more strongly V-shaped than in *catapyrrha*.

Redescription. *Adult male* (Figs 7, 15): Wingspan 14–16 mm. Male antennal pectinations shorter than in *A. catapyrrha*, up to ca 3–4× flagellum width. Labial palpi without hairlike scales projecting laterally, with moderately short, erect white to reddish brown hairlike scales ventrally. Head and thorax deep pinkish mixed with black and white; strip of pure white to deep pinkish scales along antero-ventral margin of eye. Forewing ground colour (areas between transverse markings) pale greyish brown, usually suffused with deep pinkish at least towards costa and dorsum and along veins distally; proximal line white, with slight concave curve below mid-wing; antemedian line white, gently sinuous; discal dot black, more or less equidistant between antemedian and postmedian lines or closer to antemedian; central fascia usually pallid, greyish in central band around discal dot, suffused pale brown exteriorly, dark lines or bands either side of this band contiguous with antemedian and postmedian lines; postmedian line white, strongly sinuous, with large V- to U-shaped evagination centrally, section between evagination and costa straight to very weakly convex; veins not lined blackish beyond discal cell; distal line grey, indistinct; fringe greyish, not chequered. Hindwing ground colour yellow-orange, but this colour only present as rather narrow V-shaped band beyond basal blotch and as scattered scales elsewhere; antemedian line strongly V-shaped and near wing centre; rest of wing suffused blackish without distinct lines; fringe brownish, paler distally. Forewing underside (Fig. 15) pale orange, with costa sometimes suffused deep pinkish; antemedian line absent; discal dot very small but distinct, black; postmedian line usually distinct, blackish, not double, with strong median evagination; no white spot on costa beyond postmedian line; subterminal fascia and subterminal line absent; terminal fascia represented at most by scattered suffusions of black scales. Hindwing underside pale orange, unmarked except for distinct black V-shaped antemedian line. Abdomen blackish, sprinkled white and orange, distal margin of each segment not usually distinctly paler; anal tuft mixed orange and white.

Male abdomen and genitalia (Figs 24, 25): S3-4 and 6 moderately elongate (rectangular), S5 more squarish, all sternites evenly sclerotised; T2-6 more or less evenly sclerotised but may have faintly desclerotised lines centrally and laterally. Uncus digitate, moderately robust basally, attenuate apically; labides rather short, broad, slightly curved, obliquely truncate apically; dorsal scobinate portion of manica with rather numerous blunt teeth; juxta triangular, with keel-like ventral lobe (juxta tending to flip over towards saccus in slide preparations); valva very short, rather narrow, with rounded-truncate apex; basal costal sclerite with straight costal edge, ending in short blunt process distinctly projecting beyond valval costa; sacculus process lobelike to distinctly pointed, just reaching valval apex, not scobinate; saccus very short, blunt, somewhat recurved under genital capsule. Phallus (Fig. 25) with tonguelike apical process; vesica with 2 moderately long and a comb-like group of smaller cornuti (longer cornuti more basal in uneverted vesica).

Adult female (Fig. 8): Wingspan 16 mm. Similar to male, but antennae without pectinations; labial palpi more or less as in male; forewing and hindwing both tending to be slightly narrower than in male; forewing tending to be slightly paler with middle portion of central fascia more whitish grey (though in specimens with narrower central fascia, entire fascia may be pale brownish and discal dot absent).

Female genitalia (Fig. 31): Total length ca 1.9 mm. Ovipositor lobes subtriangular, apically blunt. S8 with weakly concave lamella postvaginalis not clearly distinguished from remaining S8 sclerite. Ostium round, narrow; antrum not differentiated from posterior portion of ductus bursae; ductus bursae not sclerotised, but thickly membranous, with weakly rugose posterior portion



Figures 7–11. *Arctesthes* spp., uppersides. **7)** *A. siris*, male, Zero Gully, Waikaia River CO; **8)** *A. siris*, female, Rock and Pillar Range CO; **9)** *A. titanica*, male paratype, White Burn, Von River OL; **10)** *A. titanica*, female paratype, White Burn, Von River OL; **11)** *A. titanica*, female, Von River north branch OL. Scale bars: 10 mm.

roughly equal in length and width to smooth anterior portion. Corpus bursae membranous, round.

Distribution. (Fig. 35). Confined to Central Otago: occurs between 1050–1140 m on the Lammermoor Range and 1200–1380 m on the Rock and Pillar Ranges of eastern CO, 1050–1150 m on South Rough Ridge further inland, 1150–1620 m on the Garvie Mountains, Old Man and Old Woman Ranges of nuclear CO, and 1700-1850 m on the Pisa Range further west. The species is not known from the adjacent Umbrella Mountains or The Remarkables, but may have been missed there.

CO.

Biology. Confined to mountains, where it lives in cushion wetlands and snowbanks. The adults fly by day low over the open vegetation and are found between early December and mid April; they can be locally common in these habitats. Larvae have not been described but have been observed to feed on various low-growing plants including *Plantago* and *Coprosma* (BHP, pers. obs.); unfortunately no photographs are available.

Remarks. This local Central Otago endemic was discovered by railwayman J.H. Lewis in February 1906,

high (over 1320 m) on the Old Man Range. BHP has recorded it 37 times since 1982 from seven discrete alpine areas (see Distribution above). In low alpine habitats of Central Otago, both *Arctesthes catapyrrha* and *A. siris* can sometimes be found flying together in cushion wetlands, such as at 1400 m on Symes Road on the Old Man Range [45°20.5'S, 169°13.7'E].

Arctesthes titanica Patrick, Patrick & Hoare, sp. nov.

http://zoobank.org/BC0ADE2C-9DCF-4F9F-9A81-C2CA8D148D9F

Figs 9–11, 16, 26, 27, 32, 35 (map)

Type material. Holotype: male (pinned), 'NZ OL 800m White Burn Sth Br Von R 4 Feb 2006 B M Lyford / NZAC slide Geo. 29 genitalia ♂' [South branch of Von River: 45°13'S, 168°21'E] (NZAC). Paratypes (1 male, 2 females): 1 male, same locality as holotype, 6 Mar 2004, B. & H. Patrick (NZAC) (Figs 9, 16); 1 female, same data as holotype but not dissected (Fig. 10) (NZAC); 1 female, same locality as holotype, 18 Feb 2004, S. Morris (genitalia on slide NZAC Geo. 32) (NZAC).

Other material examined. 3 males, 3 females, same locality as holotype, 6 Mar 2004, B. & H. Patrick; 4 females, same data as holotype but not dissected; 1 female, OL: North Branch of Von River, 18 Feb 2006, B.M. Lyford; 3 females, North Branch of Von River, 17–18 Feb 2007, B.H. Patrick (Fig. 11). (NZAC, BLNZ, BPNZ).

Diagnosis. This species can easily be distinguished from *A. catapyrrha* by its larger size (in spite of the slight overlap in wingspan measurements, this is always a much more robust, larger-winged moth) and the almost unmarked hindwing upperside. The strongly 3-lobed antemedian line on the hindwing underside is also diagnostic. Differences from *A. avatar* are given under that species, below.

Description. *Adult male* (Figs 9, 16): Wingspan 21–22 mm. Male antennal pectinations up to ca 4× flagellum width. Labial palpi without hairlike scales projecting laterally, with moderately long, dark grey hairlike scales ventrally. Head and thorax blackish with admixture of scattered white to silvery grey scales; strip of pure white scales along antero-ventral margin of eye. Forewing ground colour (areas between transverse markings) mid-grey, suffused with pale ochreous brown in basal blotch, central fascia and along veins distally (brown colour appears darker when not seen under magnification); proximal line pale grey mixed pale brown, with slight convex curve towards costa; antemedian line pale grey mixed pale brown, rather strongly V-shaped centrally; discal dot black, closer to antemedian than to postmedian line; central fascia usually mid- grey in central band around discal dot, black, strongly suffused pale brown exteriorly; postmedian line pale brown mixed pale grey, strongly sinuous, with large V- to U-shaped evagination centrally, section between evagination and costa weakly to strongly convex; veins lined blackish and speckled pale brown beyond discal cell; distal line pale grey, rather indistinct; fringe dark grey, weakly chequered blackish. Hindwing ground colour bright orange; basal blotch suffused blackish except in narrow strip along costa, the suffusion extending along anal margin of wing to anal angle; antemedian line represented only by variable short dark section adjacent to anal margin, but pallid, more or less W-shaped underside fascia beyond antemedian showing faintly through in normal light (not or barely visible in strong overhead light); postmedian line obsolete, except for slight smudge on anal margin; terminal line obsolete, but series of black dashes along termen very distinct; fringe blackish, distally with some brownish white scale-tips. Forewing underside (Fig. 16) pale orange; antemedian line absent or present only as dark smudge on costa; discal dot small, distinct, black; postmedian line distinct only in costal 1/3 of wing or less, blackish, double, with upper part of strong median evagination usually still represented where lines fade, sometimes suffused brownish between the two lines; outer line more or less distinctly edged white towards costa; subterminal fascia represented by series of brown elongate smudges between veins in costal 1/3 of wing; terminal fascia distinct, brown, narrowing and petering out towards tornus; a series of dark dashes along termen. Hindwing underside pale ochreous brown; basal blotch with scattered whitish scales, distal end of blotch a dark brown line, roughly following contours of antemedian line; antemedian line strongly 3-lobed, with third lobe cut off by anal margin of wing, invagination between first and second lobes incorporating distinct elongate discal spot; a very distinct white fascia beyond antemedian line, following its contours; weakly defined postmedian line beyond fascia, blurred distally into broad brown distal area, which is bisected by whitish scalloped subterminal line. Abdomen blackish, sprinkled pale brown, distal margin of each segment narrowly white; anal tuft blackish, with some scales tipped brownish white.

Male abdomen and genitalia (Figs 26, 27): S3-4 and 6 elongate (subrectangular), S5 more squarish, all sternites evenly sclerotised; T2-6 evenly sclerotised. Uncus digitate, narrow, attenuate and minutely hooked apically; labides very large, robust, strongly C-shaped, blunt apically; dorsal scobinate portion of manica with rather numerous sharp teeth; juxta flat, broad, tongue-shaped, with rounded blunt apex; valva moderately short, rather narrow, with rounded apex; basal costal sclerite with central process distinctly projecting beyond valval costa, (apex of sclerite bluntly rounded); sacculus process very large, C-shaped, projecting well beyond valval costa and apex reaching just beyond valval apex, dorsally and apically with dense fine spinules; saccus moderately short, very weakly 3-pointed, hardly recurved under genital capsule. Phallus without distinct tongue-like apical process; vesica scobinate, with two symmetrical cornutal patches, each containing numerous rather long, curved spine-like cornuti.

Adult female (Figs 10, 11): Wingspan 19–22 mm. Similar to male, but antennae without pectinations; labial palpi with ventral scales mostly brownish white; forewing ground colour distinctly paler than in male, with central fascia more strongly contrasting; forewing fringe distinctly chequered dark and pale.

Female genitalia (Fig. 32): Total length ca 2.4 mm. Ovipositor lobes subtriangular, apically moderately blunt. S8 with lamella postvaginalis broad, smooth and flat, lacking concavity. Ostium very broad; antrum a squat, broad sclerotised chamber weakly differentiated from posterior portion of ductus bursae; ductus bursae thickly membranous, not distinctly rugose, short and broad. Corpus bursae membranous, round.

Distribution. (Fig. 35). At present only known from two localities in the valley of the Von River, south of Lake Wakatipu, Otago Lakes.

OL.

Biology. The species is only known from intermontane wetlands. Both the north and south branches of the Von River harbour rather extensive valley floor wetlands that are a mixture of cushion and moss bogs at 800–820m, surrounded by short tussock or copper tussock (*Chionochloa rubra* subsp. *cuprea*) grasslands; individual wetlands are approximately 0.1–0.4 ha in extent. The cushion plant *Oreobolus pectinatus* is the dominant cushion species, but a wide range of grasses, herbs and sedges share this habitat. Adult moths have been found on four occasions between 4 February and 6 March, but as they were relatively numerous each time and in good condition, their flight period probably extends from late January to late March at least. Adult females laid yellow eggs on leaves which hatched 13 days later. Larvae were given a variety of exotic and native herbs to feed on of which *Plantago,* prostrate-growing *Coprosma*, *Ranunculus*, *Bellis* and *Trifolium* were eaten; however, rearing was unsuccessful. The first instar larvae are brown-grey in colour and quite active. Unfortunately, no photographs were taken of the larvae.

Etymology. Based on its large wingspan compared to *A. siris* and *A. catapyrrha*, the species is named (with an element of hyperbole) after the Titans of Greek mythology, primeval deities of enormous size and strength, and by extension after the legendary but ill-fated 'Titanic', in its time the largest passenger ship ever built and the subject of the popular James Cameron movie of 1997 (see also Etymology under *A. avatar* below). The name is a Latin adjective.

Remarks. Given the narrow distribution of this species and the fragility of its wetland habitat in an area still managed for extensive pastoralism, this species is threatened with extinction. Although the moth is relatively abundant where it occurs, the habitat is small and vulnerable to damage from farming practices such as over-sowing, grazing, stock trampling and vehicle damage. Additionally the areas are mostly unfenced, so recreational vehicles have access to these wetlands and could easily inflict damage as has occurred elsewhere in Otago and Southland.

***Arctesthes avatar* Patrick, Patrick & Hoare, sp. nov.**

http://zoobank.org/FE52851D-72D6-46B8-B40B-8913C6290B43

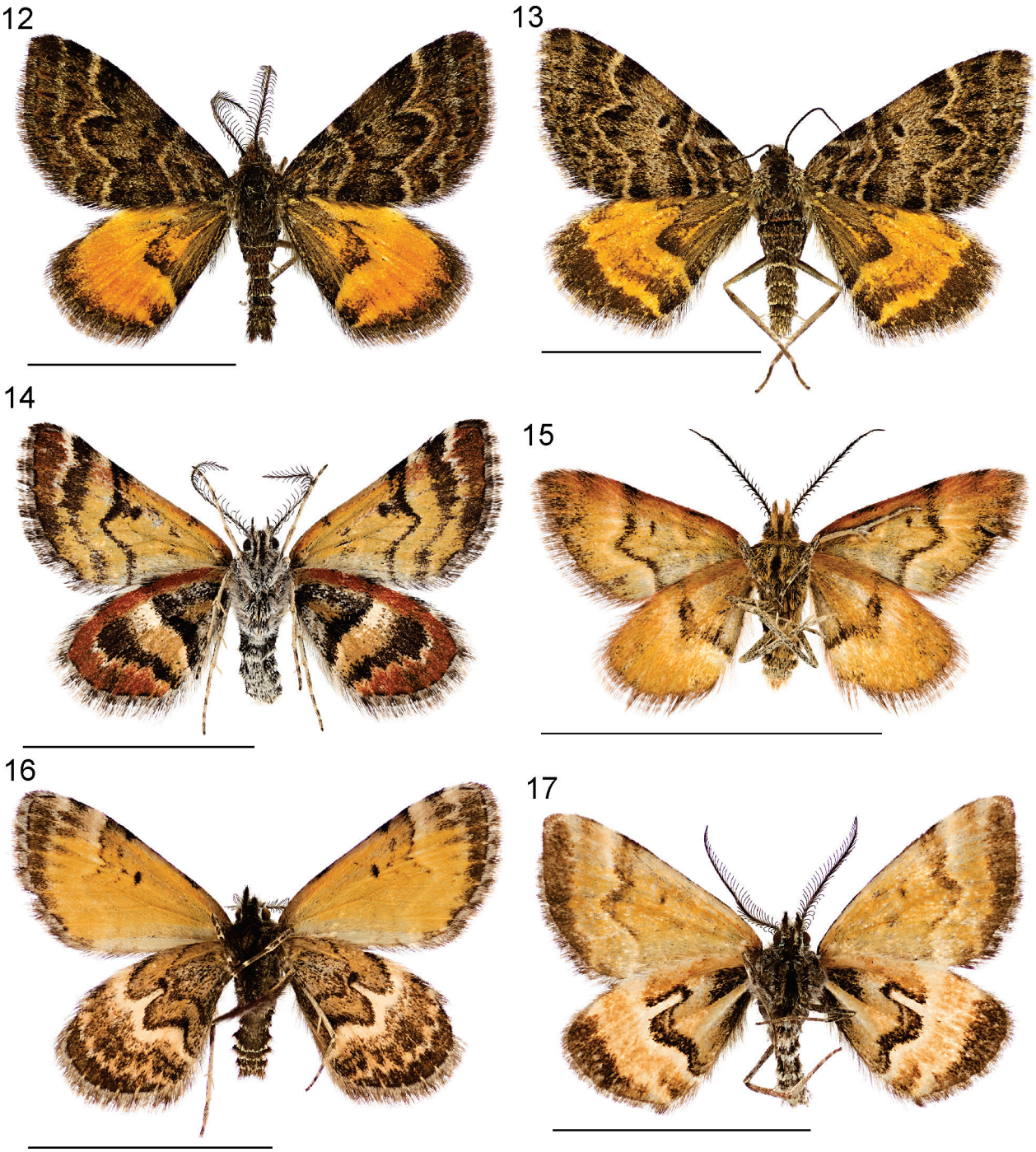
Figs 12, 13, 17, 19, 28, 29, 33, 35 (map)

Type material. Holotype: male (pinned), 'NEW ZEALAND NN Denniston - Rochfort wetland area 855m 16–18 Feb 2015 Brian Patrick / NZAC slide Geo. 46 genitalia ♂' [41°46.3'S, 171°45.3'E] (NZAC). Paratypes (1 male, 1 female): 1 male, NN: Denniston Plateau 640–720 m, 16–18 Feb 2015, B.H. Patrick (Fig. 12); 1 female, NN: Mt Rochfort 1000m, 16 Feb 2015, B.H. Patrick (genitalia on slide NZAC Geo. 47) [41°46.7'S, 171°44.6'E] (both NZAC).

Other material examined. 1 male, same data as holotype; 2 males, 1 female (Fig. 13), NN: Denniston Plateau 640–720 m, 16–18 Feb 2015, B.H. Patrick; 1 male, Denniston Plateau wetland 650 m, 3 Mar 2012, B. & H. Patrick (Fig. 17). (BPNZ, NZAC).

Diagnosis. *Arctesthes avatar* is superficially similar to *A. titanica*. However, the species are almost certainly strongly allopatric and should be identifiable based on locality alone. The most conspicuous diagnostic characters are on the hindwing upperside and underside as follows: *A. avatar* has a very distinct wedge-shaped area of dark shading on the hindwing upperside from the base, enclosed by the strongly developed dorsal half of the antemedian line: in *A. titanica*, the antemedian line is reduced to a smudge on the anal margin only. *Arctesthes avatar* also has a strong dark terminal shade on the hindwing but lacks black dashes along the termen itself; in *A. titanica* the black dashes are present and distinct, but there is no terminal shading. The hindwing underside in *A. avatar* is predominantly very pale orange with only the antemedian line and terminal shading showing up conspicuously darker; in *A. titanica*, the hindwing underside is predominantly mid-brown with the area beyond the antemedian line and the subterminal line showing up conspicuously paler. In the male genitalia, the longer, narrower labides and much shorter sacculus process easily distinguish *A. avatar* from *A. titanica*.

Description. *Adult male* (Figs 12, 17): Wingspan 20–22 mm. Very similar to *A. titanica*, with the following differences. Forewing with antemedian and postmedian lines slightly better defined than in *titanica*; postmedian line with indentation above median evagination and level with discal spot tending to be more pronounced than in *titanica*. Hindwing with dark antemedian line reaching much further across wing than in *titanica* (about half way to costa), and then diverting basad to join small variably distinct discal dot; terminal line present as dark brown fascia, with weakly scalloped inner margin; black dashes along termen absent. Forewing underside (Fig. 17) with postmedian line more distinct than in *titanica* and almost complete, reaching to near dorsum. Hindwing underside with blackish suffusion from base; area basad of antemedian line largely pale orange (not brown) and without dark edging to basal blotch; white fascia beyond antemedian line rather indistinct; from here to terminal fascia



Figures 12–17. *Arctesthes* spp. **12)** *A. avatar*, male paratype upperside, Denniston Plateau NN; **13)** *A. avatar*, female upperside, Denniston Plateau NN; **14)** *A. catapyrrha*, male underside, Yaldhurst MC; **15)** *A. siris*, male underside, Zero Gully CO; **16)** *A. titanica*, male paratype underside, White Burn OL; **17)** *A. avatar*, male underside, Denniston Plateau NN. Scale bars: 10 mm.

pale brownish orange, with brownish smudge at anal angle representing postmedian line; subterminal line very faintly paler, not distinct as in *titanica* (where it stands out against brown background).

Male genitalia (Figs 28, 29): S3-4 elongate (subrectangular); S6 elongate (trapezoidal, tapered distally), S5 more squarish, all sternites evenly sclerotised; T2-6 evenly sclerotised. Uncus digitate, narrow and minutely hooked apically; labides large, robust (but distinctly narrower than in *A. titanica*), strongly C-shaped, blunt apically; dorsal scobinate portion of manica with rather few sharp teeth; juxta moderately narrow, flat, tongue-shaped, with rounded bifid apex; valva moderately short, rather narrow, with rounded apex; basal costal sclerite with sinuous central process, distinctly projecting beyond valval costa, (apex of sclerite bluntly rounded); sacculus process robust, short, truncate, with concave distal margin, barely projecting beyond valval costa and apex not reach-







Figures 18–20. *Arctesthes* spp., live adults and larva. **18)** *A. catapyrrha*, male; **19)** *A. avatar*, female; **20)** *A. catapyrrha*, larva.

ing valval apex, apically with dense fine spinules; saccus moderately short, V-shaped (narrower than in *A. titanica*), hardly recurved under genital capsule. Phallus without distinct tongue-like apical process; vesica scobinate, with two symmetrical cornutal patches, each containing numerous rather long, curved spine-like cornuti.

Adult female (Figs 13, 19): Wingspan 20 mm. Similar to male, but antennae without pectinations; forewing ground colour distinctly paler than in male, with central fascia more strongly contrasting; forewing fringe chequered dark and pale.

Female genitalia (Fig. 33): Total length ca 2.0 mm. As described above for *A. titanica*, but smaller; ovipositor lobes slightly blunter.

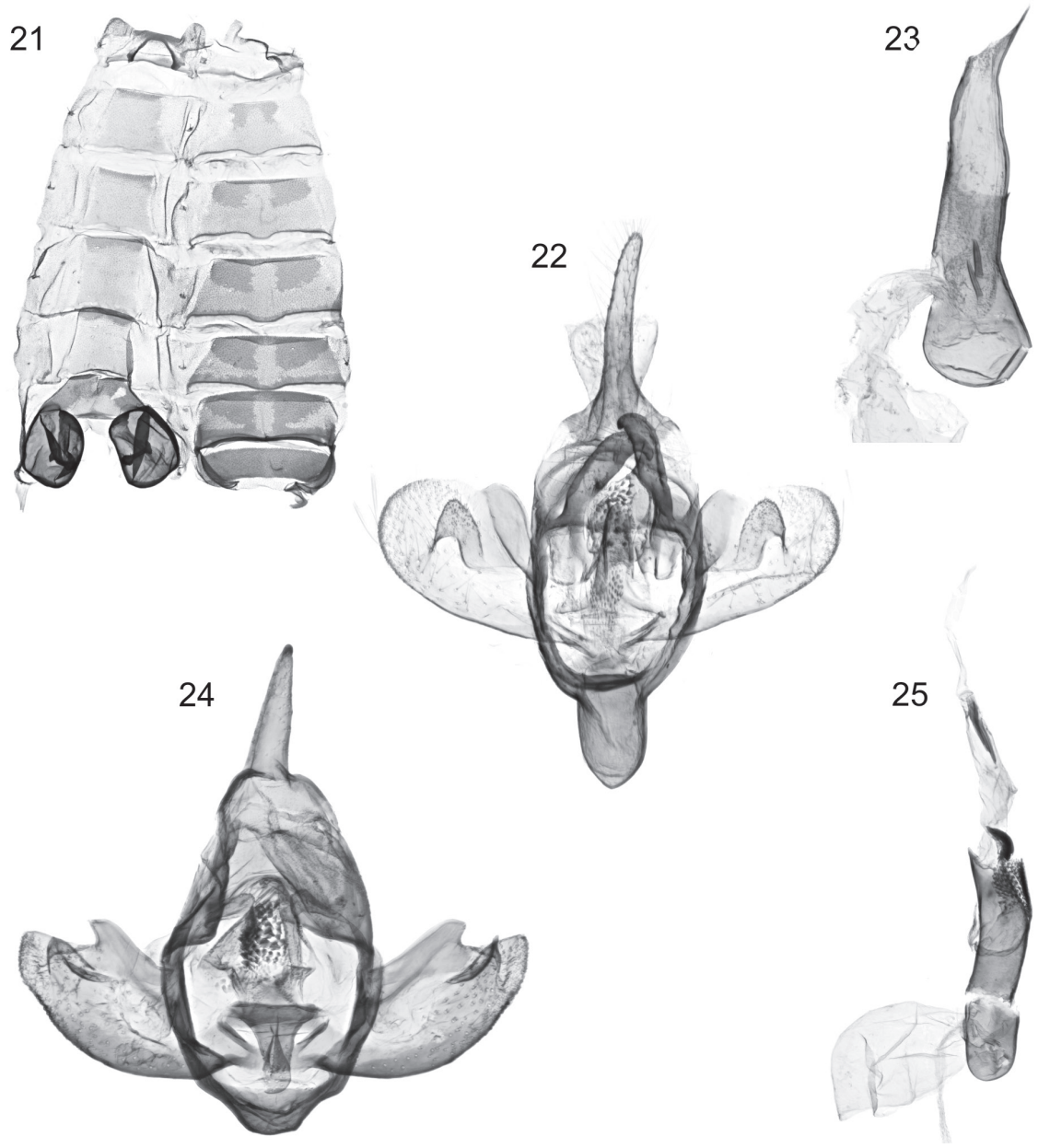
Distribution. (Fig. 35). Only known from the Denniston Plateau / Mt Rochfort area in the north-western South Island (Nelson district).

NN.

Biology. The species has been found at 640–1000 m a.s.l. in ephemeral wetlands of short sedges and herbs, including *Liparophyllum*, *Donatia*, *Ficinia*, *Oreobolus* and *Euphrasia* species. Specimens have been disturbed or taken flying by day from 6 February to 22 March. Females were observed to lay eggs in rows on the underside of leaves of *Liparophyllum gunnii* (Menyanthaceae) growing in the wettest areas. A larva reared from the egg in captivity was briefly described as brown dorsally, paler ventrally, and fed on dying leaves, stems and roots of *Liparophyllum*, but rearing was unsuccessful and it was not photographed. In a 2015 survey, BHP and Ian Millar found that *Liparophyllum* was the only dicot herb present at all sites where the moth was found, so, unlike other *Arctesthes* species, *A. avatar* may be monophagous on this plant.

Etymology. Forest & Bird, who organised the Denniston Plateau BioBlitz at which this species was found, ran a public competition to choose a name for this species. The 'avatar moth' was picked as the winning entry. The name refers to the James Cameron movie Avatar; like the indigenous people and fauna of that film, the moth is vulnerable to habitat change or destruction in its very limited area of occurrence. The original avatars of Hindu mythology were incarnations of deities, especially of Vishnu: one of these, Varaha the boar, is depicted in a Pahari miniature painting of ca 1740 with the black, white and orange coloration of *A. avatar* killing a demon and rescuing the Earth on his tusks (image available from Wikipedia: https://en.wikipedia.org/wiki/Chamba,_Himachal_Pradesh). The name is to be treated as a noun in apposition.

Remarks. The discovery of this species in 2012 was briefly discussed by Patrick and Patrick (2015). At first known only from a single specimen from one small site on the Denniston Plateau, it has since been discovered to be more widespread in wetlands from the Denniston Plateau to nearby Mt Rochfort, though still extremely localised and confined to potentially vulnerable wetland sites on the margins of a coal-mining area. The largest

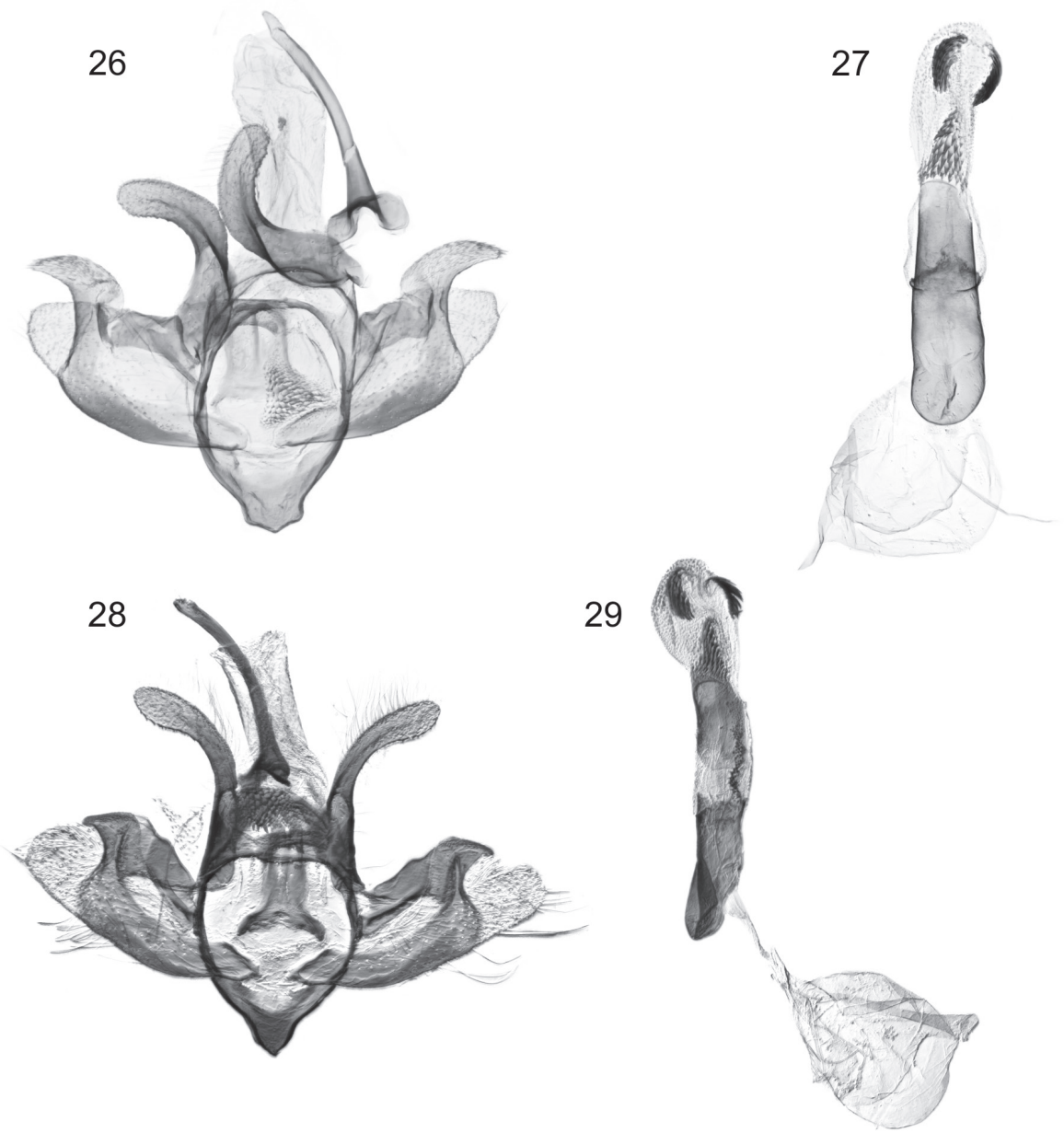


Figures 21–25. *Arctesthes* spp., male abdomen and genitalia (ventral view unless otherwise indicated). **21)** *A. catapyrrha*, male abdomen (unrolled); **22)** *A. catapyrrha*, genital capsule; **23)** *A. catapyrrha*, phallus; **24)** *A. siris*, genital capsule; **25)** *A. siris*, phallus.

known population currently exists on the northern side of the old Denniston soccer field, where a wetland sward has developed. As with *A. titanica*, a high conservation status is appropriate for this moth.

Discussion

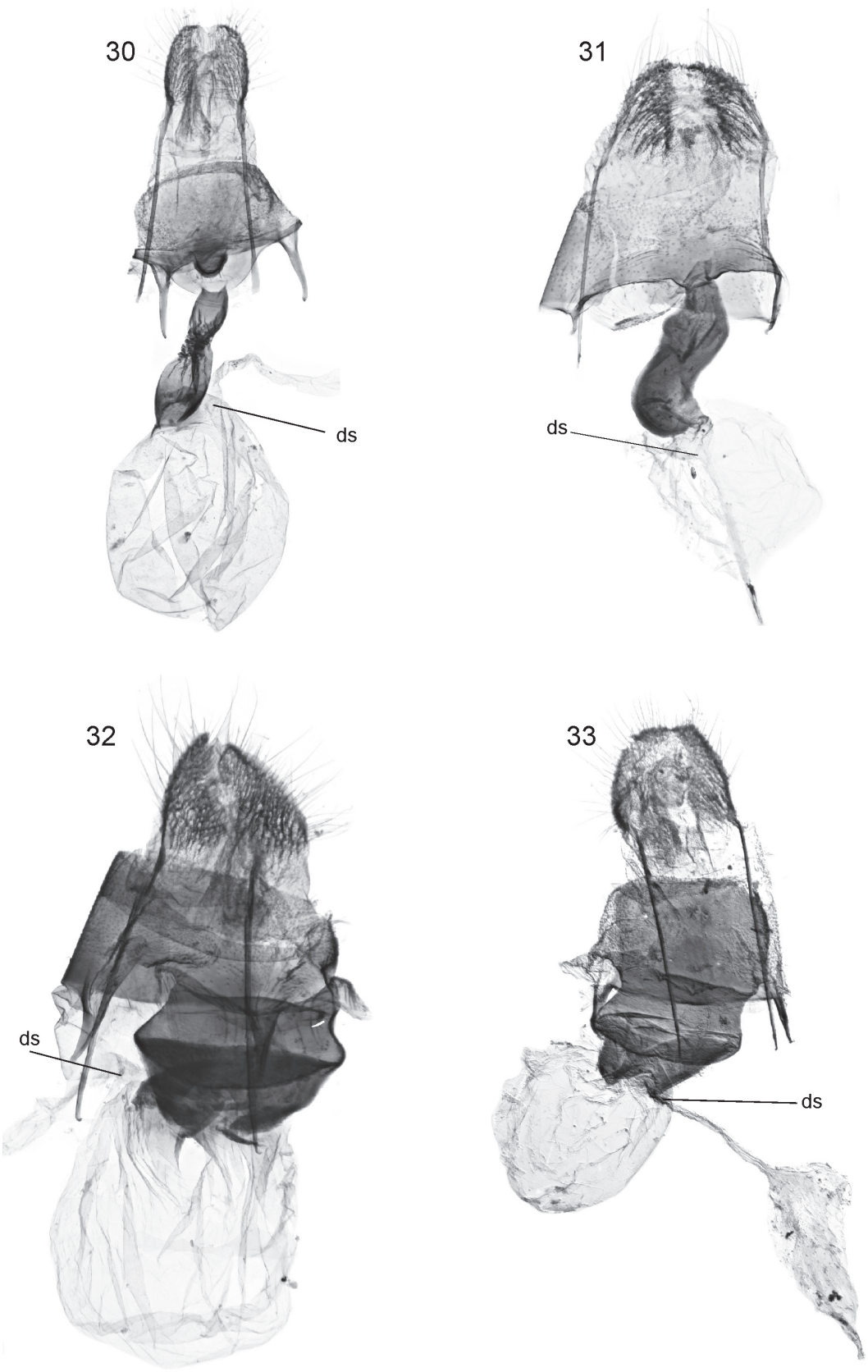
Hoare (2010a) listed 1703 named species and subspecies of New Zealand Lepidoptera: subsequent research on endemic genera (Patrick et al. 2010, Hoare 2010b, Hoare 2012, Hoare 2017) and on introduced species (Hoare and Hudson 2018) has brought that total to 1744. The Lepidoptera fauna is highly endemic at the species level (ca 85%): it can be characterised as moderately well collected, though many species are represented in collections by very sparse material, indicating that much remains to be discovered. The level of taxonomic understanding varies substantially between groups (cf. Dugdale 1988, Hoare 2010a), and knowledge of life histories is patchy and still lacking for a number of common species (cf. Hoare 2017). Many unnamed species are already recognised in collections and some of the more challenging groups (e.g. Psychidae, Gelechiidae, Oecophoridae) require substantial revision before the true composition of the fauna is understood. There are very few active collectors of Lepidoptera in the country at present. Nonetheless, earlier collectors covered much ground and did not neglect the



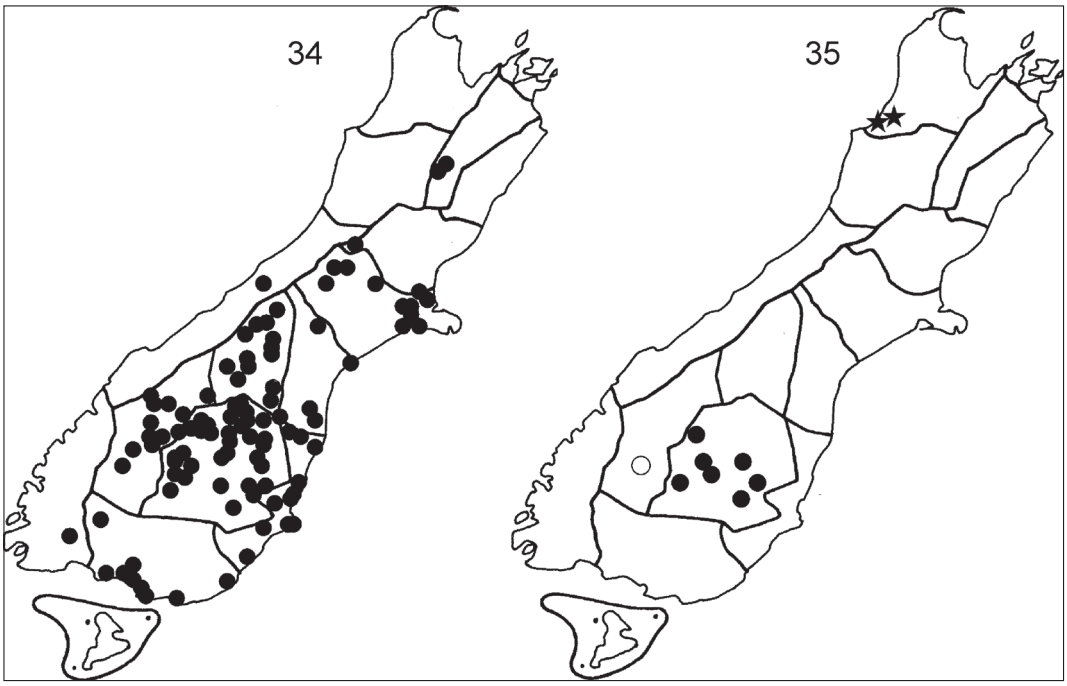
Figures 26–29. *Arctesthes* spp., male abdomen and genitalia (ventral view). **26)** *A. titanica* holotype, genital capsule; **27)** *A. titanica* holotype, phallus; **28)** *A. avatar* holotype, genital capsule; **29)** *A. avatar* holotype, phallus.

rich and extensive alpine zone of the South Island (see Dugdale (1988) for a historical summary). Further intensive surveys of the alpine zone from the 1960's to the present by John S. Dugdale, BHP and Brian M. Lyford (Queenstown) have greatly increased our knowledge. As a result, the discovery of previously overlooked endemic macro-moths is becoming a rare event. The two new species reported here are conspicuously patterned, day-flying insects; their late discovery must certainly be due to their extreme localisation in poorly sampled habitats. A very distinctive undescribed noctuid species has subsequently been found in the same habitat as *Arctesthes titanica* by B.M. Lyford, indicating the importance of the Von Valley as an area of narrow-range endemism in Lepidoptera.

We have described the two new *Arctesthes* species here to promote their future monitoring and conservation, and to highlight the need for continued Lepidoptera survey work in the New Zealand alpine zone. Quantitative studies as well as work on life histories and ecology are particularly needed. Already one formerly common endemic geometrid species, *Xanthorhoe bulbulata* (Guenée, 1868), has declined drastically and is feared possibly extinct (Patrick 2000, Hoare et al. 2017): its life history and host-plant have never been discovered. Without further intensive study of the fauna of modified and threatened New Zealand environments, we will be unable to prevent other species slipping away.



Figures 30–33. *Arctesthes* spp., female genitalia (ventral view). **30)** *A. catapyrrha*; **31)** *A. siris*; **32)** *A. titanica* paratype; **33)** *A. avatar* paratype; (ds = ductus seminalis inception).



Figures 34, 35. *Arctesthes* spp., known distribution, New Zealand: South Island. 34) *A. catapyrrha*; 35) *A. siris* (black circles); *A. titanica* (open circle); *A. avatar* (stars).

Acknowledgements

We are grateful to Eric Edwards, Department of Conservation, Invercargill, for showing BHP the collections of insects from the Von Valley that contained *Arctesthes titanica* in a timely manner, enabling an expedition to the site while the adults were still flying. We thank Forest and Bird for organising the BioBlitz on the Denniston Plateau in March 2012 that led to a further new species of *Arctesthes* being discovered. Additionally we acknowledge the skill and patience of Birgit Rhode of Manaaki Whenua—Landcare Research, Auckland, in taking and editing the colour photographs of set adult moths and structural features and putting together the plates. We sincerely thank Axel Hausmann and Pasi Sihvonen for their helpful reviews of this manuscript. This work was funded in part by Core funding for Crown Research Institutes from the Ministry of Business, Innovation and Employment's Science and Innovation group.

References

Butler AP (1877) On two collections of heterocerous Lepidoptera from New Zealand, with descriptions of new genera and species. Proceedings of the Zoological Society of London for 1877: 379–407.

Craw RC (1986) Review of the genus *Notoreas* (sensu auctorum) (Lepidoptera: Geometridae; Larentiinae). New Zealand Journal of Zoology 13: 131–140. https://doi.org/10.1080/03014223.1986.10422654

Craw RC (1987) Revision of the genus *Helastia* sensu stricto, with description of a new genus (Lepidoptera: Geometridae: Larentiinae). New Zealand Journal of Zoology 14: 269–293. https://doi.org/10.1080/03014223.1987.10422997

Crosby TK, Dugdale JS, Watt JC (1998) Area codes for recording specimen localities in the New Zealand subregion. New Zealand Journal of Zoology 25: 175–183. https://doi.org/10.1080/03014223.1998.9518148

Dugdale JS (1988) Lepidoptera – annotated catalogue, and keys to family-group taxa. Fauna of New Zealand 14. DSIR, Wellington. 282 pp.

Fereday RW (1898) A synonymic list of the Lepidoptera of New Zealand. Transactions and proceedings of the New Zealand Institute 30: 326–377.

Hoare RJB (2000) A new genus of primitive Nepticulidae (Lepidoptera) from eastern Australia, with a revised diagnosis of nepticulid subfamilies. Zoological Journal of the Linnean Society 128(3): 289–317. https://doi.org/10.1111/j.1096-3642.2000.tb00165.x

Hoare RJB (2010a) Lepidoptera. In: Gordon DP (Ed.) New Zealand Inventory of Biodiversity, vol. 2. Kingdom Animalia: Chaetognatha, Ecdysozoa, Ichnofossils. Canterbury University Press, 363–368 [introduction], 457–465 [checklist].

Hoare RJB (2010b) *Izatha* (Insecta: Lepidoptera: Gelechioidea: Oecophoridae). Fauna of New Zealand 65. Manaaki Whenua Press, Lincoln, 201 pp.

Hoare RJB (2012) A new species of *Hierodoris* Meyrick (Lepidoptera: Oecophoridae) with a telescopic ovipositor, from granite sand-plains in Fiordland. New Zealand Entomologist 35(1): 51–57. https://doi.org/10.1080/00779962.2012.651776

Hoare RJB (2017) Noctuinae (Insecta: Lepidoptera: Noctuidae) part 1: *Austramathes*, *Cosmodes*, *Proteuxoa*, *Physetica*. Fauna of New Zealand 73. Manaaki Whenua-Landcare Research, Auckland, 130 pp.

Hoare RJB, Dugdale JS, Edwards ED, Gibbs GW, Patrick BH, Hitchmough RA, Rolfe JR (2017) Conservation status of New Zea-

land butterflies and moths (Lepidoptera), 2015. New Zealand Threat Classification Series 20. Department of Conservation, 13 pp.

Hoare RJB, Hudson N (2018) Adventive moths (Lepidoptera) established in mainland New Zealand: additions and new identifications since 2001. Australian Entomologist 45(3): 273–324.

Hudson GV (1898) New Zealand moths and butterflies (macro-lepidoptera). West, Newman & Co., London, 144 pp. [13 pl.] https://doi.org/10.5962/bhl.title.7912

Hudson GV (1908) Recent observations on New Zealand macro-lepidoptera, including descriptions of new species. Transactions and proceedings of the New Zealand Institute 40: 104–107.

Hudson GV (1928) The butterflies and moths of New Zealand. Ferguson & Osborn Ltd., Wellington, 386 pp. [52 pls]

Longstaff GB (1912) On the nomenclature of the Lepidoptera of New Zealand. Transactions and proceedings of the New Zealand Institute 44: 108–115.

McQuillan PB, Edwards ED (1996) Geometridae. In: Nielsen ES, Edwards ED, Rangsi V (Eds) Checklist of the Lepidoptera of Australia. Monographs on Australian Lepidoptera, Vol. 4, 200–228.

Meyrick E (1884a) A monograph of the New Zealand Geometrina. Transactions and proceedings of the New Zealand Institute 16: 49–113.

Meyrick E (1885a) Notes on the nomenclature of the New Zealand Geometrina. New Zealand Journal of Science 2: 589.

Meyrick E (1885b) Supplement to a monograph of the New Zealand Geometrina. Transactions and proceedings of the New Zealand Institute 17: 62–68.

Meyrick E (1888) Notes on New Zealand Geometrina. Transactions and proceedings of the New Zealand Institute 20: 47–62.

Meyrick E (1917) Revision of New Zealand Notodontina. Transactions and proceedings of the New Zealand Institute 49: 248–273.

Õunap E, Viidalepp J, Saarma U (2008) Systematic position of Lythriini revised: transferred from Larentiinae to Sterrhinae (Lepidoptera, Geometridae). Zoologica Scripta 37: 405–413. https://doi.org/10.1111/j.1463-6409.2008.00327.x

Patrick BH (2000) Conservation status of two rare New Zealand geometrid moths. Science for Conservation 145. Department of Conservation, Wellington, 21 pp.

Patrick BH, Chisholm WP (1989) Lower Waitaki Hydro-electric Investigations. Entomology Survey Report. Report to Works Consultancy, Dunedin, 36 pp.

Patrick BH, Hoare RJB, Rhode BE (2010) Taxonomy and conservation of allopatric moth populations: a revisionary study of the *Notoreas perornata* (Walker) complex (Lepidoptera: Geometridae: Larentiinae) with special reference to southern New Zealand. New Zealand Journal of Zoology 37(4): 257–283. https://doi.org/10.1080/03014223.2010.511127

Patrick BH, Patrick HJH (2015) A novel diurnal geometrid from the Denniston Plateau. Moths and Butterflies of New Zealand Trust magazine 14: 6–7.

Prout LB (1939) Geometridae: Fauna Indo–Australica. In: Seitz, A (Ed.) The Macrolepidoptera of the World (Stuttgart) vol. 12, 237–292.

Robinson GS (1976) The preparation of slides of Lepidoptera genitalia with special reference to the Microlepidoptera. Entomologist's Gazette 27: 127–132.

van Nieukerken EJ, Doorenweerd C, Nishida K, Snyers C (2016) New taxa, including three new genera show uniqueness of Neotropical Nepticulidae (Lepidoptera). Zookeys 628: 1–63. https://doi.org/10.3897/zookeys.628.9805

Alpine Entomology 3 2019, 137–140 | DOI 10.3897/alpento.3.34518

PENSOFT

Alpine Entomology

The Drosophilidae (Diptera) of Fennoscandia and Denmark: replacing three misprinted plates

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Abstract

Three out of the 80 plates of fine line drawings of male terminalia in the book entitled *The Drosophilidae (Diptera) of Fennoscandia and Denmark,* published by Brill, Leiden, were misprinted. Here, these three plates have been reprinted, in the manner that they should have been published originally, and provide an accurate representation of the complex male terminalia of *Amiota subtusradiata*, *Leucophenga quinquemaculata*, and *Phortica variegata*.

Key Words

Male terminalia
republishing
corrigenda

In 2004, the authors published a book in the Fauna Entomologica Scandinavica series (Volume 39), entitled *The Drosophilidae (Diptera) of Fennoscandia and Denmark* (Bächli et al. 2004). Unfortunately, three of the plates with fine line drawings were misprinted. These plates displayed the complex male terminalia of *Amiota subtusradiata* Duda, 1934 (p. 44, Figs 98–101), *Leucophenga quinquemaculata* Strobl, 1893 (p. 68, Figs 148–151), and *Phortica variegata* (Fallén, 1823) (p. 75, Figs 164–167), which display a boreo-montane distribution throughout central Europe. In 2007, photomicrographs of the complex male terminalia of these species were published (Bächli and Vilela 2007); however, one of the photomicrographs was misprinted, and an erratum was published soon after (Bächli and Vilela 2009).

Along the same lines, *The Drosophilidae (Diptera) of Fennoscandia and Denmark* is widely used and cited by Drosophilidae experts, mainly taxonomists, who rely on accurate illustrations to properly identify the specimens. Therefore, it was decided to republish these plates (including the captions), with permission from Brill Publishers, aiming to help taxonomists in the species identification process.

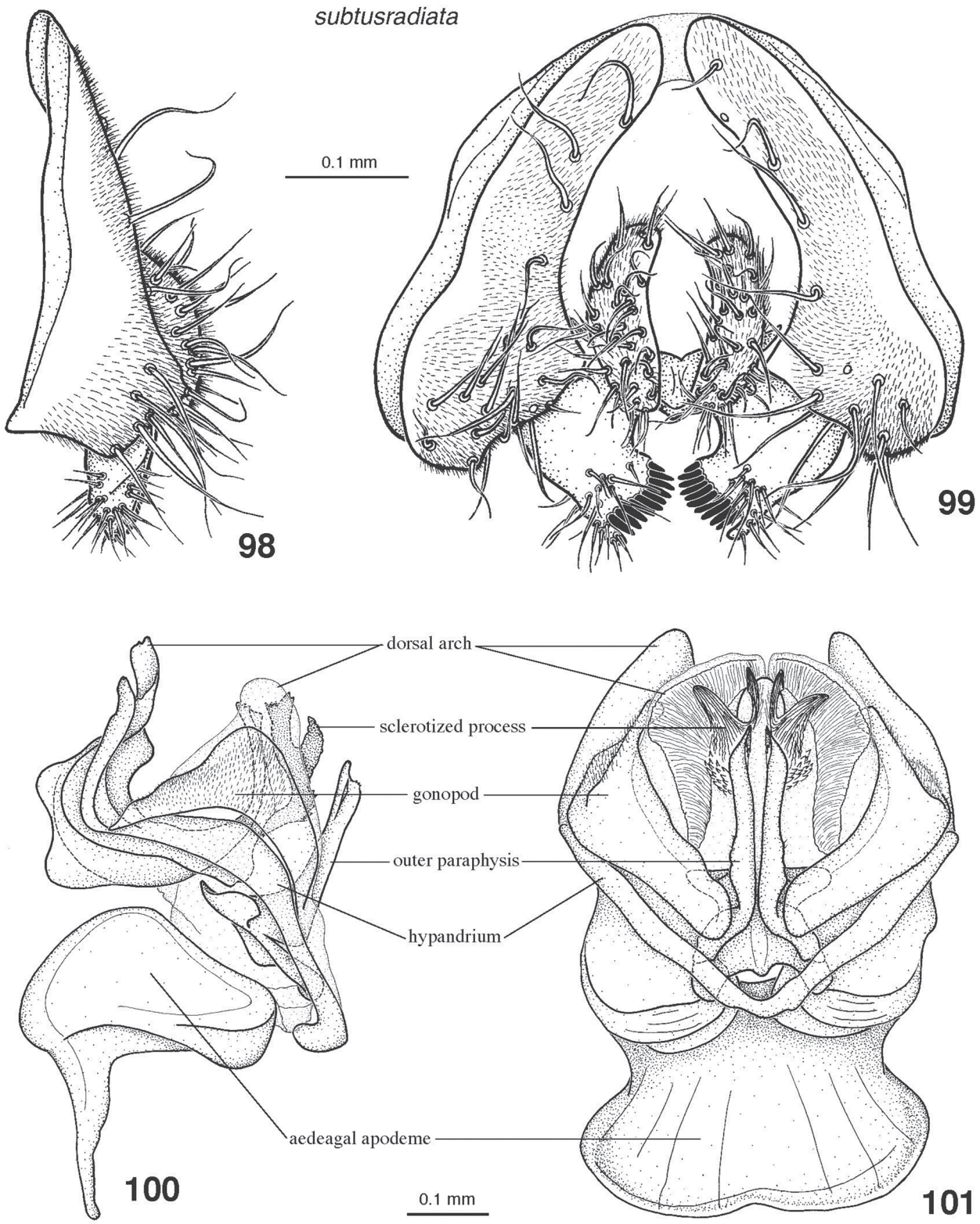
We would like to take this opportunity to again provide the corrigenda to FES (Fauna Entomologica Scandinavica) Volume 39, which is inserted as a loose sheet under the book cover:

- Page iv, the ISBN should be 978-90-04-14074-5
- Page 129, left-hand column, line 14: 42 should be 50
- Page 129, left-hand column, line 22: 50 should be 42
- Page 129, right-hand column, line 31: 42(37) should be 42(38)
- Page 130, right-hand column, line 12: 50(38) should be 50(37)
- Page 156, left-hand column, *picta* species group hereby erected

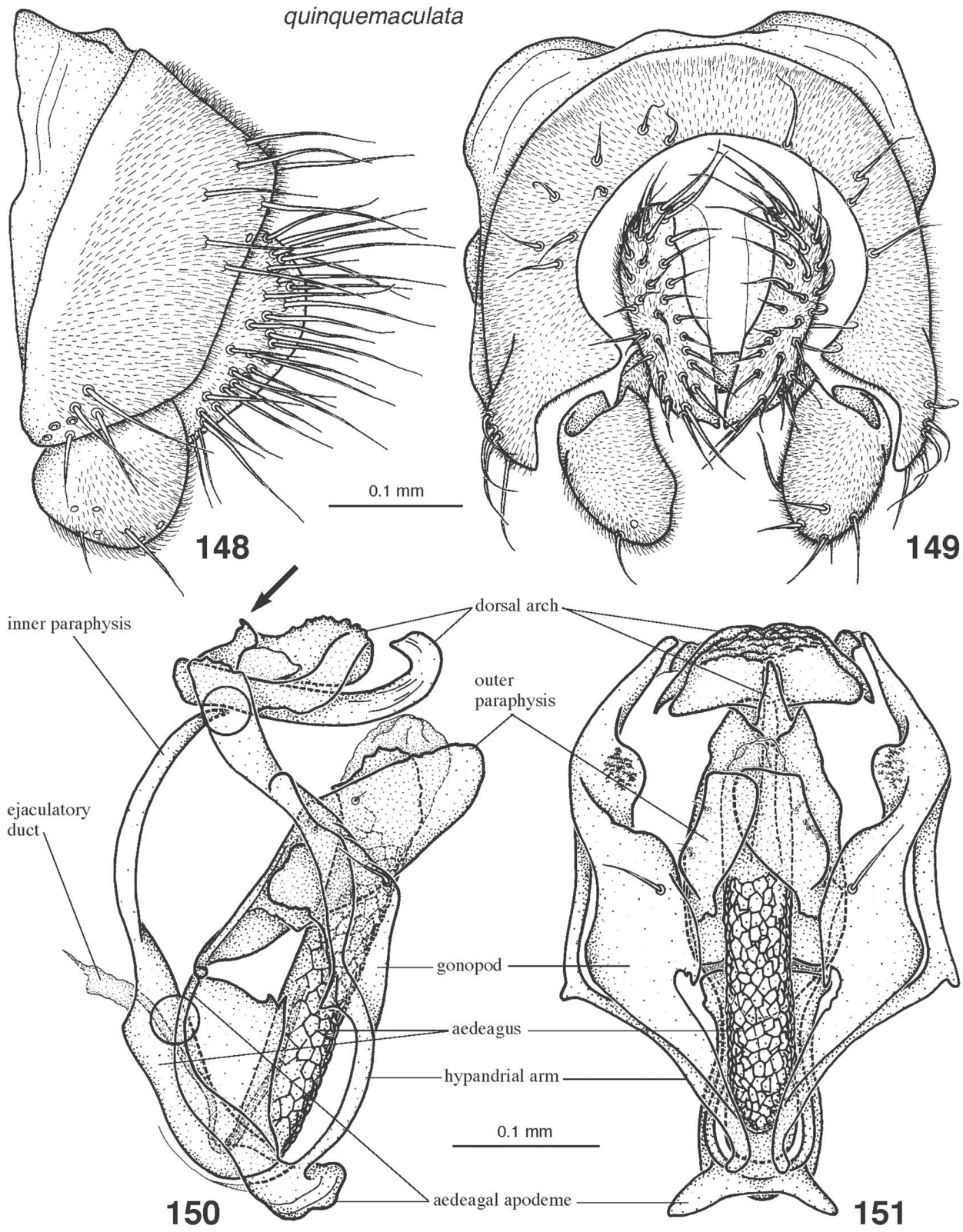
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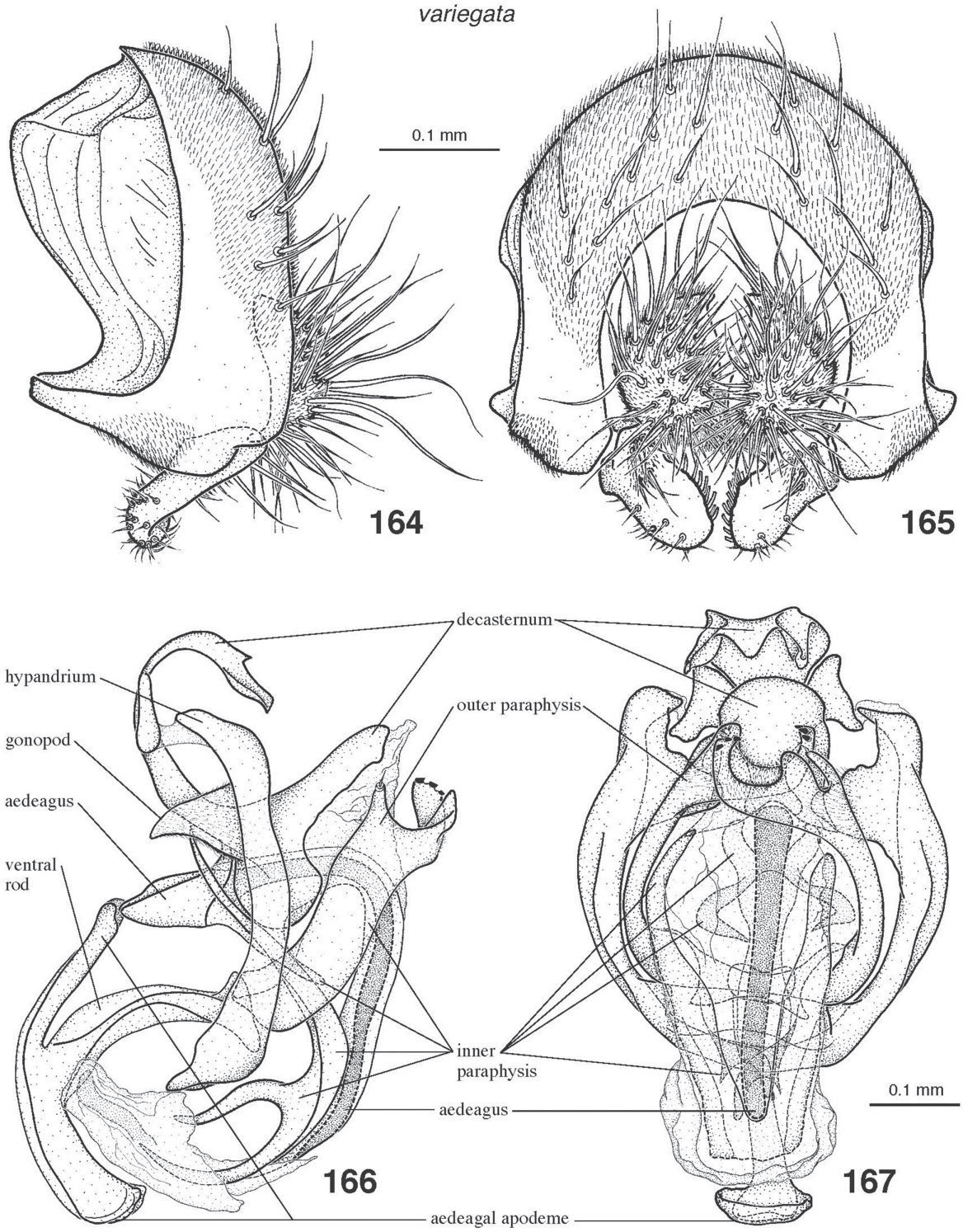
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Figures 98–101. *Amiota subtusradiata* Duda. **98:** epandrium, cerci, and surstyli, left lateral view; 99: idem, plus decasternum, posterior view; **100:** hypandrium, dorsal arch, paraphyses, and aedeagal apodeme, left lateral view; **101:** idem, posterior view.



Figures 148–151. *Leucophenga quinquemaculata* Strobl. **148:** epandrium, cerci, and surstyli, left lateral view; 149: idem, plus decasternum, posterior view; **150:** hypandrium, dorsal arch, gonopods, paraphyses, aedeagus, and aedeagal apodeme, left lateral view; **151:** idem, posterior view. Circles indicate articulation points (upper one between inner paraphysis and dorsal arch, lower one between aedeagal apodeme arm and inner paraphyses+aedeagus). The arrow points to the region of the connection between dorsal arch and posterior region of decasternum.



Figures 164–167. *Phortica variegata* (Fallén). **164:** epandrium, cerci, and surstyli, left lateral view; **165:** idem, plus basal region of decasternum, posterior view; **166:** hypandrium, gonopod, paraphysis, aedeagus, aedeagal apodeme, and distal region of decasternum, left lateral view; **167:** idem, posterior view.

References

Bächli G, Vilela CR, Escher AS, Saura A (2004) The Drosophilidae (Diptera) of Fennoscandia and Denmark. Fauna Entomologica Scandinavica, vol. 39. Brill, Leiden 362 pp.

Bächli G, Vilela CR (2007) Photomicrographs of the male terminalia of Scandinavian Drosophilidae (Diptera). Mitteilungen der schweizerischen entomologischen Gesellschaft 80: 231–246.

Bächli G, Vilela CR (2009) Erratum. Mitteilungen der schweizerischen entomologischen Gesellschaft 82: 101.

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PENSOFT

Alpine Entomology

Liste commentée des Cleroidea (Coleoptera) de Suisse

Annotated checklist of Cleroidea (Coleoptera) of Switzerland

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Résumé

Une liste actualisée des espèces suisses appartenant à la superfamille des Cleroidea est présentée et brièvement commentée. La présence de 106 espèces de Biphyllidae (2 espèces), Byturidae (2), Cleridae (18), Melyridae (66), Phloiophilidae (1), Rhadalidae (8) et Trogossitidae (9) est attestée en Suisse sur la base de 18'989 occurrences issues de l'identification de spécimens de musées et de collections privées, ainsi que de la littérature. En parallèle, 37 espèces annoncées de Suisse par le passé sont exclues de la liste car insuffisamment documentées.

Abstract

An updated checklist of the Swiss species belonging to the superfamily Cleroidea is presented and briefly discussed. A total of 106 species belonging to the families Biphyllidae (2 species), Byturidae (2), Cleridae (18), Melyridae (66), Phloiophilidae (1), Rhadalidae (8) and Trogossitidae (9) is confirmed for Switzerland. This list is based on 18'989 records obtained from the identification of specimens held in museum and private collections, and the literature. In parallel, 37 species that were recorded from Switzerland in the past are excluded from this list, for reasons of insufficient documentation.

Introduction

Plusieurs travaux de phylogénie moléculaire ont récemment bouleversé la classification supérieure traditionelle des Cleroidea telle que définie par Crowson (1955). Ainsi, les Biphyllidae et les Byturidae appartiennent maintenant à cette superfamille selon les conclusions de Hunt et al. (2007). Les Rhadalidae, précédemment traités comme une sous-famille des Dasytidae, sont maintenant considérés comme une famille à part entière suite au travail de Bocáková et al. (2012). Enfin, Gimmel et al. (2019), parmi d'autres propositions de changements, divisent les Trogossitidae en plusieurs familles (Lophocateridae, Peltidae, Thymalidae et Trogossitidae).

A l'échelle suisse, les Cleridae, les Melyridae et les Rhadalidae ont fait l'objet d'un travail très complet réalisé par Victor Allenspach, Robert Constantin et Walter Wittmer (Allenspach et Wittmer 1979). Les autres familles n'ont par contre plus fait l'objet de listes nationales actualisées depuis les publications de Stierlin et Gautard (1867) et de Stierlin (1900), alors que la découverte en Suisse du seul représentant de la famille des Phloiophilidae, endémique d'Europe, date de 1992 seulement.

Compte tenu de l'évolution des connaissances systématiques et chorologiques au cours des quarante dernières années, une mise à jour de la liste faunistique des Cleroidea de Suisse s'avérait nécessaire. Basé sur un important travail de révision des collections suisses et sur une analyse critique de la littérature, cet article propose une liste commentée actualisée de l'ensemble des espèces de Cleroidea signalées de Suisse. Les espèces indigènes sont distinguées des espèces annoncées par erreur, insuffisamment documentées ou importées.

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Matériel et méthode

Afin de disposer de l'ensemble de l'information disponible et être ainsi à même d'évaluer au mieux l'appartenance des espèces à la faune de Suisse, nous avons procédé à un relevé exhaustif de l'ensemble du matériel des principales collections muséales suisses. Les collections des institutions suivantes ont donc été consultées et relevées dans leur intégralité (les noms des personnes de contact sont indiqués entre parenthèses)

AGRO	Agroscope-Changins (anciennement SFRA), Nyon (Stève Breitenmoser)
BNM	Bündner Natur-Museum, Chur (Stephan Liersch)
ETH	Eidgenössische-Technische Hochschule, Zürich (Rod Eastwood, Michael Greeff)
KMLI	Archäologie und Museum Baselland, Liestal (Marc Limat)
MHNF	Musée d'histoire naturelle de Fribourg (Peter Wandeler)
MHNG	Muséum d'histoire naturelle de Genève (Giulio Cuccodoro)
MHNN	Musée d'histoire naturelle de Neuchâtel (Jessica Litman)
MHNS	Musée de la nature du Valais, Sion (Nicolas Kramar, Sonja Gerber)
MSNL	Museo cantonale di storia naturale, Lugano (Lucia Pollini, Michele Abderhalden)
MZA	Museum zu Allerheiligen, Schaffhausen (Urs Weibel)
MZL	Musée cantonal de zoologie, Lausanne (Anne Freitag)
NMAA	Naturama, Aarau (Janine Mazenauer)
NMB	Naturhistorisches Museum Basel (Matthias Borer)
NMBE	Naturhistorisches Museum der Burgergemeinde Bern (Hannes Baur)
NMLU	Natur-Museum, Luzern (Marco Bernasconi, Peter Herger)
NMTG	Naturmuseum Thurgau, Frauenfeld (Barbara Richner)
NMSG	Naturmuseum, St. Gallen (Priska Seri)
NMSO	Naturmuseum, Solothurn (Christoph Germann, Marc Neumann)
SPZH	Schädlingsprävention und –beratung, Zürich (Marcus Schmidt, Gabi Müller, Isabelle Landau-Lüscher)

Les collections privées des personnes suivantes ont également été prises en compte: Sylvie Barbalat (Neuchâtel NE), Mickaël Blanc (F-Sciez), Hansjörg Brägger (Bischofszell TG), Stève Breitenmoser (Givrins VD), Marie-Christine et Yannick Chittaro (Conthey VS), Vivien Cosandey (Essertines-sur-Rolle VD), Adrienne Frei (Zürich ZH), Michael Gilgen et Lea Kamber (Bangerten bei Dieterswil BE), Roman Graf (Horw LU), René Hoess (Bern BE), Barbara Huber (Thusis GR), Laurent Juillerat (Chézard-St-Martin NE), Wilfried Löderbusch (D-Markdorf), Christian Monnerat (Neuchâtel NE), Andreas Sanchez (Sion VS), Alexander Szallies (Wädenswil ZH) et Arnaud Vallat (Neuchâtel NE).

L'ensemble des données disponibles dans la littérature suisse a également été compilé. Les références des publications consultées sont intégralement mentionnées dans la bibliographie. Celles qui ne sont pas citées dans le texte de cet article sont signalées par un astérisque (*).

Les ouvrages et articles suivants ont été utilisés pour l'identification des espèces: Pardo Alcaide (1962), Freude et al. (1967, 1979), Kolibáč (1992, 1993, 2018), Lohse et Lucht (1992), Gerstmeier (1998), Kolibáč et al. (2005), Liberti et Focarile (2005), Plata Negrache (2009, 2012), Constantin et Liberti (2011) et Niehuis (2013).

Sans indication explicite, les informations générales sur la distribution des espèces sont tirées du « Catalogue of Palaearctic Coleoptera » édité par Löbl et Smetana (2007), qui n'est alors pas cité dans les textes consacrés aux espèces. Les ouvrages utilisés pour l'identification ont également fourni de précieuses informations sur la répartition des espèces, de même que les publications de Callot (2018) pour l'Alsace, de Tronquet (2014) pour la France, de Brandstetter et Kapp (1998) pour le Liechtenstein et le Vorarlberg autrichien, de Köhler et Klausnitzer (1998) et de Köhler (2000, 2011) pour l'Allemagne et de Kahlen et Hellrigl (1996) pour le Sud-Tyrol italien.

La nomenclature et systématique suivies sont celles du «Catalogue of Palaearctic Coleoptera» pour les espèces (Jelínek 2007, Kolibáč 2007, Löbl 2007, Löbl et al. 2007, Mayor 2007a, b). Par rapport à ce document de référence, nous avons néanmoins considéré les exceptions suivantes:

– nous avons pris en compte la description récente du genre *Anthomalachius* pour les espèces du groupe « *Clanoptilus spinosus* » (Tshernyshev 2009),
– nous avons suivi la mise en synonymie de *Danacea serbica* Kiesenwetter, 1863 avec *D. iners* Kiesenwetter, 1859 par Liberti (2009a),
– de même, nous avons privilégié *Dasytes gonocerus* Mulsant & Rey, 1868 à *D. erratus* Schilsky, 1895 suite au travail de synonymisation réalisé par Liberti et Constantin (2011),
– enfin, nous avons suivi les choix de Liberti et Constantin (2009) à propos du genre *Enicopus* Stephens, 1830, et avons donc considéré *E. ater ater* (Fabricius, 1787) comme distinct d'*E. pilosus* (Scopoli, 1763).

La liste des principaux synonymes de chaque taxon est détaillée dans le « Catalogue of Palaearctic Coleoptera » auquel on se réfèrera.

Pour la classification supérieure, nous avons suivi Bouchard et al. (2011), en considérant néanmoins les Rhadalidae comme famille indépendante (Bocáková et al. 2012, Gimmel et al. 2019), ainsi que les Biphyllidae et les Byturidae comme faisant partie des Cleroidea (Hunt et al. 2007, Bocák et al. 2014, Gimmel et al. 2019). Nous n'avons par contre pas suivi la récente division en

plusieurs familles des traditionnels Trogossitidae, comme proposé par Gimmel et al. (2019), dans l'attente de confirmation de leurs résultats.

Pour les plantes et champignons cités dans le document, nous avons suivi les choix taxonomiques respectifs de Juillerat et al. (2017) et de la base de donnée nationale SwissFungi (swissfungi.wsl.ch).

Une fois l'ensemble de l'information disponible, nous avons suivi la procédure proposée par Monnerat et al. (2015a) pour statuer sur l'indigénat des espèces en Suisse. Ainsi, nous n'avons pas retenu une espèce si les données relatives ne satisfaisaient pas au minimum jugé nécessaire (étiquetage univoque, collections fiables, …).

Les espèces suivies d'une lettre et d'un chiffre en gras (« **C1** » par exemple) font l'objet d'un commentaire. Ainsi, un commentaire est fourni pour les espèces les plus rares (connues de moins de vingt occurrences valides en Suisse) et l'ensemble des spécimens examinés et toutes les observations publiées sont mentionnés afin de documenter et de justifier leur prise en compte. Certaines espèces ne font l'objet que de commentaires d'ordre taxonomique ou chorologique. Tout le matériel examiné a été déterminé ou revu par les auteurs ou par des spécialistes européens (voir remerciements).

Les spécimens examinés et les données issues de la littérature sont présentés par ordre chronologique de découverte ou de publication, puis par ordre alphabétique des localités en fonction des informations disponibles. Toutes les occurrences sont citées sur le schéma suivant : nombre d'exemplaires, localité pour les données anciennes ou commune et canton abrégé pour les données récentes (à partir de l'an 2000), date, collectionneur, déterminateur, collection, acronyme officiel du musée où l'insecte est déposé lorsque cela est le cas.

Les informations qui concernent la localité et la date sont indiquées telles qu'elles figurent sur l'étiquette. Les interprétations des abréviations alphabétiques sont mentionnées entre crochets « [ ] ». Dans les collections anciennes, le collectionneur (leg.) n'est pas toujours mentionné textuellement sur les étiquettes. Nous avons donc généralement préféré la mention « coll. » jugée plus adéquate. Dans de nombreux cas, le nom du détenteur de la collection ne figure pas sur les étiquettes. Néanmoins, en fonction de l'expérience acquise dans les relevés de collections, l'attribution de certains types d'étiquettes et/ou d'écritures à une collection particulière s'est souvent avérée possible.

La collection de Charles Maerky, déposée au Muséum d'histoire naturelle de Genève, est considérée depuis longtemps comme problématique (Monnerat et al. 2015a). Mis à part les individus provenant de sa collection (« coll. Maerky C. »), elle contient également des insectes issus d'autres collections (mentionnées alors « ex coll. Melly A. » par exemple) et pour lesquelles les étiquettes originales font défaut. De ce fait, et afin de ne pas perdre l'information quant au fait que ces insectes appartiennent à la collection de Maerky C., nous avons retenu la mention de « coll. Maerky C. » pour l'intégralité de sa collection.

Pour les données issues de la littérature, détaillées sous « Données publiées », nous avons retenu la localité telle que mentionnée dans la citation originale. La personne « source » (et non pas le legit) est considérée comme l'auteur dans la publication et mentionnée par exemple comme suit: « Ormontsthal par Venetz I. (Stierlin et Gautard 1867) ». Lorsque la même localité est citée à plusieurs reprises, seule la plus ancienne est retenue ici, les localités annoncées dans les publications ultérieures étant généralement reprises telles quelles et parfois même tronquées. Nous nous sommes néanmoins dispensés de mentionner ici toutes les données figurant dans Allenspach et Wittmer (1979) si nous avons retrouvé et vérifié l'identification des spécimens qu'ils citent, et qui figurent alors sous « Matériel examiné ». Ne subsistent donc que les données d'Allenspach et Wittmer (1979) pour lesquelles nous n'avons pas retrouvé le matériel correspondant ou lorsqu'il s'agissait d'identification erronées que nous avons corrigées.

Parmi les données citées dans le document, que ce soit sous « Matériel examiné » ou sous « Données publiées », celles que nous considérons comme insuffisantes pour être retenues sont précédées d'un nombre, noté comme suit « [1)] », qui fait référence aux différentes catégories de sources d'erreurs identifiées et détaillées dans Monnerat et al. (2015a), à savoir :

1) données sources invérifiables
2) déterminations erronées
3) spécimens issus de collections problématiques
4) spécimens d'origine inconnue attribués à des localités suisses
5) double étiquetage, interprétation ou recopie erronées du nom de la localité d'origine
6) confusion entre localité d'origine, lieu d'élevage ou d'éclosion des spécimens et de dépôt de la collection
7) localités non suisses ou localités étrangères homonymes
8) incohérences chorologiques ou écologiques

Autres abréviations utilisées: coll.=collection, det.=déterminateur, ex.=exemplaire, leg.=collectionneur, s.l.=sensu lato (sens large), cantons suisses abrégés (AG=Argovie, BE=Berne, BS=Bâle-Ville, BL=Bâle-Campagne, GE=Genève, GR=Grisons, LU=Lucerne, NE=Neuchâtel, SG=Saint-Gall, SH=Schaffhouse, SO=Soleure, TI =Tessin, TG=Thurgovie, VD=Vaud, VS=Valais, ZH=Zurich).

Résultats

Liste des Cleroidea de Suisse

Les auteurs considèrent que les 106 espèces mentionnés en gras dans cette liste forment ou ont formé des populations en Suisse, même si pour bon nombre d'entre elles les informations disponibles sont rares et ponctuelles.

Les 37 espèces indiquées entre crochets « [ ] » et décalées dans la liste ne doivent par contre pas être considérées comme appartenant à la faune suisse, tout du moins

jusqu'à ce que de nouvelles données viennent infirmer notre opinion. Sont associées à cette catégorie des espèces dont les individus de référence émanent de collections problématiques, telles que celles de Charles Maerky ou de Max Täschler (Monnerat et al. 2015a), mentionnées de Suisse par erreur suite à des identifications erronées, citées dans des publications anciennes comme celle de Stierlin et Gautard (1867) sans individus de référence et considérées comme douteuses, ou encore des espèces importées. Certaines sont potentielles pour la Suisse, mais leur indigénat reste à confirmer, les données disponibles n'étant pas suffisantes à l'heure actuelle.

Afin de faciliter la recherche des espèces dans ce document, les taxa apparaissent dans l'ordre alphabétique des familles, des sous-familles, des genres, des sous-genres, des espèces et des sous-espèces.

L'ensemble des informations collectées représente un total de 18'989 occurrences pour les familles traitées. Les cartes de répartition actualisées de toutes les espèces retenues pour la Suisse sont disponibles sur le serveur cartographique d'info fauna – CSCF (Centre suisse de cartographie de la faune) (http://lepus.unine.ch/carto/). L'ensemble des données validées a également mis à disposition sur GBIF.org (https://doi.org/10.15468/dl.8up98w).

BIPHYLLIDAE LeConte, 1861

***Biphyllus lunatus* (Fabricius, 1787) C1**
***Diplocoelus fagi* (Chevrolat, 1837)**

BYTURIDAE Gistel, 1848

Byturinae Gistel, 1848
***Byturus ochraceus* (Scriba, 1790)**
***Byturus tomentosus* (DeGeer, 1774)**

CLERIDAE Latreille, 1802

Clerinae Latreille, 1802
***Allonyx quadrimaculatus* (Schaller, 1783) C2**
***Clerus mutillarius mutillarius* Fabricius, 1775**
***Opilo domesticus* (Sturm, 1837)**
[*Opilo germanus* (Chevrolat, 1843)] **C3**
***Opilo mollis* (Linnaeus, 1758)**
***Opilo pallidus* (A. G. Olivier, 1795) C4**
***Thanasimus femoralis* (Zetterstedt, 1828)**
***Thanasimus formicarius formicarius* (Linnaeus, 1758)**
***Trichodes alvearius* (Fabricius, 1792)**
***Trichodes apiarius* (Linnaeus, 1758)**
[*Trichodes favarius* (Illiger, 1801)] **C5**
[*Trichodes* cf. *heydeni* Escherisch, 1892] **C6**
[*Trichodes ircutensis* (Laxmann, 1770)] **C7**

Korynetinae Laporte, 1836
***Dermestoides sanguinicollis* (Fabricius, 1787) C8**
***Korynetes caeruleus* (DeGeer, 1775)**
***Korynetes ruficornis* (Sturm, 1837)**
***Necrobia ruficollis* (Fabricius, 1775)**
***Necrobia rufipes* (DeGeer, 1775)**
***Necrobia violacea* (Linnaeus, 1758)**
[*Tarsostenus univittatus* (P. Rossi, 1792)] **C9**

Tillinae Fischer von Waldheim 1813
***Denops albofasciatus* (Charpentier, 1825) C10**
***Tilloidea unifasciata* (Fabricius, 1787)**
***Tillus elongatus* (Linnaeus, 1758)**

MELYRIDAE Leach, 1815

Dasytinae Laporte, 1840
[*Danacea* (*Allodanacaea*) *wittmeri* Liberti, 1985] **C11**
***Danacea* (*Danacea*) *ambigua* Mulsant & Rey, 1868**
***Danacea* (*Danacea*) *denticollis* Baudi di Selve, 1861**
[*Danacea* (*Danacea*) *iners* Kiesenwetter, 1859] **C12**
[*Danacea* (*Danacea*) *marginata* (Küster, 1851)] **C13**
***Danacea* (*Danacea*) *montivaga* Mulsant & Rey, 1868 C14**
[*Danacea* (*Danacea*) *morosa* Kiesenwetter, 1863] **C15**
[*Danacea* (*Danacea*) *nigripalpis* Fiori, 1912] **C16**
***Danacea* (*Danacea*) *nigritarsis alpina* Pic, 1894 C17**
***Danacea* (*Danacea*) *nigritarsis nigritarsis* (Küster, 1850) C17**
***Danacea* (*Danacea*) *pallipes* (Panzer, 1793)**
***Dasytes* (*Anthoxenus*) *subaeneus* Schönherr, 1817 C18**
[*Dasytes* (*Dasytes*) cf. *murinus* Schilsky, 1894] **C19**
***Dasytes* (*Dasytes*) *niger* (Linnaeus, 1761)**
***Dasytes* (*Dasytes*) *pauperculus* Laporte, 1840 C20**
***Dasytes* (*Dasytes*) *thoracicus thoracicus* Mulsant & Rey, 1868 C21**
***Dasytes* (*Hypodasytes*) *alpigradus* Kiesenwetter, 1863**
***Dasytes* (*Hypodasytes*) *gonocerus* Mulsant & Rey, 1868**
***Dasytes* (*Hypodasytes*) *lombardus* Fiori, 1909 C22**
***Dasytes* (*Hypodasytes*) *obscurus* Gyllenhal, 1813**
***Dasytes* (*Hypodasytes*) *subalpinus subalpinus* Baudi di Selve, 1873**
[*Dasytes* (*Hypodasytes*) *tristiculus* Mulsant & Rey, 1868] **C23**
[*Dasytes* (*Mesodasytes*) *aeneiventris* Küster 1850] **C24**
***Dasytes* (*Mesodasytes*) *aeratus* Stephens, 1830**
***Dasytes* (*Mesodasytes*) *plumbeus* (O. F. Müller, 1776)**
***Dasytes* (*Mesodasytes*) *virens* (Marsham, 1802)**
***Dasytes* (*Metadasytes*) *caeruleus* (DeGeer, 1774)**
***Dasytes* (*Metadasytes*) *fusculus* (Illiger, 1801)**
***Dasytes* (*Metadasytes*) *nigrocyaneus* Mulsant & Rey, 1868 C25**
[*Dasytidius nigripes* (Pic, 1894)] **C26**
***Divales bipustulatus* (Fabricius, 1781)**
[*Divales quadrimaculatus* (A. G. Olivier, 1790)] **C27**
***Dolichosoma lineare* (P. Rossi, 1794)**
[*Enicopus* (*Enicopus*) *ater ater* (Fabricius, 1787)] **C28**
***Enicopus* (*Enicopus*) *pilosus* (Scopoli, 1763) C29**
[*Psilothrix* (*Psilothrix*) *aureola* (Kiesenwetter, 1859)] **C30**
[*Psilothrix* (*Psilothrix*) *smaragdina* (P. H. Lucas, 1846)] **C31**
***Psilothrix* (*Psilothrix*) *viridicoerulea* (Geoffroy, 1785)**

Malachiinae Fleming, 1821
***Anthocomus* (*Anthocomus*) *fasciatus* (Linnaeus, 1758)**
***Anthocomus* (*Anthocomus*) *rufus rufus* (Herbst, 1784)**
***Anthocomus* (*Celidus*) *equestris* (Fabricius, 1781)**
***Anthocomus* (*Celidus*) *humeralis* (Morawitz, 1862) C32**

[*Anthomalachius spinosus* (Erichson, 1840)] **C33**
[*Attalus* (*Abrinus*) *amictus* (Erichson, 1840)] **C34**
***Attalus* (*Abrinus*) *analis* (Panzer, 1798)**
***Attalus* (*Antholinus*) *minimus* (P. Rossi, 1790)**
***Attalus* (*Attalus*) *alpinus* (Giraud, 1851) C35**
[*Attalus* (*Attalus*) *cyaneus* (Fabricius, 1787)] **C36**
***Axinotarsus* (*Axinotarsus*) *marginalis* (Laporte, 1840)**
***Axinotarsus* (*Axinotarsus*) *pulicarius* (Fabricius, 1777)**
***Axinotarsus* (*Axinotarsus*) *ruficollis* (A. G. Olivier, 1790)**
***Cerapheles terminatus* (Ménétriés, 1832) C37**
[*Ceratistes dilaticornis* (Germar, 1824)] **C38**
***Charopus concolor* (Fabricius, 1801)**
***Charopus docilis* Kiesenwetter, 1852 C39**
***Charopus flavipes* (Paykull, 1798) C40**
***Charopus madidus* Kiesenwetter, 1863 C41**
***Charopus pallipes* (A. G. Olivier, 1790) C42**
***Clanoptilus* (*Clanoptilus*) *affinis* (Ménétriés, 1832) C43**
[*Clanoptilus* (*Clanoptilus*) *arnaizi* (Pardo Alcaide, 1966)] **C44**
***Clanoptilus* (*Clanoptilus*) *elegans* (A. G. Olivier, 1790)**
***Clanoptilus* (*Clanoptilus*) *emarginatus* (Krauss, 1902)**
***Clanoptilus* (*Clanoptilus*) *geniculatus* (Germar, 1824) C45**
***Clanoptilus* (*Clanoptilus*) *marginellus* (A. G. Olivier, 1790)**
[*Clanoptilus* (*Clanoptilus*) *rufus* (A. G. Olivier, 1790)] **C46**
[*Clanoptilus* (*Clanoptilus*) *spinipennis* (Germar, 1824)] **C47**
[*Clanoptilus* (*Hypoptilus*) *barnevillei* (Puton, 1865)] **C48**
***Cordylepherus viridis* (Fabricius, 1787)**
***Cyrtosus* (*Oogynes*) *ovalis* (Laporte, 1838) C49**
[*Ebaeus* (*Ebaeus*) *appendiculatus* Erichson, 1840] **C50**
[*Ebaeus* (*Ebaeus*) *ater* Kiesenwetter, 1863] **C51**
***Ebaeus* (*Ebaeus*) *battonii* Pardo Alcaide, 1962 C52**
[*Ebaeus* (*Ebaeus*) *collaris collaris* Erichson, 1840] **C53**
***Ebaeus* (*Ebaeus*) *flavicornis* Erichson, 1840 C54**
***Ebaeus* (*Ebaeus*) *gibbus* (Drapiez, 1819) C55**
***Ebaeus* (*Ebaeus*) *pedicularius pedicularius* (Linnaeus, 1758)**
[*Ebaeus* (*Ebaeus*) cf. *rufipes* Morawitz, 1861] **C56**
***Ebaeus* (*Ebaeus*) *thoracicus* (Geoffroy, 1785)**
***Hypebaeus* (*Alloceps*) *albifrons albifrons* (Fabricius, 1775)**
[*Hypebaeus* (*Hypebaeus*) *flavicollis* (Erichson, 1840)] **C57**
***Hypebaeus* (*Hypebaeus*) *flavipes* (Fabricius, 1787)**
***Malachius* (*Malachius*) *aeneus* (Linnaeus, 1758)**
***Malachius* (*Malachius*) *australis* Mulsant & Rey, 1867**
***Malachius* (*Malachius*) *bipustulatus* (Linnaeus, 1758)**
***Malachius* (*Malachius*) *rubidus* Erichson, 1840**
***Malachius* (*Malachius*) *scutellaris* Erichson, 1840 C58**
***Micrinus heteromorphus* (Abeille de Perrin, 1869) C59**
***Micrinus inornatus* (Küster, 1846)**
***Nepachys cardiacae* (Linnaeus, 1761) C60**
***Sphinginus coarctatus* (Erichson, 1840) C61**
***Sphinginus lobatus lobatus* (A. G. Olivier, 1790)**
***Troglops albicans* (Linnaeus, 1767)**
[*Troglops cephalotes* (A. G. Olivier, 1790)] **C62**
***Troglops silo* Erichson, 1840**

PHLOIOPHILIDAE Kiesenwetter, 1863

***Phloiophilus edwardsii* Stephens, 1830 C63**

RHADALIDAE LeConte, 1861

Rhadalinae LeConte, 1861
[*Aplocnemus* (*Aplocnemus*) *albipilis* (Kiesenwetter, 1863)] **C64**
***Aplocnemus* (*Aplocnemus*) *alpestris* (Kiesenwetter, 1861)**
***Aplocnemus* (*Aplocnemus*) *chalconatus* (Germar, 1817) C65**
***Aplocnemus* (*Aplocnemus*) *impressus* (Marsham, 1802)**
***Aplocnemus* (*Aplocnemus*) *integer* (Baudi di Selve, 1873) C66**
***Aplocnemus* (*Aplocnemus*) *nigricornis nigricornis* (Fabricius, 1792)**
[*Aplocnemus* (*Aplocnemus*) *ramicornis* Kiesenwetter, 1863] **C67**
***Aplocnemus* (*Aplocnemus*) *tarsalis* (C. R. Sahlberg, 1822)**
***Aplocnemus* (*Aplocnemus*) *virens virens* (Suffrian, 1843)**
[*Trichoceble floralis* (A. G. Olivier, 1790)] **C68**
***Trichoceble memnonia* (Kiesenwetter, 1861) C69**

THANEROCLERIDAE Chapin, 1924

Thaneroclerinae Chapin, 1924
[*Thaneroclerus buquet* (Lefebvre, 1835)] **C70**

TROGOSSITIDAE Latreille 1802

Lophocaterinae Crowson, 1964
***Grynocharis oblonga* (Linnaeus, 1758) C71**

Peltinae Latreille, 1806
***Peltis ferruginea* (Linnaeus, 1758)**
***Peltis grossa* (Linnaeus, 1758)**
***Thymalus limbatus* (Fabricius, 1787)**

Trogossitinae Latreille 1802
***Calitys scabra* (Thunberg, 1784) C72**
***Nemozoma caucasicum* Ménétriés, 1832 C73**
[*Nemozoma cornutum* Sturm, 1826] **C74**
***Nemozoma elongatum* (Linnaeus, 1761)**
***Temnoscheila caerulea* (A. G. Olivier, 1790)**
***Tenebroides mauritanicus* (Linnaeus, 1758) C75**

Commentaires sur quelques espèces

C1) *Biphyllus lunatus*

Matériel examiné: [3)]1 ex., Genève, coll., Maerky C., ex coll. Melly A., MHNG; 1 ex., Bois de Chênes, 6.1994, leg. Besuchet C., MHNG; 1 ex., Cologny GE, 20.4.2010, leg. & coll. Blanc M.

Données publiées. [1)]Genf par Tournier H. et [1)]Vevey par Gautard V. (Stierlin et Gautard 1867).

Commentaire. Assez largement répandue en Europe, cette espèce est pourtant généralement rare. Seuls deux

spécimens, des cantons de Vaud et de Genève, attestent de sa présence en Suisse. L'espèce est inféodée au genre de pyrénomycètes *Daldinia*, surtout *D. concentrica,* qui pousse sur le frêne (*Fraxinus excelsior*) principalement.

C2) *Allonyx quadrimaculatus*

Fig. 1A

Matériel examiné. 1 ex., Helvet. [Helvetia], leg. Anonymous, ETH; [3)]1 ex., Wülflingen, 6.1853, coll. Dietrich K., ETH; [3)]1 ex., Wülflingen, 13.7.1858, coll. Dietrich K., ETH; 1 ex., Finges, 16.6.1962, leg. Besuchet C., MZL; 1 ex., Finges, 15.4.1979, leg. Besuchet C., MHNG; 1 ex., Finges, 6.1992, leg. Besuchet C., MHNG; 1 ex., Wallis, Pfinwald [Pfynwald], 27.6.1992, leg. & coll. Gfeller W.; 1 ex., Leuk VS, 15.5.2002, [leg. Carron G.], MHNN; 2 ex., Anniviers VS, 5.-20.6.2014, 12.-26.5.2015, leg. & coll. Sanchez A.; 12 ex., Visp VS, 6.5.-28.7.2016, leg. & coll. Sanchez A.; 1 ex., Leuk VS, 24.5.-1.7.2018, leg. & coll. Sanchez A. ; 1 ex., Riddes VS, 18.4.-22.5.2019, leg. & coll. Sanchez A.; 1 ex., Martigny VS, 21.5.-5.6.2019, leg. & coll. Sanchez A.

Données publiées. [3)]Wülflingen, 6.1853 et [1)]Nürensdorf, 1858 par Dietrich K. (Dietrich 1865); [1)]Genf par Tournier H. et [1)]Schaffhausen par Stierlin G. (Stierlin et Gautard 1867); Kanton Wallis, Susten, 27.6.1992 par Gfeller W. (Gfeller 1992); 1 ex., Anniviers VS, 5.-20.6.2014 par Sanchez A. (Sanchez et al. 2015); nombreux ex., Visp VS, 6.5.-28.7.2016 par Sanchez A. (Chittaro et Sanchez 2017).

Commentaire. Assez largement répandue en Europe, cette espèce est pourtant rare en Suisse, où elle n'est connue que de quelques localités et d'un faible nombre d'individus. En 2016, de nombreux exemplaires ont néanmoins été observés chassant sur des troncs brûlés de pin sylvestre (*Pinus sylvestris*), dans une forêt incendiée cinq ans auparavant (Chittaro et Sanchez 2017).

C3) [*Opilo germanus*]

Données publiées. [2,8)]1 ex., Lausanne VD, MZL (Allenspach et Wittmer 1979).

Commentaire. Si le statut taxonomique d'*O. germanus* est toujours incertain, la plupart des auteurs le considèrant comme synonyme d'*O. abeillei* Korge, 1960, d'*O. domesticus* ou d'*O. mollis* (Hubenthal 1916, Korge 1960, Kolibáč 2018, Gerstmeier R., comm. pers.), Tihelka (2016) l'annonce récemment comme nouveau pour l'Italie et fournit une synthèse des observations européennes du taxon. Il constate une répartition originale: toutes les données sont localisées à proximité de régions côtières, souvent de grands ports, et suggère dès lors que le taxon n'est peut-être pas indigène en Europe mais serait arrivé accidentellement au cours de différentes introductions. Nous avons retrouvé le spécimen cité dans la littérature suisse (Allenspach et Wittmer 1979) qui s'avère être, à notre avis, *O. domesticus*. Indépendamment des décisions concernant sa position taxonomique, *O. germanus* ne fait pas partie de notre faune.

C4) *Opilo pallidus*

Matériel examiné. [3)]1 ex., Genf, coll. Lasserre H., ETH; [3)]1 ex., Genf, coll. Linder A., ex coll. Täschler M., ETH; [3)]1 ex., Jura, Gimel, 2.8., leg. & coll. Maerky C., MHNG; 1 ex., Châtelaine, 6.8.1950, leg. Simonet J., MHNG; 1 ex., Commugny VD, 13.7.1954, leg. Steffen J., MHNG; 1 ex., Mendrisio, 10.1955, leg. & coll. Lautner J., NMB; 3 ex., Chiasso, 31.7.1967, leg. & coll. Scherler P., NMBE; 2 ex., Chiasso, 14.7.1969, leg. & coll. Scherler P., NMBE; 1 ex., Piazzogna, 6.1984, leg. & coll. Ettmüller W.; 1 ex., Aire-la-Ville, 31.8.1988, leg. & coll. Scherler P., NMBE; 1 ex., Genève, La Laire, 8.-9.1990, leg. Besuchet C., MHNG; 1 ex., Genève, Vandoeuvres, 8.-9.1990, leg. Besuchet C., MHNG; 1 ex., Genève, Lullier, 8.1991, leg. SFRA [Station fédérale de recherche agronomique], MHNG; 1 ex., Vaud, Nyon, 9.1991, leg. Besuchet C., MHNG; 1 ex., Genève, Avully, 8.1993, leg. Besuchet C., MHNG.

Données publiées. [1)]Genf par Chevrier F., [3)]Genf par Lasserre H. et [1)]Genf par Tournier H. (Stierlin et Gautard 1867); [1)]Chiasso (Fontana 1947).

Commentaire. Quelques données des cantons de Genève, de Vaud et du Tessin attestent de la présence en Suisse de cette espèce plutôt méridionale, qui se développe dans la canopée de différentes essences feuillues, mais principalement les chênes (*Quercus* spp.) (Sanchez et al. 2018).

C5) [*Trichodes favarius*]

Données publiées. [1,8)][Suisse] par Heer O. (Bremi-Wolf 1856); [2,8)]1 ex., Canton Tessin, ETH (Allenspach et Wittmer 1979).

Commentaire. La citation de Bremi-Wolf (1856) est invérifiable. Quant au spécimen du Tessin, il a été retrouvé et se rapporte en réalité à *Trichodes* cf. *heydeni* (voir C6). *T. favarius* est une espèce orientale et sa présence en Suisse est très peu probable.

C6) [*Trichodes* cf. *heydeni*]

Matériel examiné. [4,5,8)]1 ex., Canton Tessin, leg. Anonymous, det. Gerstmeier R., coll. Allenspach V., NMB (ex coll. ETH).

Commentaire. Le seul spécimen examiné était cité dans la littérature sous *T. favarius* (Allenspach et Wittmer 1979) (voir C5). Après vérification de l'identification, l'individu se rapproche en réalité de *T. heydeni*, une espèce connue uniquement d'Azerbaidjan, d'Arménie, d'Iran, d'Iraq et de Turquie. S'agissant d'une femelle, l'identification spécifique de cet individu ne peut néanmoins être assurée. Le taxon est dans tous les cas absent de notre faune, et il s'agit vraisemblablement d'une erreur d'étiquetage du spécimen examiné.

C7) [*Trichodes ircutensis*]

Données publiées. [1,8)]1 ex., bei Klosters, Graubünden, 7.1910 par Müller J.A. (Müller 1912).

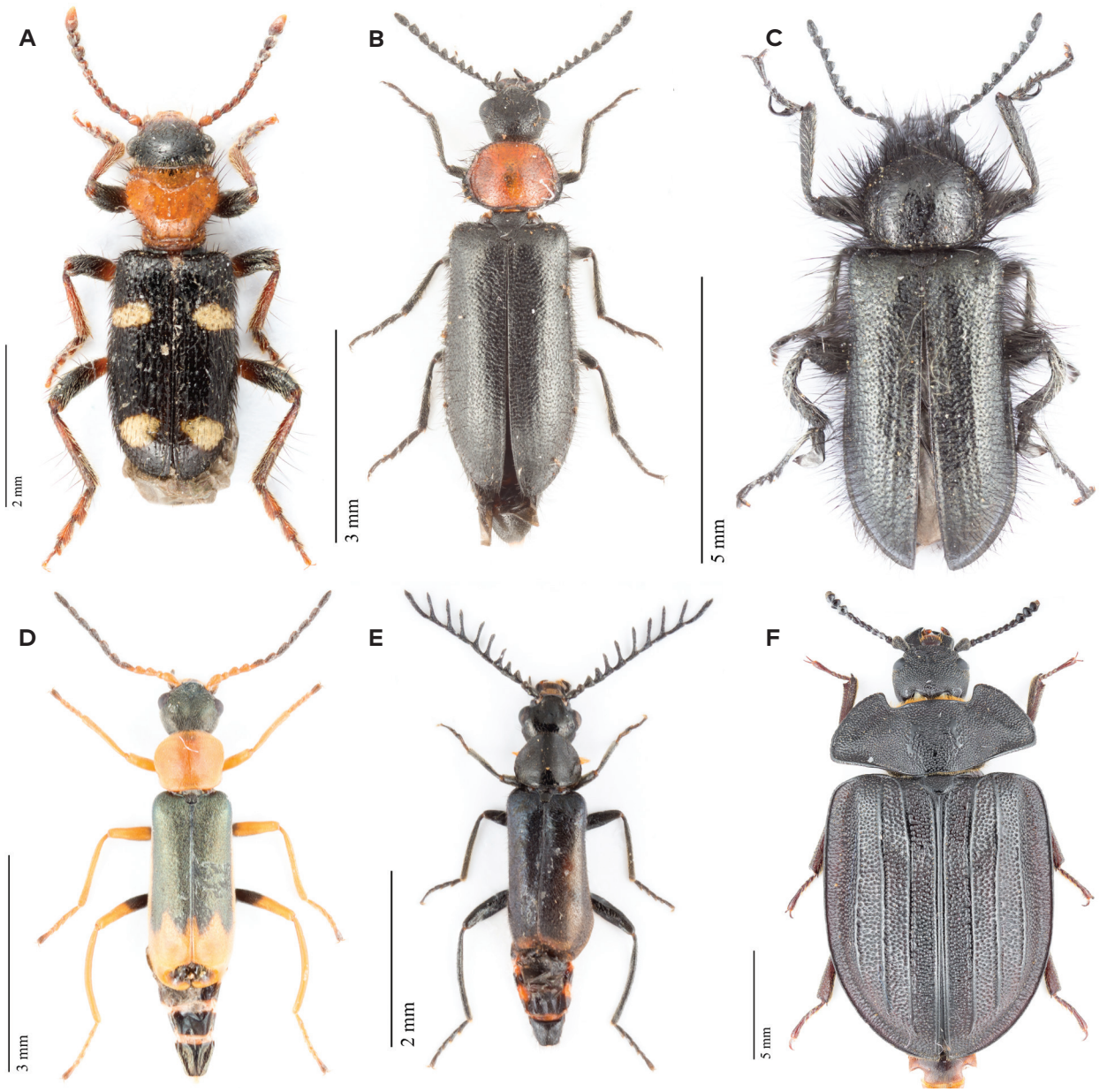


Figure 1. Habitus de quelques espèces de Cleroidea présentes en Suisse. **A)** *Allonyx quadrimaculatus*, **B)** *Dasytes thoracicus*, **C)** *Enicopus pilosus*, **D)** *Cerapheles terminatus*, **E)** *Nepachys cardiacae*, **F)** *Peltis grossa* (Photos A. Sanchez).

Commentaire. Cette espèce est connue d'Asie et d'Europe de l'Est (Pologne, Roumanie, Slovaquie et Ukraine) mais aussi de citations très anciennes d'Autriche, d'Allemagne (Niehuis 2013) et de Suisse (Müller 1912). Elle a également été découverte en Slovénie en 1993 (Niehuis 2013). Ces mentions d'Europe centrale sont à voir comme des populations relictuelles (Niehuis 2013) plutôt que comme des importations. Le spécimen suisse cité dans la littérature (Müller 1912) n'ayant pas été retrouvé et l'identification ne pouvant donc être confirmée (bien que l'espèce soit a priori inconfondable), *T. ircutensis* n'est pas considéré comme suisse en fonction des éléments à disposition. Dans tous les cas, *T. ircutensis* n'a plus été signalé en Suisse au cours des cent dernières années.

C8) *Dermestoides sanguinicollis*

Matériel examiné. [3,4,6)]1 ex., Basel, leg. & coll. Staehlin-Bischoff H., NMB; [3)]1 ex., Valais, leg. Anonymous, MHNG; 1 ex., Chiasso, T. [Tannino], 4.7.1928, coll. Fontana P., MSNL; 1 ex., Tessin, Intragna Umg., 11.6.1966, leg. & coll. Gehrig J., NMB; 1 ex., Someo, 26.6.1999, leg. & coll. Gilgen M. & Kamber L.; 1 ex., Rheinau ZH, 13.5.2007, leg. & coll. Frei A.; 1 ex., Rheinau ZH, 20.5.2007, leg. & coll Frei A.; 1 ex., Terre di Pedemonte TI, 4.-17.6.2013, leg. & coll. Chittaro Y.

Données publiées. [3,4,6)]1 ex., Basel par Staehlin-Bischoff H. et [3)]Sitten par Gautard V. (Stierlin et Gautard 1867); 1 ex., Chiasso, Tannino, 1928, par Fontana P. (Fontana 1929).

Commentaire. Rare mais assez largement distribuée en Europe, cette espèce saproxylique n'est connue que de quelques données de Suisse, principalement du Tessin et de quelques localités du nord du pays. Elle se développe principalement dans les chênes (*Quercus* spp.) et le châtaignier (*Castanea sativa*), souvent dans des arbres colonisés par le Grand capricorne *Cerambyx cerdo* (Sanchez et al. 2018).

C9) [*Tarsostenus univittatus*]

Matériel examiné. [3)]1 ex., Genève, coll. Maerky C., MHNG; [3)]1 ex., Genf, coll. Linder A., ex coll. Täschler M., ETH; 1 ex., Peney, 12.7.1886, coll. Tournier H., MHNG; 1 ex., Kt. Tessin, Chiasso, 7.1928, leg. & coll. Linder A., ETH; 1 ex., Basel, 8.1935, leg. & coll. Handschin E., NMB; 17 ex., Genève, 17.4.1984, leg. Besuchet C., MHNG; 16 ex., Genève, Eaux-Vives, 5.1984, leg. Besuchet C., MHNG; 2 ex., Genève, Port-Franc, 7.1995, leg. Besuchet C., MHNG; 1 ex., Dübendorf ZH, 3.2016, leg. Schmidt M., NMSO; 1 ex., Sion VS, 2.-18.8.2017, leg. & coll. Chittaro M.-C.
Données publiées. [1)]Genf par Tournier H. (Stierlin et Gautard 1867); Chiasso, 28.6.1922 par Fontana P. (Fontana 1925); Chiasso, Tannino, 1928 par Fontana P. (Fontana 1929).

Commentaire. Originaire probablement d'Australie, cette espèce est maintenant cosmopolite. En Suisse, elle a toujours été trouvée isolément et généralement en lien à des importations de bois (dans une tannerie au sud du Tessin, dans une menuiserie et un port-franc à Genève,…). La dernière capture, à Sion en 2017, a néanmoins été réalisée *in natura*. Les données disponibles actuellement ne permettent pas de savoir si l'espèce est réellement capable de s'établir en Suisse, comme cela a été le cas localement dans le sud de l'Allemagne (Geis 2001). De ce fait, elle est pour l'heure considérée comme ne faisant pas partie de la faune suisse.

C10) *Denops albofasciatus*

Matériel examiné. 1 ex., Cavigliano TI, 17.-30.6.2013, leg. & coll. Chittaro Y.

Données publiées. 1 ex., Cavigliano TI, 17.-30.6.2013 par Chittaro Y. (Chittaro 2014).

Commentaire. Présente dans une grande partie de l'Europe méridionale, cette espèce n'est pour l'heure connue en Suisse que d'un unique exemplaire tessinois, capturé au piège d'interception dans une châtaigneraie.

C11) [*Danacea* (*Allodanacaea*) *wittmeri*]

Matériel examiné. [8)]2 ex., Lago di Lugano, Castagnola, 25.5.1924, leg. Anonymous, det. Liberti G., coll. Wittmer W., NMB.

Commentaire. Cette espèce endémique de la région de Naples (Liberti 1985) n'est assurément pas présente en Suisse. Il s'agit donc d'une erreur d'étiquettage des spécimens du NMB ou d'une importation accidentelle.

C12) [*Danacea* (*Danacea*) *iners*]

Matériel examiné. [3,8)]1 ex., Genf [Genève], det. Liberti G., coll. Lasserre H., MHNG.

Commentaire. La donnée de «Genf» provient d'une collection problématique qui ne doit pas être considérée. Cette espèce balkanique, atteignant à peine la frontière italienne, n'est pas indigène en Suisse. Mentionnée par Mayor (2007a) sous *D. serbica*, elle a été récemment synonymisée avec *D. iners* (Liberti 2009a).

C13) [*Danacea* (*Danacea*) *marginata*]

Données publiées. [1,8)]Sta. Maria, Costeras, 19.6.1953 par Handschin E. (Handschin 1963).

Commentaire. Cette espèce colonise la partie méridionale de l'Europe de l'est et de l'Italie mais est toutefois absente d'Autriche, ce qui ne soutient guère une présence dans l'est de notre pays. Allenspach et Wittmer (1979) mettaient déjà en doute l'annonce de Handschin (1963), aucun individu de référence n'étant présent dans sa collection. *D. marginata* est à considérer comme absente de Suisse.

C14) *Danacea* (*Danacea*) *montivaga*

Matériel examiné. 2 ex., Chur, coll. Killias E., NMB; 2 ex., Schweiz, leg. Anonymous, NMB; 1 ex., Wallis, leg. Anonymous, ETH; 1 ex., Loèche-les-Bains, 16.5.1880, coll. Bugnion E., det. Constantin R., MZL; 2 ex., Kt. Wallis, Saastal, Saas-Almagell, 8.1939, leg. & coll. Lautner J., det. Liberti G., NMB; 1 ex., La Forcla [La Forclaz VS], 24.7.1951, leg. & coll. Simonet J., det. Liberti G., MHNG; 3 ex., Tessin, Mte. Gambarogno, 23.7.1980, leg. & coll. Scherler P., det. Liberti G., NMBE.

Données publiées. [1)] Simplon? [avec indication de doute] par Rätzer A. et [1)]Val Ferret? [avec indication de doute] par Rätzer A. (Rätzer 1888); [1)]Chandolin par Favre E., [1)]Forclaz par Tournier H., Loèche-les-bains par Bugnion E., [1)]Mauvoisin par Bugnion E. et [1)]Saas par Benteli F. (Favre 1890).

Commentaire. Cette espèce alpine rare est endémique des Alpes occidentales de France (de Chamonix au Mercantour), d'Italie (des Alpes de Ligurie au Monte Rosa) et de Suisse (Constantin et Liberti 2011), d'où elle est attestée avec certitude (examen de l'édéage) de quelques individus mâles provenant du Valais, mais aussi du Tessin.

C15) [*Danacea* (*Danacea*) *morosa*]

Données publiées. [1)]Sierre par Steck-Hofmann T. et [1)]Visperterminen par Bugnion E. (Favre 1890); [1)]Chiasso, 5. par Fontana P. (Fontana 1925).

Commentaire. Cette espèce d'Europe centrale (sud de la Pologne, République tchèque, Slovaquie, Autriche, Hongrie), présente marginalement dans les Balkans et dans le nord est de l'Italie (Liberti 2009a), n'est pas présente en Suisse. Aucun individu de référence soutenant les citations de la littérature n'existe en effet dans les collections muséales suisses.

C16) [*Danacea* (*Danacea*) *nigripalpis*]

Matériel examiné. [3,8)]4 ex., Sierre, coll. Favre E., det. Liberti G., MHNG.

Commentaire. Cette espèce endémique de Sicile (Liberti 1989) n'appartient assurément pas à la faune de Suisse. Les individus étiquetés de Sierre sont donc vraisemblablement le fruit d'erreurs d'étiquetage.

C17) *Danacea* (*Danacea*) *nigritarsis* s.l.

Matériel examiné. Nombreux exemplaires, principalement du Valais et du sud des Alpes, mais aussi isolément au nord des Alpes et sur le Plateau.

Commentaire. Deux sous-espèces de cette espèce politypique sont représentées en Suisse (Constantin et Liberti 2011): la sous-espèce *alpina*, largement répandue sur le versant sud des Alpes, et la sous espèce nominale. Nous n'avons toutefois pas procédé à la dissection systématique des individus mâles de *D. nigritarsis*, si bien qu'il est difficile de fournir une répartition fine des deux sous-espèces.

C18) *Dasytes* (*Anthoxenus*) *subaeneus*

Matériel examiné. [3)]1 ex., Nyon, coll. Maerky C., ex coll. Poncy E., det. Constantin R., MHNG; [3)]1 ex., Alpes, Tessin, coll. Maerky C., ex coll. Ghidini A., MHNG; [3)]1 ex., Bienne, 6.6., leg. & coll. Maerky C., MHNG; 1 ex., Auenst. [Auenstein AG], 17.7., leg. Anonymous, MHNG; 1 ex., Chancy GE, 13.7.1987, leg. & coll. Scherler P., NMBE; 1 ex., Genève, Chancy, La Laire, 13.7.1987, leg. Besuchet C., MHNG; 1 ex., Dittingen BL, 10.6.2017, leg. & coll. Chittaro Y.

Données publiées. [1)]Genf par Chevrier F., [1)]Genf par Lasserre H., [1)]Genf par Tournier H. et [1)]Jura par Heer O. (Stierlin et Gautard 1867); [1)]Chiasso, 5. par Fontana P. (Fontana 1925); [2)]Innufer, 25.5.1953, [1)]Las Ruinas, 18.6.1953, [2)] Costeras, 19.6.1953, [2)]Scuol-Ramosch, 30.6.1953, [1)]Zernez, 20.6.1955 et [2)]Sta. Maria, 23.6.1955 par Handschin E. (Handschin 1963); [1)]Weissenburg-Simmental BE par Huguenin E., [2)]Lac Bleu-Arolla-V. d'Hérens VS [par Besuchet C.], MHNG (Allenspach et Wittmer 1979).

Commentaire. Largement répandue en Europe, cette espèce est pourtant très rare en Suisse, où sa présence n'est attestée que par quelques spécimens provenant des cantons de Genève, de Bâle-Campagne et d'Argovie. La plupart des citations de la littérature sont invérifiables, mais celles qui ont pu être contrôlées se reportaient à d'autres espèces du genre *Dasytes*.

C19) [*Dasytes* (*Dasytes*) cf. *murinus*]

Matériel examiné. [3,6,8)]1 ex., Suisse, Nyon, leg. Anonymous, det. Liberti G., coll. Maerky C., MHNG.

Commentaire. L'individu examiné se rapproche de *D. murinus*, une espèce connue uniquement de Grèce et de Turquie. Provenant d'une collection problématique, il ne doit pas être considéré. Cette espèce n'est pas présente en Suisse.

C20) *Dasytes* (*Dasytes*) *pauperculus*

Matériel examiné. 1 ex., Genève, Avully, 5.-6.1993, leg. Besuchet C., det. Majer K., MHNG; 1 ex., Neuchâtel NE, 9.-25.5.2010, [leg. Haenni J.-P.], MHNN; 1 ex., Maggia TI, 6.4.-10.5.2014, leg. & coll. Chittaro Y.

Commentaire. Trois spécimens seulement attestent de la présence en Suisse de cette espèce connue également d'Espagne, de France, d'Italie et de Slovénie. Les individus du Tessin et de Neuchâtel, deux femelles, ont été capturés au moyen de pièges d'interception placés dans de vieilles chênaies, une situation déjà documentée auparavant (Liberti 2009b).

C21) *Dasytes* (*Dasytes*) *thoracicus thoracicus*
Fig. 1B

Matériel examiné. 1 ex., Wallis, Gondo, 14.7.1954, leg. Wolf J. P., MHNG; 1 ex., Tessin, Bordei, 21.7.1981, leg. Besuchet C., MHNG; 1 ex., Anzonico TI, 10.6.1997, leg. & coll. Scherler P., NMBE; 30 ex., Zwischbergen VS, 1.7.2018, leg. & coll. Breitenmoser S., Chittaro M.-C. & Chittaro Y.

Données publiées. Anzonico par Focarile A. (Liberti et Focarile 2005).

Commentaire. En Suisse, cette espèce relique à distribution discontinue n'était connue jusqu'à récemment que de trois spécimens capturés dans le nord ouest du Tessin et sur le versant sud du Simplon. En 2018, elle a pu être capturée en grand nombre à proximité de l'ancienne station valaisanne. Les individus se trouvaient dans un mélèzin clair, à 1350 m d'altitude, perchés au sommet de graminées (*Festuca rubra* aggr., det. Godat Saskia & Eggenberg Stefan). C'est la sous-espèce nominale, dont les femelles ont le thorax de couleur rouge (Fig. 1B), qui est présente en Suisse, en France et en Italie dans les Alpes occidentales (Alpes de Ligurie et Val d'Aoste) et dans les Appenins septentrionaux (Liberti et Focarile 2005).

C22) *Dasytes* (*Hypodasytes*) *lombardus*

Matériel examiné. 1 ex., Chiasso, 5.7.1937, coll. Fontana P., MSNL; 2 ex., Camoghé TI, 8.1963, leg. Toumayeff G., det. Constantin R., MHNG; 1 ex., Tessin, Camoghé, 6.8.1963, leg. Besuchet C., det. Constantin R., MHNG; 6 ex., Tessin, Somazzo, 11.7.1969, leg. & coll. Scherler P., NMBE; 2 ex., Mte. San Giorgio TI, 22.7.1977, leg. & coll. Scherler P., NMBE.

Données publiée. Chiasso (Fontana 1947); [2)]1 ex., Salorino, 6.1940 par Lautner J. (Allenspach et Wittmer 1979); Cima di Foiorina (Colla), Gazzirola (Colla), Monte Bar et Capriasca TI, 6.2004 par Focarile A. (Liberti et Focarile 2005).

Commentaire. Les trois espèces *Dasytes alpigradus*, *D. gonocerus* et *D. lombardus* sont morphologiquement

très proches et seuls les mâles peuvent être identifiés de manière certaine, après dissection et examen de l'édéage. Elles occupent cependant des aires de répartition globalement distinctes en Suisse (Fig. 2), avec seulement quelques zones de contact connues, notamment au Tessin (Liberti et Focarile 2005). *D. lombardus*, endémique des Préalpes calcaires lombardes, de l'Adamello aux Alpes Orobie et aux montagnes qui entourent le lac de Côme (Liberti et Focarile 2005), est la plus localisée des trois et ne se rencontre en Suisse que dans l'est du Tessin et dans le Val Mesolcina, où ses populations sont dans la continuité de celles du nord de l'Italie.

C23) [*Dasytes* (*Hypodasytes*) *tristiculus*]

Matériel examiné. [3,8)]1 ex., Alpes, Sierre, 6.7., coll. Maerky C., det. Majer K., MHNG; [3,8)]1 ex., Jura, Argovie, leg. Anonymous, coll. Maerky C., ex coll. Frey-Gessner E., det. Majer K., MHNG.

Commentaire. Connue du nord-est de l'Espagne, d'Italie tyrrhénienne (Constantin et Liberti 2011) et de la moitié méridionale de la France et de Corse, cette espèce n'est pas retenue pour la Suisse, les deux individus examinés provenant d'une collection problématique.

C24) [*Dasytes* (*Mesodasytes*) *aeneiventris*]

Données publiées. [1,8)] Loèche-ville et [1,8)]Lausanne par Bugnion E. (Favre 1890).

Commentaire. Cette espèce méridionale est connue de France, de Grèce, d'Italie, d'Espagne, d'Algérie, du Maroc et de Tunisie, ce qui ne soutient guère les citations de la littérature suisse (Favre 1890), pour lesquelles il n'existe par ailleurs aucun individu de référence.

C25) *Dasytes* (*Metadasytes*) *nigrocyaneus*

Matériel examiné. 1 ex., Indemini TI, 14.6.1974, leg. & coll. Spälti A., det. Liberti G., MHNG; 2 ex., Vaud, Bonmont, 5.-7.1991, leg. Besuchet C., det. Majer K., MHNG; 1 ex., Vaud, Genolier, 5.-7.1991, leg. Besuchet C., det. Majer K., MHNG.

Données publiées. [2)]1 ex., Lausanne, 7. par Toumayeff G. (Allenspach et Wittmer 1979).

Commentaire. Cette espèce très rare, bien que largement distribuée en Europe occidentale et centrale, est connue de quelques observations de France, d'Allemagne, d'Autriche, de Hongrie et de Slovaquie (Constantin 2014). En Suisse, elle n'est attestée que par trois données du canton de Vaud et du Tessin. Le spécimen de Lausanne de Toumayeff G., signalé dans la littérature (Allenspach et Wittmer 1979), était un *D. aeratus*.

C26) [*Dasytidius nigripes*]

Matériel examiné. [3,8)]1 ex., Suisse, Gilly, 6.6., coll. Maerky C., MHNG; [3,8)]1 ex., Suisse, Gilly, 8.6., coll. Maerky C., MHNG.

Commentaire. Les deux spécimens examinés sont issus d'une collection problématique qui ne doit pas être considérée. Cette espèce n'est connue que d'Azerbaidjan, de Grèce (Rhodes), de Chypre, d'Iran, d'Iraq, de Syrie et de Turquie et n'appartient pas à notre faune.

C27) [*Divales quadrimaculatus*]

Matériel examiné. [3,8)]3 ex., Bienne, leg. & coll. Maerky C., MHNG; [3,8)]3 ex., Bienne, 18.6., leg. & coll. Maerky C., MHNG.

Commentaire. Cette espèce est connue uniquement de Provence en France et, très marginalement, de la province italienne d'Imperia en Ligurie occidentale (Constantin et Liberti 2011). Les seuls spécimens «suisses» que nous ayons pu examiner proviennent d'une collection problématique qui ne doit pas être considérée. L'espèce ne fait pas partie de notre faune.

C28) [*Enicopus* (*Enicopus*) *ater ater*]

Matériel examiné. [3)]2 ex., Valais, coll. Maerky C., ex coll. Fries A., MHNG.

Commentaire. Ce n'est que récemment que le statut taxonomique de cete espèce a été clarifié (Liberti et Constantin 2009). Il s'agit d'une espèce avec une large distribution, de l'Europe centrale jusqu'au Kirghizistan, qui est notamment connue du sud de la France et d'Italie (Constantin et Liberti 2011). Les seuls spécimens examinés provenant d'une collection problématique, l'espèce n'est pas retenue pour la Suisse.

C29) *Enicopus* (*Enicopus*) *pilosus* (Fig. 1C)

Matériel examiné. [3)]1 ex., Alpes, Valais, leg. & coll. Maerky C., MHNG; 1 ex., Wallis, Gr. St. Bernard, coll. Cerutti N., MHNG; 1 ex., Gabi-Simplon, 6.-8.1948, leg. Weber P., coll. Allenspach V., NMB; 30 ex., Simplon VS, 30.6.2018 & 11.7.2018, leg. & coll. Breitenmoser S., Chittaro M.-C, Chittaro Y. & Monnerat C.; 3 ex., Simplon VS, 11.7.2018, leg. & coll. Chittaro Y.

Données publiées. [1)]Schaffhausen par Stierlin G. (Stierlin et Gautard 1867); [1)]Aigle par Jaccard H., [7)]Versant sud du St-Bernard [Col du Grand Saint-Bernard] par Favre E. (Favre 1890); [1)]Rocca Bella par Rühl F. (Caflisch 1894); [1)]Zernez, Clüs, 7.1937 par Handschin E. (Handschin 1963); [1,3)]3 ex., Le Vaud-Begnins, [coll. Maerky C.], MHNG; [1,3)]5 ex., Tessin, [coll. Maerky C.], MHNG (Allenspach et Wittmer 1979).

Commentaire. Cette espèce est connue du versant espagnol des Pyrénées, du sud-est de la France, de la quasi-totalité de l'Italie continentale ainsi que de Sicile (Constantin et Liberti 2011). Jusqu'à récemment, elle n'était connue en Suisse que de deux spécimens valides, l'un capturé en 1948 à Gabi, au sud du Simplon, et l'autre au Grand-Saint-Bernard (capture sans indication de date mais antérieure à 1900). S'agissant de deux femelles, la détermination spécifique demeurait néanmoins incertaine. En 2018, plu-

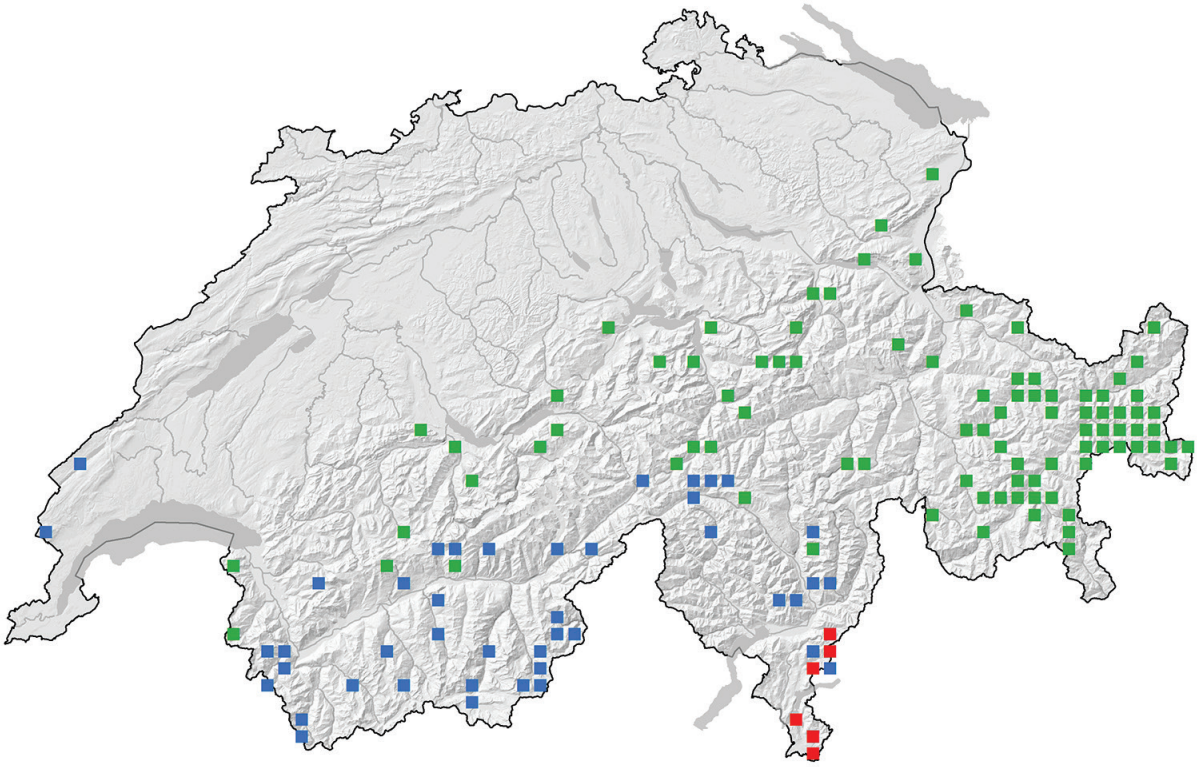


Figure 2. Répartition en Suisse de *Dasytes alpigradus* (en vert), *D. gonocerus* (en bleu) et *D. lombardus* (en rouge).

sieurs dizaines d'individus ont pu être observés, perchés le long de tiges de graminées, dans des pentes séchardes de mélèzins clairs à 1500 m d'altitude, à proximité de la localité historique du Simplon. Les spécimens mâles capturés permettent d'assurer l'identification spécifique et de confirmer l'existence d'une population sur territoire helvétique, dans la continuité de celles du nord de l'Italie, où elle est connue de diverses localités collinéennes et montagnardes. Elle semble par contre avoir disparu du Sud-Tyrol italien (Kahlen et Hellrigl 1996). Les autres citations suisses de la littérature sont invérifiables, ou, dans le cas des citations d'Allenspach et Wittmer (1979), concernent des spécimens femelles (en outre issues d'une collection problématique) qui ne peuvent être identifiés de manière certaine (Constantin et Liberti 2011).

C30) [*Psilothrix* (*Psilothrix*) *aureola*]

Données publiées. [1,8)]Schaffhausen par Vogler (Stierlin 1883).

Commentaire. Cette espèce méditerrannéenne, connue des îles Baléares jusqu'au sud de la Grèce, ainsi que d'Afrique du Nord et des deux tiers méridionaux de l'Italie (Liberti 2009b), n'a été annoncée en Suisse que dans la littérature. Il n'existe pas d'individu de référence. *P. aureola* n'est dont pas retenu pour la Suisse.

C31) [*Psilothrix* (*Psilothrix*) *smaragdina*]

Données publiées. [1)]Schaffhausen (Stierlin 1898).

Commentaire. Aucun matériel de référence suisse n'existe pour cette espèce, connue uniquement d'Italie et de Tunisie. Elle ne fait pas partie de notre faune.

C32) *Anthocomus* (*Celidus*) *humeralis*

Matériel examiné. 1 ex., Hasle-Rüegsau, 9.1972, leg. Kiener S., det. Švihla V., MHNG; 1 ex., Zürich, Rüti, 29.5.1973, leg. Stankowski B., det. Liberti G., MHNG.

Commentaire. En fonction des caractères donnés par Kolibáč et al. (2005), deux femelles capturées en Suisse peuvent être attribuées à cette espèce. Des spécimens supplémentaires seraient néanmoins bienvenus pour confirmer son indigénat. *A. humeralis* est cité d'Autriche, de Bulgarie, de République tchèque, de Grèce, de Roumanie, de Slovaquie, de Russie et de Turquie (Mayor 2007a).

C33) [*Anthomalachius spinosus*]

Matériel examiné. [3)]1 ex., Bienne, coll. Maerky C., ex coll. Poncy E., det. Liberti G., MHNG; [3)]1 ex., Nyon, coll. Maerky C., ex coll. Poncy E., det. Liberti G., MHNG; [3)]1 ex., Zürich, coll. Maerky C., ex coll. Poncy E., det. Liberti G., MHNG.

Données publiées. [1)]Dübendorf par Bremi-Wolf J.J., [1)]Genf par Tournier H. et [1)]Wallis par Stierlin G. (Stierlin et Gautard 1867); [1)]Martigny par Favre E. (Favre 1890); [1)]Aigle par Jaccard H. (Jaccard 1890); [1)]Martigny, MZL (Allenspach et Wittmer 1979).

Commentaire. Largement répandue en Europe, cette espèce n'est pourtant pas retenue pour la Suisse en fonction des données à disposition. Les seuls spécimens «suisses» examinés proviennent en effet d'une collection qui ne doit pas être considérée, tandis que les citations issues de la littérature demeurent invérifiables.

C34) [*Attalus* (*Abrinus*) *amictus*]

Données publiées. [1,8)]1 ex., Wallis par Imhof L. (Stierlin et Gautard 1867); [1,8)]Siders et [1,8)]Visp par Rätzer A. (Rätzer 1888); [1,8)]Martigny par Favre E. et [1,8)]Sierre par Böschenstein A. (Favre 1890); [2,8)]Nombreuses citations du canton du Valais (Allenspach et Wittmer 1979).

Commentaire. Annoncé de nombreuses localités valaisannes par Allenspach et Wittmer (1979), tous les individus que nous avons retrouvés et vérifiés sont à attribuer en réalité à l'espèce voisine *A. analis*. *A. amictus*, connu d'Espagne, du Portugal et du sud-ouest de la France (Constantin 2014), n'est donc pas considéré comme suisse en fonction des éléments disponibles.

C35) *Attalus* (*Attalus*) *alpinus*

Matériel examiné. 1 ex., Chandolin, coll. Favre E., MHNG; 1 ex., S-chanf, Godgod, [27.7.-4.]8.1981, leg. Reser-Rezbanyai L., coll. Wittmer W., NMB; 1 ex., All'Acqua, Val Bedretto TI, 12.6.2007, leg., det. & coll. Liberti G.

Données publiées. [1)]1 ex., Saas nach Fee, 1861 par Kiesenwetter H. (Kiesenwetter 1861); [1)]Pontresina par Stierlin G. (Heyden 1863); [1)]Bevers et [1)]Rosegg, 6.1862 par Stierlin G. (Stierlin 1863);[1)]Saas par Gautard V. (Stierlin et Gautard 1867); [1)]Davos par Nagel H. (Caflisch 1894); Chandolin, [1)]Ponchette et [1)]Simplon par Favre E. (Favre 1890); 1 ex., S-chanf, Godgod, 27.7.-4.8.1981 par Reser-Rezbanyai L. (Herger 1994b).

Commentaire. Cette espèce très rare est présente uniquement dans les Alpes de France, d'Italie, d'Autriche et de Suisse. En Suisse, elle est confirmée uniquement de trois localités, du Valais, du Tessin et des Grisons, auxquelles viennnent s'ajouter quelques citations de littérature plausibles mais invérifiables. Le spécimen des Grisons (Godgod) a été capturé au piège lumineux alors que celui du Tessin (All'Acqua) a été obtenu au battage d'un épicéa (*Picea abies*) à 1520 m d'altitude.

C36) [*Attalus* (*Attalus*) *cyaneus*]

Matériel examiné. [3,8)]1 ex., Genève, leg. & coll. Poncy E., det. Švihla V., MHNG; [3,8)]3 ex., Sierre, coll. Bugnion E., det. Švihla V., MHNG.

Données publiées. [1)]St. Bernhard (Stierlin 1898); [1)]Chiasso (Fontana 1947).

Commentaire. Cette espèce méditerranéenne occidentale est connue du sud-est de la France (Alpes-Maritimes et Var selon Constantin 2014), d'Italie, de Malte, d'Espagne, d'Algérie et de Tunisie. Nous ne la retenons pas pour la Suisse, les données publiées étant très anciennes et invérifiables, alors que les individus examinés sont issus de collections reconnues comme étant parfois problématiques.

C37) *Cerapheles terminatus*

Fig. 1D

Matériel examiné. 1 ex., Digue du Rhône [VD], 21.5.1918, coll. Gaud A., MZL; 19 ex., Kt. Waadt, Villeneuve, 5.1944, leg. Linder A., coll. Linder A. & Allenspach V., ETH, NMB & NMSO; 1 ex., Villeneuve, Grangettes, 24.5.1944, leg. von Peez A., coll. Pochon H., MHNF; 2 ex., Vaud, Seeufer Villeneuve, 27.5.1944, leg. von Peez A., MHNG; 2 ex., Kt. Waadt, Villeneuve, 6.1945, leg. & coll. Linder A., ETH; 1 ex., Vaud, Neuveville [Villeneuve], 30.3.1946, leg. & coll. Pochon H., MHNF; 1 ex., Kleinbösingen FR, 14.6.1991, leg. Hoess R., NMBE; 2 ex., Cudrefin VD, 11.7.1991, leg. & coll. Scherler P., NMBE; 1 ex., Cudrefin VD, 5.6.1993, leg. & coll. Scherler P., NMBE; 1 ex., Berne, Uebeschisee, 6.6.1996, leg. Besuchet C., MHNG; 2 ex., Cudrefin VD, 17.5.2018, leg. & coll. Chittaro Y.; 1 ex., Avully GE, 24.5.2018, leg. & coll. Chittaro Y.

Données publiées. Villeneuve, 5.1944 et 5.-6.1944 par von Peez A. et Villeneuve, 6.1945 par Linder A. (Linder 1946); [1)]1 ex., Les Echets-Caux, 5.1929, MHNG (Allenspach et Wittmer 1979); Portalban-Cudrefin, 11.6.1991 et 11.7.1991 par Scherler P. (Scherler 1995).

Commentaire. Cette espèce, assez largement répandue en Europe, colonise les roselières de bords de lacs et de grands cours d'eau. Elle n'est connue que de quelques localités de plaine en Suisse, toutes situées dans l'ouest du pays.

C38) [*Ceratistes dilaticornis*]

Données publiées. [1)]St. Gallen par Täschler M. (Stierlin 1883); [1)]1 ex., Bironico, 25.5.1901 par Fontana P. (Fontana 1925).

Commentaire. Aucun spécimen en collection ne vient soutenir les citations de la littérature. Cette espèce est principalement répandue dans le sud-est de l'Europe. Ses citations (anciennes) de France et d'Italie sont douteuses (Franzini G., comm. pers.).

C39) *Charopus docilis*

Matériel examiné. 1 ex., Kt. Tessin, Ascona, 6.1934, leg. & coll. Linder A., ETH; 2 ex., Genève, Chancy, La Laire, 20.5.1985, leg. Besuchet C., det. Švihla V. & Liberti G., MHNG.

Commentaire. Cette espèce méridionale est connue d'Italie, d'Espagne, d'Andorre, d'Algérie et de France. Dans ce dernier pays, elle remonte jusqu'en Bugey (Ain) notamment (Constantin 2014), ce qui soutient sa présence, seulement récemment mise en évidence, à Genève aussi. Un spécimen tessinois, très abîmé, a aussi été attribué à

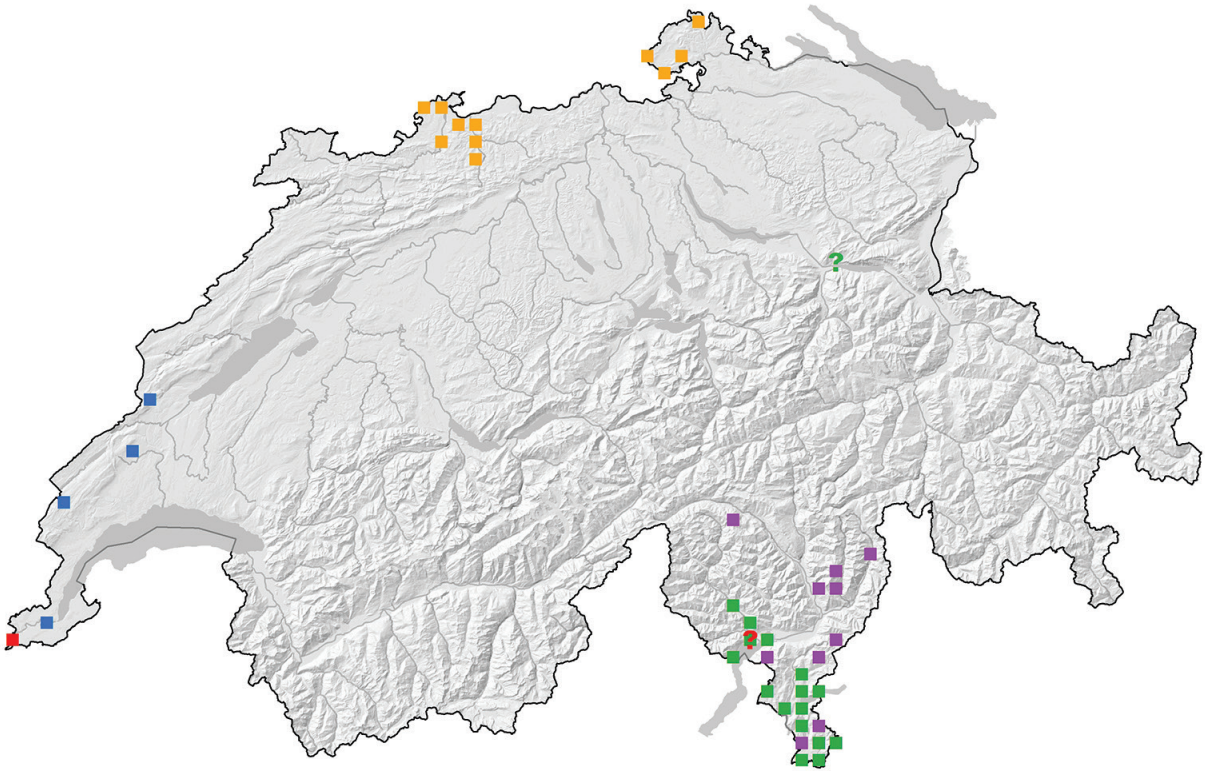


Figure 3. Répartition des espèces du genre *Charopus* en Suisse: *C. concolor* (en vert), *C. docilis* (en rouge), *C. flavipes* (en orange), *C. madidus* (en violet) et *C. pallipes* (en bleu). Une observation au nord des Alpes de *C. concolor* (1 ex., Betlis am Walensee, Gasthaus «Paradiesli», 4.7.1967, leg. Farmer R., NMB; aussi publiée par Allenspach (1968)) résulte probablement d'une importation et est signalée par un point d'interrogation vert. Une observation de *C. docilis* au Tessin est également incertaine, l'individu étant très abîmé (voir C39), et est indiquée par un point d'interrogation rouge.

cette espèce, mais une confusion avec *C. concolor*, commun dans la région (Fig. 3), n'est pas totalement exclue.

C40) *Charopus flavipes*

Matériel examiné. 1 ex., Löhningen, 2.6.1944, leg. & coll. Allenspach V., NMB; 2 ex., Basler Jura, Bubendf. [Bubendorf], 30.6.1946, leg. Wolf J.P., ETH; 2 ex., Basler Jura, Ziefen, 30.6.1946, leg. Wolf J.P., ETH; 1 ex., Basler Jura, Tiefental, 12.6.1947, leg. Wolf J.P., ETH; 2 ex., Merishausen, 23.5.1948, leg. & coll. Allenspach V., NMB; 1 ex., Muttenz BL, 5.1954, leg. Toumayeff G., MHNG; 2 ex., Bâle, Allschwil, 6.1955, leg. Toumayeff G., MHNG; 1 ex., Muttenz BL, 6.1955, leg. Toumayeff G., MHNG; 2 ex., Aesch BL, 7.1958, leg. Toumayeff G., MHNG; 1 ex., Kt. Basel, Augst, 6.1967, leg. & coll. Linder A., ETH; 1 ex., Kt. Bern, Duggingen, 6.1967, leg. & coll. Linder A., ETH; 1 ex., Allschwil BL, Ziegelei, 17.5.1978, leg. Kiener S., MHNG; 1 ex., Kt. BL, Allschwil, Ziegelei, 8.7.1978, leg. Kiener S., det. Švihla V., MHNG; 1 ex., s/Hallau, Röti SH, 5.1984, leg. Toumayeff G., MHNG; 1 ex., Schaffhouse, s/Osterfingen, 9.6.1988, leg. Besuchet C., MHNG; 1 ex., Schaffhouse, Wangental près Osterfingen, 10.6.1988, leg. Besuchet C., MHNG; 2 ex., Bubendorf BL, 18.6.2005, leg., det. & coll. Geiser M., NMBE; 1 ex., Basel BS, 16.-18.6.2017, leg. & det. Germann C., NMSO.

Données publiées. [1)]Valais par Stierlin G. (Favre 1890); [2)]Chiasso, 14.6, par Fontana P. (Fontana 1925); [2)]Generoso par Fontana P. (Fontana 1947); [1)]5 ex., Noville, 5.1901, MZL, [2)]1 ex., Mendrisio, 7.1940 par Allenspach V., [2)]Mte Generoso par Linder A., [2)]1 ex., Mesocco, 7.-8.1943 par Allenspach V., [2)]1 ex., Mte Generoso, 7.1964 par Scherler P., [2)]2 ex., Mte Generoso, 8.1965 par Scherler P., [2)]2 ex., Mte Generoso, 8.1967 par Scherler P., [2)]1 ex., Mte Bisbino-V. Muggio-Italien, 7.1954, [leg. Besuchet C.], MZL, [2)]2 ex., Tesserete-V. Colla, 7.1964, par Scherler P. et [2)]1 ex., V. Calanca, 6.1948, par Allenspach V. (Allenspach et Wittmer 1979); Zoo Basel, secteur H (Sprecher et al. 2008).

Commentaire. Cette espèce est très largement répandue en Europe. En Suisse, elle se limite uniquement au nord du pays, contrairement à l'espèce voisine *C. pallipes* qui colonise plutôt le sud-ouest (Fig. 3). Les données publiées du Tessin sont à reporter en quasi-totalité à *C. madidus*.

C41) *Charopus madidus*

Matériel examiné. 2 ex., Chiasso, coll. Fontana P., MHNG; 1 ex., Generoso, 2.7.1926., coll. Fontana P., MSNL; 1 ex., Mendrisio TI, 10.-24.7.1940, leg. & coll. Allenspach V., NMB; 1 ex., Mesocco GR, 6.-7.1943, leg. & coll. Allenspach V., NMB; 1 ex., V. Calanca, 5.6.1948,

leg. & coll. Allenspach V., NMB; 1 ex., Kt. Tessin, Generoso, 7.1954, leg. & coll. Linder A., ETH; 1 ex., Tessin, Mte. Generoso, 26.7.1954, leg. Besuchet C., det. Švihla V., MZL; 1 ex., Tessin, Mte. Bisbino, 27.7.1954, leg. Besuchet C., MZL; 1 ex., B. Vista [Bellavista, Monte Generoso], 12.7.1960, leg. Zuber A., det. Švihla V., MHNG; 1 ex., Camoghe TI, 8.1963, leg. Toumayeff G., MHNG; 1 ex., Tessin, Generoso, 14.7.1964, leg. & coll. Scherler P., NMBE; 4 ex., Tessin, s/Colla, 20.7.1964, leg. & coll. Scherler P., NMBE; 2 ex., Tessin, Generoso, 22.8.1965, leg. & coll. Scherler P., NMBE; 1 ex., Tessin, Generoso, 14.8.1967, leg. & coll. Scherler P., NMBE; 1 ex., Indemini, 7.1969, leg. Toumayeff G., MHNG; 1 ex., Tessin, Mt. Generoso, 22.7.1977, leg. Marggi W., MHNG; 5 ex., Tessin, Bella Vista, 11.7.1981, leg. Besuchet C., MHNG; 1 ex., Tessin, Somazzo, 15.6.1990, leg. & coll. Scherler P., NMBE; 10 ex., Monte Generoso TI, Vetta, 13.7.1990, leg. Reser-Rezbanyai L., NMLU; 1 ex., Tessin, Alpe Brogoldone, s/Claro, 17.7.1990, leg. Besuchet C., MHNG; 2 ex., Molinera TI, 19.7.1990, leg. & coll. Scherler P., NMBE.

Données publiées. Generoso (Fontana 1947); Capriasca TI, 6.2004 par Focarile A. (Liberti et Focarile 2005).

Commentaire. Plusieurs spécimens de diverses localités tessinoises (Fig. 3) confirment la présence en Suisse de cette espèce localisée, connue également d'Autriche, d'Italie, de Slovénie et des Balkans.

C42) *Charopus pallipes*

Matériel examiné. 1 ex., Vaud, Marchairuz, Roch, 27.6.1976, leg. & coll. Scherler P., NMBE; 1 ex., Vaud, Moiry, 30.5.1982, leg. & coll. Scherler P., NMBE; 1 ex., Genève, Pl. des Nations, 28.6.1987, leg. Steffen J., MHNG; 1 ex., Vaud, Aig. [Aiguilles] de Baulmes, 3.8.1987, leg. & coll. Scherler P., NMBE; 1 ex., Genève, Pl. des Nations, 7.7.1992, leg. Steffen J., det. Švihla V., MHNG.

Données publiées. [1)]Basel par Bischoff-Ehinger A., [1)]Genf par Stierlin G., [1)]Genf par Tournier H. et [1)] Schaffhausen par Stierlin G. (Stierlin et Gautard 1867); [1)]Poschiavo par Jörger J. (Linder 1967).

Commentaire. Moins largement répandue en Europe que *C. flavipes*, cette espèce est retenue pour la Suisse sur la base de quelques exemplaires mâles provenant de trois localités du canton de Vaud et d'une de Genève (Fig. 3).

C43) *Clanoptilus* (*Clanoptilus*) *affinis*

Matériel examiné. 1 ex., St. Maria, Costeras, 25.5.1953, leg. & coll. Handschin E., BNM; 1 ex., St. Maria, Costeras, 19.6.1953, leg. & coll. Handschin E., BNM; 1 ex., St. Maria, Valpaschun, 20.6.1953, leg. & coll. Handschin E., BNM; 1 ex., Münstertal ob Müstair, 1.8.1956, leg. Eglin W., BNM; 2 ex., Müstair GR, 28.7.1970, leg. & coll. Scherler P., det. Wittmer W., NMBE.

Données publiées. [1)]Lägern par Isenschmid M., [1)]Locarno par Isenschmid M. et [1)]Siders par Isenschmid M. (Stierlin 1883); [1)]Sierre et environs par Schacht W. (Favre 1890); [1)]Maienfeld par Müller J.A. (Müller 1912); [1)]Generoso (Fontana 1947); [1)]Scuol, Gurlaina, 27.5.1953, Sta. Maria, Costeras, 25.5.1953 et Valpaschun, 20.6.1953 par Handschin E. (Handschin 1963); [2)]Les Grangettes-Villeneuve VD, [2)]Lötschental et [2)]Sion par Pochon H., [2)]Morcote, MHNG, [2)]Alpe di Neggia [par Besuchet C.], [2)]Monti di San Abbondio-Ranzo [par Besuchet C.], MHNG, [2)]Locarno [par Gaud A.], MZL, [2)]Dandrio-V. Pontirone par Allenspach V., [1)]Altanca-Ambri-Piotta, MZL, [1)]1 ex., Siloah-Muri BE, 7.1953, MHNG, [2)]1 ex., Lutry VD, 5.1955, [par Aubert J.], MZL (Allenspach et Wittmer 1979).

Commentaire. Seuls six spécimens, tous capturés dans l'extrême est de la Suisse (Val Müstair, Fig. 4), permettent de considérer cette espèce comme faisant partie de la faune suisse. Tous les autres individus figurant sous « *Clanoptilus affinis* » dans les collections suisses examinées, pour certains cités par Allenspach et Wittmer (1979), appartenaient en réalité à d'autres espèces des genres *Clanoptilus*, *Malachius* ou *Cordylepherus*. A proximité des populations suisses, *C. affinis* est également connu du Vorarlberg (Brandstetter et Kapp 1998) et du Sud-Tyrol italien (Kahlen et Hellrigl 1996). Présent localement en France (Constantin 2014), *C. affinis* pourrait aussi se trouver dans l'ouest de la Suisse dans des zones xérothermophiles.

C44) [*Clanoptilus* (*Clanoptilus*) *arnaizi*]

Données publiées. [1)]Suisse (Constantin 2014).

Commentaire. Nous n'avons pas connaissance de spécimens suisses se référant à cette espèce colonisant l'Italie, l'Espagne et la moitié méridionale de la France. Néanmoins, un spécimen du Val d'Aoste voisin (Italie), où l'espèce est commune, est conservé au MHNG. C'est peut-être de cet individu que découle la mention bibliographique. Pour l'heure, l'espèce n'est pas retenue pour la Suisse bien qu'elle y soit potentielle, notamment dans certaines zones xériques du Valais.

C45) *Clanoptilus* (*Clanoptilus*) *geniculatus*

Matériel examiné. [3)]1 ex., Tarasp, leg. Anonymous, BNM; [3)]1 ex., Trins, leg. Anonymous, BNM; 1 ex., Bellinzona, 7.1914, coll. Kehrmann F., det. Švihla V., MHNG; 1 ex., Locarno TI, 5.1934, leg. Toumayeff G., MHNG; 1 ex., Chiasso, 26.5.1939, coll. Fontana P., MSNL; 8 ex., Kt. Graubünden, Grono, 6.1951, leg. & coll. Linder A., ETH; 1 ex., Golino TI, 13.6.1987, leg. & coll. Scherler P., NMBE.

Données publiées. [1)]Menaggio par Meyer-Dür R. (Stierlin 1863–1864); [1)]Genf par Chevrier F., [1)]Genf par Tournier H. et [1)]Schaffhausen par Stierlin G. (Stierlin et Gautard 1867); [1)]Sierre et environs par Schacht W. (Schacht 1879); [1)]Entremont, [1)]Ferret, [1)]Gadmen et [1)]Pieterlen a. Jura par Rätzer A. (Rätzer 1888); [1)]Domleschg par Stoffel A., [1)]Schuls, [1)]Tarasp et [1)]Nairs, 1874 par Killias E., [1)]Bergell par Bazzigher L. (Caflisch 1894); [1)]Martigny, [1)]Fully, [1)]Isérables, [1)]Sierre et [1)]Chandolin par Favre (Favre 1890), [1)]Chiasso (Fontana 1925); [1)]Airolo (Fontana 1947); Grono par Linder A. (Linder 1967); [2)]Bölchen SO/

BL par Lautner J. & Wittmer W; [2)]Lägern ZH par Lautner J.; [1)]Biel BE; [2,3)]Gilly [ex coll Maerky C.,MHNG]; [2)]Vevey [par Gaud A.], MZL; [2)]Pomy-Yverdon VD [par Mellet P., MZL]; [2,3)]Fribourg, [ex coll Maerky C.], MHNG, [2)]Pérolles par Pochon H.; [1)]Schwarzenburg BE par Toumayeff G., MHNG; [2,3)]Burgdorf BE, MHNG; [1)]Zürich par Huguenin H., [2)]Muttenz BL par Toumayeff G., [MHNG]; [2)]Baden AG par Toumayeff G., [MHNG]; [2)]Bülach ZH par Lautner J. [NMB]; [1)]V. Eau Froide par Scherler P.; [2)]Roche par Scherler P., [NMBE]; [2)]Aigle VD par Scherler P., [NMBE]; [2,3)]Les Ormonts VD [coll Maerky C.], MHNG; [1)]Gryon VD, MZL; [2)]La Comballaz par Toumayeff G., [MHNG]; [2)]Schweinsberg FR par Pochon H. [MHNF]; [1)]Simmental BE par Huguenin H., MHNG; [1)]Gadmen-Innertkirchen BE par Allenspach V.; [1)]Baltschiedertal par Toumayeff G.; [2)]Isérables [par Simonet J.], MHNG; [1)]Vissoie, St. Luc par Spälti A.; [2)]Nanztal-Brig par Toumayeff G., MHNG; [1)]Scuol, MHNG; [2)]Montagnola-Lugano par Kutter H., [MZL]; [2)]Sopraceneri, Cartada-Locarno par Brugger A. [MHNG] (Allenspach et Wittmer 1979).

Commentaire. Seuls quelques rares spécimens provenant du sud des Alpes (Fig. 4) permettent de considérer cette espèce, largement répandue à l'échelle paléarctique, comme suisse. Citée d'Alsace (Callot 2018), sa présence dans le nord du pays serait également envisageable. La plupart de spécimens cités par Allenspach et Wittmer (1979) qui ont été retrouvés appartenaient en réalité à d'autres espèces des genres *Clanoptilus*, *Malachius* ou *Cordylepherus*.

C46) [*Clanoptilus* (*Clanoptilus*) *rufus*]

Matériel examiné. [4,8)]1 ex., Lausanne, 7., leg. Toumayeff G., MHNG.

Données publiées. [4,8)]1 ex., Lausanne, 7.7, par Toumayeff G., MHNG (Allenspach et Wittmer 1979).

Commentaire. Cette espèce méditerranéenne, connue d'Espagne, du Maghreb, d'Italie et de France, ne peut pas être retenue pour la faune de Suisse sur la base de l'unique exemplaire examiné. Bien qu'appartenant à une collection de qualité, l'étiquette de la localité laisse penser à une erreur d'étiquetage ou à un échange, Toumayeff G. mentionnant toujours l'année de découverte, ce qui n'est pas le cas ici.

C47) [*Clanoptilus* (*Clanoptilus*) *spinipennis*]

Données publiées. [1,8)]Sierre et environs par Redtenbacher L. (Schacht 1879); [1,8)]Chandolin, [1,8)]Niouc et [1,8)]Sierre par Favre E. (Favre 1890); [1)]Trins, 1890 par Caflisch J. (Caflisch 1894); [2)]1 ex., Bex VD [par Gaud A.], MZL, [2)]Pfynwald par Pochon H. [MHNF], [1)]Mörel, MZL; [2)]V. d'Anniviers, Niouc [par Gaud A.], MZL, [1)]Bigorio-Tesserete et [2)] Monti-Locarno par Spälti A. (Allenspach et Wittmer 1979).

Commentaire. Citée dans plusieurs références bibliographiques, aucun spécimen valide de cette espèce n'a cependant été trouvé dans les collections suisses examinées. La plupart de spécimens cités par Allenspach et Wittmer (1979) qui ont été retrouvés appartenaient en effet à d'autres espèces des genres *Clanoptilus*, *Malachius* ou *Cordylepherus*. Cette espèce est principalement répandue en Europe de l'est, jusqu'au Caucase et l'ouest de l'Asie. En Italie du Nord, elle n'est connue que de la côte adriatique (Franzini G., comm. pers.). Sa présence en Suisse est très peu probable.

C48) [*Clanoptilus* (*Hypoptilus*) *barnevillei*]

Données publiées. [1)]Brigue par van der Hoop D. (Favre 1890); [2)]2 ex., Müstair, 7.1970 par Scherler P. (Allenspach et Wittmer 1979).

Commentaire. Cette espèce est connue localement de France, d'Italie, d'Espagne, d'Allemagne, d'Angleterre et de Suède. Citée de l'Ain et du Jura en France (Constantin 2014), une présence dans l'ouest de notre pays est possible, mais aucun spécimen suisse ne vient pour l'heure confirmer cette hypothèse. Les spécimens cités par Allenspach et Wittmer (1979) étaient des *C. affinis*, alors que le spécimen de Brigue n'a pas été retrouvé dans les collections consultées.

C49) *Cyrtosus* (*Oogynes*) *ovalis*

Matériel examiné. 1 ex., Caneggio, coll. Fontana P., MSNL; 5 ex., Chiasso, coll. Fontana P., MSNL; [8)]1 ex., Valais, Euseigne, 6.6., leg. & coll. Pochon H., MHNF; 3 ex., Mendrisio, 25.5.1930, leg. & coll. Allenspach V., NMB; 1 ex., Chiasso, 6.6.1933, coll. Fontana P., MSNL; 1 ex., Mendrisio, 30.5.-2.6.1936, leg. & coll. Lautner J., NMB; 14 ex., Kt. Tessin, Mendrisio, 5.1943, leg. & coll. Linder A., ETH; 1 ex., Tessin, Mendrisio, 1.6.1943, leg. & coll. Pochon H., MHNF; 2 ex., Mendrisio, 6.1949, leg. & coll. Linder A., ETH; 2 ex., Chiasso, 6.1953, leg. Linder A., coll. Toumayeff G. & coll. Lautner J., MHNG & NMB; 1 ex., Kt. Tessin, Origlio, 6.1975, leg. Linder A., NMBE; 8 ex., Muzzano TI, 12.6.1985, leg. & coll. Scherler P., NMBE; 5 ex., Muzzano TI, 20.6.1985, leg. & coll. Scherler P., NMBE; 2 ex., Tessin, Lago di Muzzano, 24.6.1987, leg. Besuchet C., MHNG; 6 ex., Muzzano TI, 24.6.1987, leg. & coll. Scherler P., NMBE.

Données publiées. Mendrisio, 5.1943 par Linder A. (Linder 1946); Chiasso (Fontana 1947).

Commentaire. En Suisse, cette espèce est connue de quelques localités tessinoises, dans la continuité de ses observations au nord de l'Italie. On la connaît aussi d'Espagne, de Grèce et de Turquie. La localité valaisanne est douteuse et résulte probablement d'une erreur d'étiquetage.

C50) [*Ebaeus* (*Ebaeus*) *appendiculatus*]

Données publiées. [1)]Burgdorf par Meyer, [1)]Genf par Tournier H. et [1)]Schaffhausen par Stierlin G. (Stierlin et Gautard 1867); [1)]Siders par Stierlin G. (Stierlin 1883); [1)]Nairs par Killias E. (Caflisch 1894); [2)]1 ex., Agiez-Orbe VD, 7.1949, [par Besuchet C., MZL], [2)]1 ex., Veyrier GE, 7.1953, [par Simonet J., MHNG], [1)]1 ex., Irchel-Winterthur,

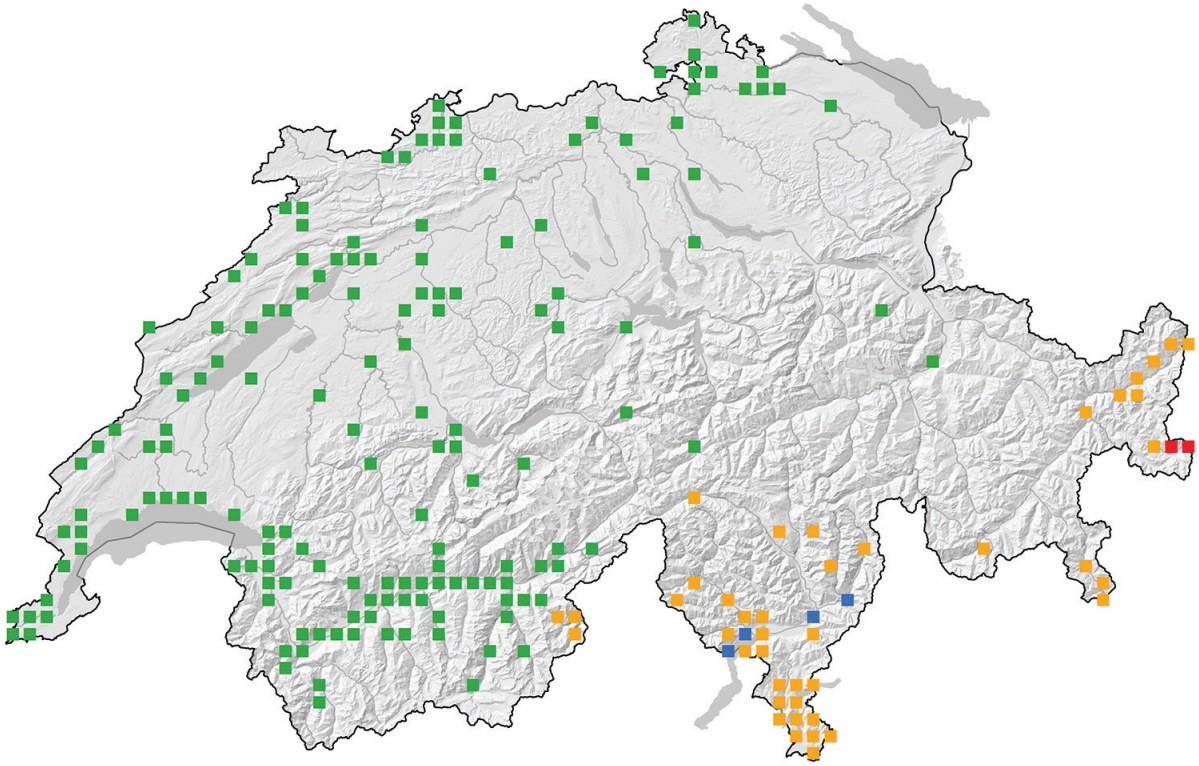


Figure 4. Répartition des espèces du genre *Clanoptilus* en Suisse, à l'exception de *C. marginellus* : *C. affinis* (en rouge), *C. elegans* (en vert), *C. emarginatus* (en orange) et *C. geniculatus* (en bleu). Les deux espèces sœurs *C. elegans* et *C. emarginatus* ne cohabitent pas.

NMB, [1)]1 ex., St-Triphon-Ollon, 5.1951, MZL, [2)]1 ex., Follaterres-Martigny, 6.1954 (Allenspach et Wittmer 1979).

Commentaire. Cette espèce colonise principalement les pays d'Europe centrale et de l'est. Citée plusieurs fois dans la littérature suisse, nous n'avons toutefois pas vu de spécimen de référence dans les collections examinées. Les quelques individus retrouvés se rapportaient en effet à d'autres espèces des genres *Ebaeus* ou *Hypebaeus*. Citée notamment du Sud-Tyrol italien (Kahlen et Hellrigl 1996) et du sud-est de l'Allemagne (Köhler et Klausnitzer 1998), sa présence est possible en Suisse, mais demande confirmation.

C51) [*Ebaeus* (*Ebaeus*) *ater*]

Données publiées. [2)]1 ex., Versoix, 6.1946 par Toumayeff G. (Linder 1953); [2)]1 ex., Ofenpass, NP [National Park], 7.1971, par Scherler P. (Allenspach et Wittmer 1979).

Commentaire. *E. ater* est une espèce d'Europe centrale, incertaine en France (où elle n'a tout du moins plus été revue depuis longtemps, selon Constantin 2014). Pour la Suisse, les individus mentionnés dans la littérature ont pu être retrouvés mais leur identification était incorrecte : le spécimen de Versoix était un *Hypebaeus flavipes*, alors que celui de l'Ofenpass a été attribué à *E. flavicornis* (voir C54). A l'heure actuelle, nous n'avons donc aucune certitude quant à la présence de cette espèce en Suisse, bien qu'elle soit notamment citée du Sud-Tyrol italien (Kahlen et Hellrigl 1996).

C52) *Ebaeus* (*Ebaeus*) *battonii*

Matériel examiné. 1 ex., Chiasso, 26.5., coll. Fontana P., MHNG; 1 ex., Kt. Wallis, Martigny, leg. & coll. Linder A., ETH; 1 ex., Grono, 7.1887, leg. Anonymous, NMBE; 1 ex., Castello, 2.7.1924, coll. Fontana P., MSNL; 1 ex., Chiasso, rsv [Riva San Vitale], 8.6.1925, coll. Fontana P., MSNL; 1 ex., Tessin, Mendrisio, 10.6.1944, leg. & coll. Pochon H., MHNF; 1 ex., Mendrisio, 6.1950, leg. & coll. Linder A., ETH; 1 ex., Kt. Tessin, Lugano, 4.1959, leg. & coll. Linder A., ETH; 1 ex., Minusio TI, 9.-12.7.1965, leg. & coll. Allenspach V., NMB; 1 ex., Mendrisio TI, 16.6.1971, leg. Allenspach V., MHNG; 1 ex., Tessin, Rovio, 7.7.1980, leg. & coll. Scherler P., NMBE; 1 ex., Riva S. Vitale, 26.6.1984, leg. & coll. Scherler P., NMBE; 1 ex., Riva S. Vitale, 4.7.1984, leg. & coll. Scherler P., NMBE; 1 ex., Someo TI, 17.6.2008, leg. & coll. Brägger H.

Commentaire. Cette espèce est connue du Bas-Rhin (Callot 2011) et du sud-est de la France (Constantin 2014), d'Italie, d'Autriche et de Suisse, où elle est signalée du Tessin principalement. Selon les critères donnés par Pardo Alcaide (1962) et Plata Negrache (2009), c'est bien cette espèce et non *E. collaris* (voir C53) qui est présente en Suisse.

C53) [*Ebaeus* (*Ebaeus*) *collaris collaris*]

Données publiées. [1,8)]St. Bernhard par Luisier (Stierlin 1883); [2,8)]Martigny par Favre (Favre 1890); [2,8)]1 ex.,

Chiasso, 1914 par Fontana P. [MSNL] (Fontana 1925); [2,8)]Riva St. Vitale par Fontana P. [MSNL] (Fontana 1947).

Commentaire. Cette espèce d'Europe méridionale est connue d'Autriche, de Croatie, du sud-ouest de la France, de Grèce, de Sardaigne, du Portugal, d'Espagne et de Russie. En suivant les clés d'identifications fournies par Pardo Alcaide (1962) et par Plata Negrache (2009), les spécimens de la littérature qui ont été retrouvés en collection ont été attribués à l'espèce voisine *E. battonii*, décrite en 1962 et donc postérieurement aux dates de publications citées ci-dessus. *E. collaris* n'est pas présent en Suisse.

C54) *Ebaeus* (*Ebaeus*) *flavicornis*

Matériel examiné. 1 ex., Fully, leg. Anonymous, det. Švihla V., MHNG; 2 ex., Tarasp, leg. Anonymous, BNM; 1 ex., Schuls GR, 7.1938, leg. Toumayeff G., det. Švihla V., MHNG; 1 ex., Ofenpass GR, 27.7.1971, leg. & coll. Scherler P., NMBE; 1 ex., Sulgen, Langstuden TG, 24.7.1990, leg. Blöchlinger H., det. Liberti G., MHNG.

Données publiées. [1)]3 ex., Umgebung Sihlsee, 6.1946 par Lautner J. (Linder 1968); [1)]1 ex., Irchelgebiet-Freienstein ZH par Lautner J. (Allenspach et Wittmer 1979).

Commentaire. Seul un des spécimens examinés, de Tarasp dans les Grisons, est un mâle. Tous les autres spécimens sont des femelles et une confusion avec *E. appendiculatus* et *E. ater* (voir C50 et C51) n'est dès lors pas exclue. Au vu de la distribution générale d'*E. flavicornis* et de sa présence confirmée dans le sud de l'Allemagne (Köhler et Klausnitzer 1998) et en Alsace (Callot 2011), la donnée de Sulgen TG devrait néanmoins aussi se rattacher à cette espèce. Les spécimens cités dans la littérature n'ont pas été retrouvés dans la collection de Lautner J. au NMB.

C55) *Ebaeus* (*Ebaeus*) *gibbus*

Matériel examiné. 3 ex., Chiasso, 25.6., coll. Fontana P., MSNL; 1 ex., Chiasso, 26.6.1937, coll. Fontana P., MSNL; 1 ex., Chiasso, 21.7.1941, coll. Fontana P., MHNG; 1 ex., Kt. Tessin, Mendrisio, 6.1950, leg. & coll. Linder A., ETH; 3 ex., Kt. Tessin, Rancate, 5.1968, leg. & coll. Linder A., ETH; 2 ex., Kt. Tessin, Tremona, 7.1970, leg. & coll. Linder A., ETH; 1 ex., Kt. Tessin, Arogno, 5.1971, leg. & coll. Linder A., ETH.

Données publiées. [1)]St. Bernhard par Stierlin G. (Stierlin 1883); Chiasso, 25.6. par Fontana P. (Fontana 1925).

Commentaire. Quelques spécimens collectés au Tessin confirment la présence en Suisse de cette espèce connue également d'Italie, de Corse et de Malte (Constantin 2014). L'espèce n'a toutefois plus été observée en Suisse depuis près de cinquante ans.

C56) [*Ebaeus* (*Ebaeus*) cf. *rufipes*]

Matériel examiné. [3,8)]1 ex., Alpes, Tête Noire, 12.7., det. Liberti G., coll. Maerky C., MHNG.

Commentaire. Le spécimen examiné se rapproche d'*E. rufipes*, une espèce connue de Russie, d'Ukraine, du Kazakhstan et du Turkménistan. Provenant d'une collection problématique, il ne doit toutefois pas être considéré. Cette espèce ne fait pas partie de la faune suisse.

C57) [*Hypebaeus* (*Hypebaeus*) *flavicollis*]

Matériel examiné. [3,8)]2 ex., Fully, 6.5.1929, coll. Gaud A., MZL.

Données publiées. [3,8)]Fully par Favre E. (Favre 1890).

Commentaire. Cette espèce méridionale est connue des Baléares, du sud de la France, de Corse, d'Italie, de Malte ainsi que d'Algérie. Malgré la présence de deux spécimens en collection, soutenus par une citation dans la littérature, *H. flavicollis* n'est pas considéré comme indigène au vu de sa distribution générale en Europe et en Afrique du Nord. La collection d'Alphons Gaud contient en effet ponctuellement des spécimens douteux, comme cela a déjà été mis en évidence pour d'autres espèces en Suisse (Monnerat et al. 2015a).

C58) *Malachius* (*Malachius*) *scutellaris*

Matériel examiné. 1 ex., London [Allondon], 16.5.1920, leg. Simonet J., MHNG; 1 ex., Kt. Freiburg, Freiburg, 5.1946, leg. & coll. Linder A., ETH; 1 ex., London [Allondon], 11.5.1947, leg. Simonet J., MHNG; 6 ex., Genève, London [Allondon], 5.1949, leg. Toumayeff G., MHNG; 1 ex., Kt. Freiburg, Montbovon, 5.1949, leg. & coll. Linder A., ETH; 1 ex., Ml. Vert [Moulin de Vert], 16.4.1957, leg. Anonymous, MHNG; 1 ex., Laconnex, 28.4.1957, leg. Anonymous, MHNG; 3 ex., Chancy, 7.5.1960, leg. Anonymous, MHNG; 1 ex., Chancy, La Laire, 17.5.1961, leg. Régnier J.-C., MHNG; 1 ex., Branson, 7.7.1963, leg. Van de Gümster J., MHNG; 1 ex., Genève, Russin, Allondon, 16.5.1996, leg. Besuchet C., MHNG.

Données publiées. [1)]Genf par Böschenstein A., [1)]Siders et [1)]Sitten par Isenschmid M. (Stierlin 1883); [1)]Basel et [1)]Büren par Rätzer A. (Rätzer 1888); [1)]UnterWallis (Stierlin 1898).

Commentaire. Cette espèce colonise largement l'Europe occidentale, centrale et orientale. En Suisse, elle n'est présente que dans l'ouest du pays et principalement à Genève.

C59) *Micrinus heteromorphus*

Matériel examiné. 1 ex., Ticino, Locarno, Pizzo Trosa, leg. Focarile A., coll. Wittmer W., NMB; 1 ex., Mte. Lema Tic., 15.6.1955, leg. & coll. Allenspach V., NMB; 3 ex., Indemini TI, 6.1968, leg. Toumayeff G., MHNG; 6 ex., A. di Neggia TI, 6.1968, leg. Toumayeff G., MHNG; 3 ex., Indemini TI, 7.1969, leg. Toumayeff G., MHNG & NMB; 1 ex., A. di Neggia TI, 7.1971, leg. Toumayeff G., MHNG; 3 ex., Tessin, Pne di Breno, 17.7.1980, leg. & coll. Scherler P., NMBE; 2 ex., Tessin, Mte. Gambarogno, 23.7.1980, leg. & coll. Scherler P., NMBE; 2 ex., Pne

di Breno TI, 29.6.1983, leg. & coll. Scherler P., NMBE; 1 ex., Mte. Gambarogno TI, 23.6.1986, leg. & coll. Scherler P., NMBE; 1 ex., Gambarogno TI, 19.6.2013, leg. & coll. Szallies A.; 1 ex., Gambarogno TI, 4.7.2013, leg. & coll. Szallies A.; 2 ex., Val Müstair GR, 19.7.2016 et 24.6.2017, leg. & coll. Chittaro Y.

Commentaire. Cette espèce alpine est connue d'Italie, de France et de Suisse, où elle colonise quelques sommets du Tessin et du Val Müstair dans l'est des Grisons.

C60) *Nepachys cardiacae*

Fig. 1E

Matériel examiné. 2 ex., Mont. [Montana], coll. Berhaut J., MHNS; 1 ex., Kt. Wallis, Montana, [leg. Cerutti N.], coll. Linder A., ETH; 2 ex., Wallis, Montana, leg. & coll. Cerutti N., MHNF; 3 ex., St. Luc, 8.1925, leg. Linder A., coll. Linder A. & Wittmer W., ETH & NMB; 1 ex., Graubünden, Alter Schynweg, 7.7.1936, leg. & coll. Wolf J. P., ETH; 1 ex., Kt. Wallis, Bürchen, 7.1963, leg. & coll. Linder A., ETH; 1 ex., Randonne s/Saillon VS, 1.8.1982, leg. & coll. Scherler P., NMBE; 1 ex., Anniviers VS, 7.7.-13.8.2014, leg. & coll. Sanchez A.; 1 ex., Vollèges VS, 4.-17.7.2017, leg. & coll. Sanchez A.; 1 ex., Simplon VS, 11.7.2018, leg. & coll. Chittaro Y.

Données publiées. [1)]Pontresina par von Heyden L. (Heyden 1864); [1)]Churwalden par Huguenin G. (Stierlin 1883); [1)]Basel (Stierlin 1898); Montana par Cerutti N. (Linder 1941); [1)]Blockhaus Cluozza, 20.7.1921, [1)]Plaun Larschaida, 24.8.1936 et [1)]Zernez, Clüs, 26.7.1921 par Handschin E. (Handschin 1963); [1)]1 ex., Zürichberg, 5., MZL (Allenspach et Wittmer 1979); 2 ex., Valais, Mayens de Sion, leg. Carret A., coll. Constantin R. (Constantin 2013).

Commentaire. Décrite de Scandinavie et assez répandue dans le nord de l'Europe, cette espèce est présente aussi sporadiquement dans certaines régions montagneuses de France et d'Europe centrale, dont les Alpes, où elle est rare (Constantin 2013). En Suisse, elle n'est connue que de quelques localités du Valais et des Grisons.

C61) *Sphinginus coarctatus*

Matériel examiné. 3 ex., Chiasso, 20.6., coll. Fontana P., MSNL; 1 ex., Kt. Tessin, Mendrisio, 6.1943, leg. & coll. Linder A., ETH; 1 ex., Tessin, Mte. San Giorgio, 5.8.1970, leg. & coll. Scherler P., NMBE; 1 ex., Kt. Tessin, Locarno, 5.1971, leg. & coll. Linder A., ETH; 3 ex., Tessin, Mte. San Giorgio, 14.7.1980, leg. & coll. Scherler P., NMBE; 1 ex., Mte. Ceneri TI, 28.6.1986, leg. & coll. Scherler P., NMBE; 1 ex., Origlio TI, 24.6.1987, leg. & coll. Scherler P., NMBE; 1 ex., Tessin, Lago di Muzzano, 24.6.1987, leg. Besuchet C., MHNG; 1 ex., Pne. d'Arzo TI, 25.6.1990, leg. & coll. Scherler P., NMBE; 1 ex., Tessin, S. Salvatore, 17.6.1995, leg. Besuchet C., MHNG; 1 ex., Meride, Serpiano, 11.-20.7.1995, leg. Reser-Rezbanyai L., NMLU; 1 ex., Meride, Serpiano, 1.-10.7.1996, leg. Reser-Rezbanyai L., NMLU; 3 ex., Terre di Pedemonte TI, 13.5.2014, leg. & coll. Chittaro Y.

Données publiées. [1)]Monte Generoso par Frey-Gessner E. (Stierlin 1883).

Commentaire. Plusieurs spécimens tessinois attestent de la présence en Suisse de cette espèce d'Europe centrale et méridionale et du Maghreb. L'espèce voisine *S. lobatus* colonise quant à elle l'ouest et le nord de la Suisse.

C62) [*Troglops cephalotes*]

Données publiées. [2)]Chiasso, 20.5., 4.6. par Fontana P. (Fontana 1925); [2)]Mendrisio, 6.1936 par Allenspach V. et [2)]1 ex., Locarno, 7.1944 par Linder A. (Linder 1946); [2)]Frasco (Fontana 1947); [1)]1 ex., Finsterhennen BE, 10.1936, NMBE (Allenspach et Wittmer 1979); [1)]Cevio TI, 2003 par Focarile A. (Focarile 2003).

Commentaire. Après vérification des identifications, tous les spécimens cités dans la littérature qui ont été retrouvés étaient en réalité des *T. silo*. Le très rare *T. cephalotes*, connu d'Autriche, de France et d'Italie, reste néanmoins possible en Suisse mais sa présence demande confirmation.

C63) *Phloiophilus edwardsii*

Matériel examiné. 3 ex., Genève, Vandoeuvres, 5.-6.1992, leg. Besuchet C., MHNG.

Commentaire. Assez largement répandue, cette espèce est néanmoins assez rare en Europe centrale et occidentale (Kolibáč 2018). C'est aussi le cas en Suisse, où elle n'est connue que de trois spécimens capturés dans une localité genevoise. L'espèce étant principalement active en automne et en hiver, la date de capture tardive des spécimens suisses est étonnante. *P. edwardsii* se développe dans les carpophores du champignon *Peniophora quercina* notamment (Sanchez et al. 2018).

C64) [*Aplocnemus* (*Aplocnemus*) *albipilis*]

Matériel examiné. [3,8)]1 ex., Alpes, Novel, 27.6., leg. & coll. Maerky C., MHNG; [3,8)]1 ex., Alpes, St. Bernard, 2.8., leg. & coll. Maerky C., det. Constantin R., MHNG; [3,8)]1 ex., Genève, Peney, 7.7., leg. & coll. Maerky C., det. Constantin R., MHNG.

Commentaire. Les spécimens suisses examinés proviennent tous d'une collection problématique et ne doivent pas être considérés. Cette espèce ne colonise que la Péninsule ibérique et les Pyrénées-orientales françaises.

C65) *Aplocnemus* (*Aplocnemus*) *chalconatus*

Matériel examiné. 1 ex., Chiasso, coll. Fontana P., MSNL; [8)]1 ex., Trient, leg. Anonymous, coll. Kiener S., det. Majer K., MHNG; [3)]1 ex., Trient, leg. Preudhomme de Borre C., MHNG; 1 ex., Mendrisio, 5.1943, leg. & coll. Linder A., ETH; 2 ex., Mendrisio, 6.1943, leg. & coll. Linder A., ETH; 1 ex., Tessin, Mendrisio, 1.6.1944, leg. & coll. Pochon H., det. Constantin R., MHNF; 2 ex., V. Calanca, 5.6.1948, leg. & coll. Allenspach V., NMB;

2 ex., Mendrisio, 5.1949, leg. & coll. Linder A., ETH; 1 ex., Mendrisio, 16.-25.6.1949, leg. & coll. Allenspach V., NMB; 2 ex., Mendrisio, 6.1949, leg. & coll. Linder A., ETH; 1 ex., Mendrisio, 6.1950, leg. & coll. Linder A., ETH; 4 ex., Brusio GR, 20.-21.6.1967, leg. & coll. Allenspach V., NMB; 1 ex., Campascio GR, 30.7.1969, leg. & coll. Scherler P., det. Constantin R., NMBE; 1 ex., Miralago GR, 18.7.1970, leg. & coll. Scherler P., det. Constantin R., NMBE; 1 ex., Cavaione GR, 9.7.1975, leg. & coll. Scherler P., NMBE; 1 ex., Brusio GR, 7.1975, leg. Toumayeff G., MHNG; 1 ex., Poschiavo GR, Zalende, 18.7.1984, leg. Besuchet C., MHNG; 1 ex., Lago di Poschiavo, 1.6.1990, leg. & coll. Brägger H.; 2 ex., Brusio GR, 17.5.-16.6.2012, leg. Sanchez A., det. Geiser M., coll. Chittaro Y.; 1 ex., Brusio GR, 16.6.-10.07.2012, leg. Sanchez A., det. Geiser M., coll. Geiser M., NMBE.

Données publiées. [1,8)]Schaffhausen par Stierlin G. (Stierlin et Gautard 1867); [1,8)]St. Gallen par Müller J. A. (Müller 1904); Chiasso et [1)]Generoso par Fontana P. (Fontana 1925); [1)]Bisbino par Fontana P. (Fontana 1947); [2)]Wallis, ETH (Allenspach et Wittmer 1979).

Commentaire. Largement répandue en Italie, en Autriche et dans la Péninsule balkanique, et marginale en France, cette espèce floricole atteint sa limite septentrionale de répartition dans le sud de la Suisse (Tessin et Grisons). Les citations de la littérature de Schaffhausen et de St. Gallen sont invérifiables mais hautement douteuses. Quant à celle du Valais (Wallis), il s'agissait en réalité d'*A. tarsalis*.

C66) *Aplocnemus* (*Aplocnemus*) *integer*

Matériel examiné. 5 ex., Chiasso, coll. Fontana, MSNL; [3)]1 ex., Bienne, 29.6.1908, coll. Maerky C., det. Majer K., MHNG; 1 ex., Chiasso, 1932, coll. Burghold W., det. Liberti G., NMBE; 1 ex., Mendrisio, 6.1943, leg. & coll. Linder A., ETH; 1 ex., Mendrisio, 6.1949, leg. & coll. Linder A., ETH; 1 ex., Somazzo, Toretta-O. TI, 16.5.1990, leg. Reser-Rezbanyai L., det. Liberti G., NMLU.

Commentaire. Cette espèce d'Europe centrale et méridionale n'est connue en Suisse que de quelques spécimens valides, tous provenant du sud du Tessin. L'individu de Bienne est issu d'une collection problématique et ne doit pas être considéré. C'est le plus rare de nos *Aplocnemus*.

C67) [*Aplocnemus* (*Aplocnemus*) *ramicornis*]

Matériel examiné. [3,8)]1 ex., Genève, Aïre, 10.5., leg. & coll. Maerky C., det. Constantin R., MHNG; [3,7,8)]1 ex., Jura, Dôle, 2.7., coll. Maerky C., det. Majer K., MHNG.

Commentaire. Cette espèce n'est connue que d'Ukraine, ce qui discrédite une fois encore la collection à laquelle appartiennent les spécimens « suisses » examinés.

C68) [*Trichoceble floralis*]

Données publiées. [1)]Puschlav par Killias E. (Killias 1860); [1)]Genf par Chevrier F., [1)]Engadin et [1)]Monte Rosa par Gautard V. (Stierlin et Gautard 1867); [1)]Entremont par Rätzer A. (Rätzer 1888); [1)]Sussillon par Favre E. (Favre 1890); [1)]Pontresina par Meyer-Dür R. (Stierlin 1863–1864); [1)]1 ex., Pfyn-Sierre, 5.1919, NMB, [2)]1 ex., V. d'Hérens, Euseigne par Allenspach V. et [2)]1 ex., V. d'Anniviers, Ayer, 7.1961 par Scherler P. (Allenspach et Wittmer 1979).

Commentaire. *T. floralis* est une espèce qui présente une distribution européenne assez large mais discontinue. Elle est sporadique dans la majeure partie de la France et semble inféodée aux vieilles futaies (Constantin et Liberti 2011). Aucun spécimen de référence n'existe pour la Suisse, la plupart des spécimens cités dans la littérature n'ayant pas été retrouvés à l'exception de deux (ceux d'Euseigne et d'Ayer) qui étaient des *T. memnonia* (C69). Citée d'Alsace (Callot 2018) et du sud de l'Allemagne (Köhler et Klausnitzer 1998), *T. floralis* pourrait néanmoins aussi se trouver en Suisse.

C69) *Trichoceble memnonia*

Matériel examiné. 1 ex., Simplon VS, 7.1881, coll. Rätzer A., NMBE; [8)]1 ex., Kt. Bern, Biel, 6.1913, leg. & coll. Linder A., ETH; 1 ex., Val. [Valais], Euseigne, 7.-18.7.1941, leg. & coll. Allenspach V., NMB; 1 ex., Valais, Ayer, 3.8.1961, leg. & coll. Scherler P., NMBE; 1 ex., Kt. Wallis, Bürchen, 8.1963, leg. & coll. Linder A., ETH; 2 ex., Kt. Graubünden, Felsberg, 7.1971, leg. & coll. Linder A., ETH; 1 ex., Ilanz GR, 1.7.1971, leg. & coll. Pochon H., MHNF; 1 ex., Bürchen VS, 13.7.1974, leg. & coll. Scherler P., NMBE.

Données publiées. 1 ex., Annivier-Thale, 1861 par Kiesenwetter H. (Kiesenwetter 1861); 1 ex., Bürchen, 8.1963 par Linder A. (Linder 1968); 1 ex., Briey-Chalais-Chippis VS, 7. 1975 par Toumayeff G., [1)]2 ex., Palagnedra-Verdasio-Centovalli TI, 7.1976 par Besuchet C. (Allenspach et Wittmer 1979), 1 ex., Sion, 1903, par Robert (Liberti 2012).

Commentaire. Décrite sur la base d'une femelle du Val d'Anniviers (Kiesenwetter 1861), cette espèce rare d'Europe occidentale et centrale est inféodée aux étages montagnards et subalpins (Constantin et Liberti 2011). En Suisse, elle est connue de quelques données isolées provenant de localités alpines, mais n'a plus été signalée depuis près de cinquante ans. Nous n'avons pas retrouvé l'exemplaire tessinois capturé en 1976 cité dans Allenspach et Wittmer (1979), et considérons la localité de Biel [Bienne], sur le Plateau suisse, comme problématique.

C70) [*Thaneroclerus buquet*]

Matériel examiné. 1 ex., Kirchberg SG, 17.3.2009, leg. Anonymous, det. Landau-Lüscher I., SPZH; Dinhard ZH, 3.4.2009, leg. Anonymous, det. Schmidt M., SPZH; Zürich ZH, 11.2.2010, 20.2.2012 et 24.2.2016, leg. Anonymous, det. Schmidt M., SPZH; Uster ZH, 21.10.2011, leg. Anonymous, SPZH; Wangen-Brüttisellen ZH, 6.3.2012, leg. Anonymous, det. Schmidt M., SPZH; 2 ex., Zug ZG, 27.3.2013, leg. Anonymous, det.

Landau-Lüscher I., SPZH; Les Genevez JU, 2.10.2013, leg. Anonymous, det. Schmidt M., SPZH; Dietlikon ZH, 30.10.2013, leg. Anonymous, det. Schmidt M., SPZH.

Commentaire. Probablement originaire d'Asie du sud-est ou d'Inde, cette espèce synanthrope est maintenant presque cosmopolite. Quelques larves ont été trouvées en Suisse au cours des dernières années dans plusieurs localités et soumises pour identification au centre de Schädlingsprävention und –beratung de Zürich. Leur importation accidentelle en Suisse ne fait aucun doute, comme c'est aussi le cas en Allemagne (Niehuis 2013). *T. buquet* est un prédateur de Coléoptères, Ptinidae et Tenebrionidae notamment, présents dans les denrées stockées (thé, café, riz, tabac, …).

C71) *Grynocharis oblonga*

Matériel examiné. [3)]1 ex., Alpes, Tessin, coll. Maerky C., ex coll. Ghidini A., MHNG; [3)]1 ex., Alpes, Aigle, 7., coll. Maerky C., MHNG; [3)]2 ex., Genf, coll. Lasserre H., ETH; 1 ex., Osco, Leventina (Predelp), leg. & coll. Focarile A.; [3)]1 ex., Valais, 7.6.1886, coll. Gaud A., MZL; [6)]1 ex., Kt. Luzern, Hünenbergstr., 3.1946, leg. & coll. Pochon H., MHNF; 1 ex., Bollingen SG, 9.5.1967, leg. & coll. Spälti A., MHNG.

Données publiées. [6)]1 ex., Luzern (vermutlich eingeschleppt) par Pochon H. (Linder 1953).

Commentaire. Très largement répandue à l'échelle européenne, cette espèce n'est pourtant connue que de rares données en Suisse, parmi lesquelles seulement deux (d'Osco au Tessin et de Bollingen à Saint-Gall) paraissent fiables. Quant à la mention de Lucerne, elle est vraisemblablement issue d'une importation (Linder 1953).

C72) *Calitys scabra*

Matériel examiné. [3)]1 ex., Alpes, Tessin, coll. Maerky C., ex coll. Ghidini A., MHNG; [3)]1 ex., Alpes, Valais, coll. Maerky C., MHNG; 2 ex., Doml. [Domleschg], coll. Jörger J. J., ex coll. Killias E., NMB; 1 ex., Domleschg GR, coll. Killias E., MHNG; 1 ex., Furstenau, leg. Anonymous, NMAA; 1 ex., Helvetia, coll. Burghold W., NMBE; [3)]1 ex., Kt. Wallis, coll. Linder A., ex coll. Täschler M., ETH; [3)]1 ex., Ober-Wallis, coll. Heer O., ETH; 1 ex., Valais, coll. Mellet L., MZL; [3,8)]1 ex., Weissb. [Weissenburg], coll. Huguenin G., ETH; [3)]1 ex., Alpes, Viège, 4.7., coll. Maerky C., MHNG; [3)]1 ex., Genève, Aïre, 10.5., coll. Maerky C., MHNG; 1 ex., Rätia, Rezia? [Canton des Grisons], 1885, leg. Anonymous, MHNG; 1 ex., Saas, 7.1886, leg. Anonymous, NMBE; 1 ex., V. Somvix [Val Sumvitg], 25.7.1891, leg. Anonymous, NMBE.

Données publiées. [1)]Vallée de Conches bei Visp im Wallis par Venetz I. et [1)]Oberwallis par Gautard V. (Stierlin et Gautard 1867); [1)]Chur par Scheuchzer (Stierlin 1883); Saas par Steck-Hofmann T. et [1)]Simplon par Favre E. (Favre 1890); [1)]Domleschg par Mengold, [1)]Malans par Amstein J.R. et [1)]Thusis par Amstein J. R. (Caflisch 1894); [1)]Bérisal par Bourgeois J. (Bourgeois 1909).

Commentaire. Cette espèce colonise la zone boréale et les montagnes de toute l'Europe mais est généralement très rare. En Suisse, elle est connue uniquement de quelques données très anciennes et n'y a plus été retrouvée depuis plus d'un siècle. Elle est liée aux polypores du genre *Antrodia,* notamment *Antrodia xantha* (Brustel 2009).

C73) *Nemozoma caucasicum*

Matériel examiné. Nombreux exemplaires du Plateau suisse principalement, mais aussi du Tessin et du Chablais vaudois.

Données publiées. 1 ex., Dardagny GE, 22.7.-10.8.2012 par Blanc M. (Chittaro et al. 2013).

Commentaire. Originaire du Caucase, cette espèce est en forte expansion en Europe occidentale (Kolibáč 2018). Elle a été signalée pour la première fois en Suisse à Genève en 2012 (Chittaro et al. 2013), puis dans le nord du pays (en Argovie) en 2013 et dans le sud du Tessin en 2018. Elle s'étend maintenant dans notre pays à partir de ces trois voies de colonisation.

C74) [*Nemozoma cornutum*]

Données publiées. [1,8)][Suisse] par Bremi-Wolf J. J. (Bremi-Wolf 1856).

Commentaire. La citation de la littérature, sans aucune précision, se réfère assurément à une autre espèce. *N. cornutum* n'est connu que du sud de la Russie et d'Ukraine et ne fait donc pas partie de notre faune.

C75) *Tenebroides mauritanicus*

Matériel examiné. Nombreux exemplaires, de la plupart des régions de Suisse.

Commentaire. A l'instar de ce qui a été proposé par Kolibáč (2007, 2013), et bien qu'il existe certaines différences morphologiques entre les deux taxa (Kolibáč 1993), nous avons considéré ici sous *T. mauritanicus* non seulement les spécimens synanthropes, mais également les spécimens trouvés *in natura* qui sont parfois attribués à une espèce distincte: *T. fuscus* Goeze, 1777. La présence des deux taxa est dans tous les cas attestée en Suisse (Huber et Kobel 1994, Herger 1998a).

Discussion

Cette liste commentée s'inscrit dans la continuité des synthèses réalisées au cours des dernières années sur diverses familles de Coléoptères (Marggi et Luka 2001, Carron 2005, Carron 2008, Luka et al. 2009, Germann 2010, Chittaro et Blanc 2012, Reibnitz et al. 2013, Monnerat et al. 2015b, Breitenmoser et al. 2016, Chittaro et Sanchez 2016b, Cosandey et al. 2017, Sanchez et Chittaro 2018) et contribue à améliorer nos connaissances sur la faune de Suisse. Elle fournit, avec les cartes de distribution basées sur les données récoltées (disponibles sur le serveur

Table 1. Nombre d'espèces de Cleridae, Melyridae et Rhadalidae, considérées comme résidentes en Suisse par Allenspach and Wittmer (1979) et par le présent travail, par famille. Les espèces supprimées (-) et ajoutées (+) par rapport à la liste de 1979 sont indiquées.

	Allenspach and Wittmer 1979	–	+	**Présent travail 2019**
CLERIDAE	20	*Opilo germanus*	*Denops albofasciatus*	18
		Tarsostenus univittatus	*Korynetes ruficornis*	
		Trichodes favarius		
		Trichodes ircutensis		
MELYRIDAE	71	*Anthomalachius spinosus*	*Anthocomus humeralis*	66
		Attalus amictus	*Charopus docilis*	
		Attalus cyaneus	*Danacea montivaga*	
		Ceratistes dilaticornis	*Dasytes pauperculus*	
		Clanoptilus barnevillei	*Dasytes thoracicus*	
		Clanoptilus rufus	*Malachius australis*	
		Clanoptilus spinipennis		
		Danacea marginata		
		Ebaeus appendiculatus		
		Ebaeus ater		
		Hypebaeus flavicollis		
RHADALIDAE	9	*Trichoceble floralis*		8
Total	**100**	**16**	**8**	**92**

cartographique d'info fauna – CSCF, http://www.cscf.ch), une synthèse des connaissances actuelles sur les espèces appartenant à la superfamille des Cleroidea. Sept familles de Cleroidea sont actuellement attestées de Suisse, mais une huitième pourrait être encore découverte dans le futur, à savoir celle des Acanthocnemidae par le biais de l'espèce pyrophile cosmopolite *Acanthocnemus nigricans* (Hope, 1845), originaire d'Australie, mais introduite et déjà établie en France et en Italie (Constantin 2014, Kolibáč 2018).

En comparant notre liste avec la synthèse d'Allenspach et Wittmer (1979) pour les trois familles communes aux deux travaux, il apparaît que les chiffres annoncés en terme d'espèces par famille sont légèrement différents: alors qu'Allenspach et Wittmer (1979) annonçaient 100 espèces de Cleridae, Melyridae et Rhadalidae, nous en considérons pour notre part 92 comme suisses (Tab. 1). Si huit espèces ont été ajoutées depuis 1979, 16 autres, qu'Allenspach et Wittmer (1979) considéraient comme suisses, ont ainsi été écartées. La raison en est principalement le nouvel éclairage apporté par Monnerat et al. (2015a) sur plusieurs collections que l'on sait maintenant problématiques (voir commentaires sur ces espèces).

Si nos connaissances sur la répartition des espèces appartenant à la superfamille des Cleroidea peuvent être qualifiées de bonnes en Suisse, ce n'est pas le cas de nos connaissances sur leur écologie, qui demeurent encore très lacunaires et notamment chez les Melyridae. Si quelques espèces se développent dans des plantes herbacées à grande tige (*Psilothrix* spp., *Dolichosoma lineare*) ou se rencontrent sous des pierres (*Enicopus* spp. et *Danacea* spp.) (Constantin et Liberti 2011), il est néanmoins admis que la majorité des Cleroidea sont saproxyliques. Leurs larves se développent sous des écorces ou dans un substrat ligneux plus ou moins décomposé, souvent en tant que prédateurs (ou prédateurs occasionnels) d'autres organismes. Quelques uns sont mycétophages (Peltinae notamment). Plusieurs Cleroidea tels *Allonyx quadrimaculatus* (Fig. 1A) et *Peltis grossa* (Fig. 1F) présentent des exigences écologiques très élevées, et figurent sur la liste des Coléoptères saproxyliques emblématiques de Suisse (Sanchez et al. 2016). Certains représentants des Melyridae et des Rhadalidae (*Dasytes nigrocyaneus*, *D. pauperculus*, *Aplocnemus integer*, *Trichoceble memnonia* notamment,…), deux familles qui n'ont pas encore été traitées par Sanchez et al. (2016), devraient y figurer également lors d'une future actualisation.

Du point de vue conservatoire, signalons que bon nombre de ces espèces forestières se sont fortement raréfiées en Suisse au cours du siècle dernier et certaines (*Calitys scabra*, *Trichoceble memnonia* notamment) n'ont plus été trouvées dans notre pays depuis très longtemps. Les espèces liées aux milieux ouverts séchards ont également vu leurs populations décroître en même temps que disparaissaient leurs habitats. Très largement répandu par le passé, *Clanoptilus marginellus* n'a ainsi plus été signalé en Suisse au cours des vingt dernières années. Les espèces du genre *Charopus* semblent également s'être fortement raréfiées. Ce bilan peu réjouissant ne va *a priori* pas aller en s'améliorant, au vu de la poursuite d'une urbanisation galopante (Lachat et al. 2010) sur les rares milieux encore favorables. Les espèces qui colonisent les étages subalpins et alpins sont un peu mieux loties et profitent de milieux généralement mieux conservés. C'est par exemple le cas de *Dasytes lombardus*, *D. thoracicus*, *Danacea denticollis*, *D. montivaga*, *Micrinus heteromorphus* et *Attalus alpinus*, autant d'espèces endémiques des Alpes. La Suisse porte une responsabilité élevée pour leur conservation!

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Références

Allenspach V (1968) Käferfang am Schmetterlingsschirm in Minusio/TI. Mitteilungen der Entomologischen Gesellschaft Basel 18: 125–133.

Allenspach V (1971) Käferfang am Schmetterlingschirm in Minusio/Tessin (Erster Nachtrag). Mitteilungen der Entomologischen Gesellschaft Basel 21: 110–114.*

Allenspach V, Wittmer W (1979) Cantharoidea, Cleroidea, Lymexylonoidea. Insecta Helvetica 4, 139 pp.

Besuchet C (1983) Coléoptères des Alpes suisses atteignant ou dépassant l'altitude de 3000 m. Bulletin Romand d'Entomologie 1(3): 167–176.*

Bocák L, Barton C, Crampton-Platt A, Chester D, Ahrens D, Vogler AP (2014) Building the Coleoptera tree-of-life for >8000 species: composition of public DNA data and fit with Linnaean classification. Systematic Entomology 39: 97–110. https://doi.org/10.1111/syen.12037

Bocáková M, Constantin R, Bocák L (2012) Molecular phylogenetics of the melyrid lineage (Coleoptera: Cleroidea). Cladistics 28: 117–129. https://doi.org/10.1111/j.1096-0031.2011.00368.x

Bouchard P, Bousquet Y, Davies A, Alonso-Zarazaga M, Lawrence J, Lyal C, Newton A, Reid C, Schmitt M, Slipinski A, Smith A (2011) Family-group names in Coleoptera (Insecta). ZooKeys 88: 1–972. https://doi.org/10.3897/zookeys.88.807

Bourgeois J (1909) Notes sur quelques espèces de Coléoptères de la faune alpine. Mitteilungen der Entomologischen Gesellschaft 11: 388–395.

Brandstetter CM, Kapp A (1998) Käferinventar von Vorarlberg und Liechtenstein. Insecta: Coleoptera. Eigenverlag des Ersten Vorarlberger Coleopterologischen Vereins, Bürs, 92 pp.

Breitenmoser S (2017) Les chênes séculaires de Duillier (VD): un sanctuaire pour des Coléoptères saproxyliques exceptionnels. Bulletin de la Société Vaudoise des Sciences Naturelles 96: 49–76.*

Breitenmoser S, Chittaro Y, Sanchez A (2016) Liste commentée des Oedemeridae (Coleoptera) de Suisse. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 89: 73–92.

Bremi-Wolf JJ (1856) Catalog der Schweizerischen Coleopteren, als Vorläufer der Beiträge für Schweizerische Entomologie. Druck und Commission von Friedrich Schulthess, Zürich, 78 pp.

Brustel H (2009) *Antrodia* spp., Polypores hôtes de rares *Quilnus* spp. (Heteroptera Aradidae) et de *Calytis scabra* (Coleoptera Trogositidae) et révélation d'un haut lieu entomologique dans les Pyrénées: la vallée du Rioumajou. L'Entomologiste 65(5): 226–232.

Bugnion E (1880) Notes sur les coléoptères des Alpes vaudoises. Jahrbuch des Schweizer Alpenclub 16: 109–120.*

Caflisch JL (1894) Beiträge zu einem Verzeichnisse der Insecten-Fauna Graubündens von Dr. E. Killias. IV: Coleopteren. Supplement/Beilage zu Jahresbericht der Naturforschenden Gesellschaft Graubündens, 275 pp.

Callot H (2011) *Cantharis paradoxa* Hicker, 1960, *Ebaeus flavicornis* Erichson, 1840 et *E. battonii* Pardo, 1962, trois espèces probablement nouvelles pour la faune de France. Rappel de la présence d'une autre espèce méconnue, *Olibrus gerhardti* Flach, 1888, dans les Vosges (Coleoptera Cantharidae, Malachiidae et Phalacridae). L'Entomologiste 67(3): 121–123.

Callot H (2018) Liste de référence des Coléoptères d'Alsace. Société Alsacienne d'Entomologie, 107pp. http://soc.als.entomo.free.fr [version du 30-IX-2018]

Carron G (2005) Kommentierte Checkliste der Dytiscidae und Noteridae (Coleoptera) der Schweiz. Mitteilungen der Entomologischen Gesellschaft Basel 55 (3): 93–114.

Carron G (2008) Checklist des coléoptères aquatiques de Suisse. Deuxième partie: Gyrinidae, Haliplidae, Paelobiidae, Sphaeriusidae. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 81: 53–60.

Chittaro Y (2014) *Denops albofasciatus* (Charpentier, 1925), un Cleridae (Coleoptera) nouveau pour la Suisse. Entomo Helvetica 7: 145–146.

Chittaro Y, Blanc M (2012) Liste commentée des Cerophytidae, Elateridae, Eucnemidae et Throscidae (Coleoptera) de Suisse. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 85: 91–114.

Chittaro Y, Sanchez A (2016a) Inventaire des Coléoptères saproxyliques d'un site exceptionnel: la Châtaigneraie de Fully (VS). Bulletin de la Murithienne 133: 13–27.*

Chittaro Y, Sanchez A (2016b) Liste commentée des Tenebrionoidea (Coleoptera) de Suisse. Partie 1: Aderidae, Anthicidae, (Boridae), Melandryidae, Meloidae, Mycetophagidae, Mycteridae, Prostomidae, Pyrochroidae, Pythidae, Ripiphoridae, Salpingidae, Tenebrionidae, Tetratomidae, Zopheridae. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 89: 183–235.

Chittaro Y, Sanchez A (2017) A propos de quelques Coléoptères rares ou nouveaux pour la Suisse. Entomo Helvetica 10: 45–53.

Chittaro Y, Sanchez A, Blanc M, Monnerat C (2013) Coléoptères capturés en Suisse par pièges attractifs aériens: bilan après trois années et discussion de la méthode. Entomo Helvetica 6: 101–113.

Constantin R (2013) Contribution à la connaissance des Malachiidae d'Europe et description de deux espèces nouvelles (Coleoptera, Cleroidea). Bulletin de la Société entomologique de France 118(3): 305–320.

Constantin R (2014) Dasytidae, Acanthocnemidae, Prionoceridae, Melyridae, Malachiidae. pp. 468–477. In: Tronquet M (Coord) Catalogue des Coléoptères de France. Perpignan, Association Roussillonnaise d'Entomologie, 1056 pp.

Constantin R, Liberti G (2011) Coléoptères Dasytidae de France. Musée des Confluences, Lyon, 144 pp.

Cosandey V, Chittaro Y, Sanchez A (2017) Liste commentée des Scarabaeoidea (Coleoptera) de Suisse. Alpine Entomology 1: 57–90. https://doi.org/10.3897/alpento.1.21179

Crowson RA (1955) The natural classification of the families of Coleoptera. Nathaniel Llyod, Co., Ltd., London, 187 pp.

Dietrich K (1865) Beitrag zur Kenntnis der Insekten-Fauna des Kantons Zürich. Käfer. Neue Denkschriften der allgemeinen schweizerischen Gesellschaft für die gesammten Naturwissenschaften 21: 1–240.

Favre E (1890) Faune des Coléoptères du Valais et des régions limitrophes. Zurcher, Furrer, 448 pp.

Focarile A (1984) Nuove ricerche sui popolamenti di coleotteri nel Ticino settentrionale – Campagne 1979–1982. Bolletino della Società Ticinese di Scienza Naturali 72: 7–55.*

Focarile A (1988) Ricerche sui Coleotteri del Parco alpino della Val Piora (Ticino, Svizzera). Bolletino della Società Ticinese di Scienza Naturali 76: 61–89.*

Focarile A (2003) Ecologia e faunistica degli insetti (particolarmente Coleotteri) nell'ecosistema alluviale della Val Bavona (Ticino, Svizzera). Rapporto Fondazione Valle Bavona, Cavergno, 85 pp.

Fontana P (1925) Contribuzione alla Fauna coleotterologica ticinese III. Bolletino della Società Ticinese di Scienza Naturali 19: 32–56.

Fontana P (1929) Note di Entomologia crepuscolare. Bolletino della Società Ticinese di Scienza Naturali 24: 121–127.

Fontana P (1947) Contribuzione alla fauna coleotterologica ticinese. Bolletino della Società Ticinese di Scienza Naturali 42: 16–94.

Freude H, Harde KW, Lohse GA (1967) Die Käfer Mitteleuropas. Band 7. Clavicornia. Goecke, Evers, Krefeld, 310 pp.

Freude H, Harde KW, Lohse GA (1979) Die Käfer Mitteleuropas. Band 6. Diversicornia. Goecke, Evers, Krefeld, 367 pp.

Frey-Gessner E (1900–1901) Souvenirs d'excursions d'un entomologiste dans le Val d'Anniviers. 1865–1900. Bulletin de la Murithienne 29–30: 66–72.*

Frey-Gessner E (1900) Liste des Coléoptères et des Lépidoptères intéressants notés par M. le chanoine E. Favre. Bulletin de la Murithienne 29–30: 73–77.*

Gaud A (1904) Binn. Course du 27 juillet au 1er août 1903. Bulletin de la Murithienne 33: 55–59.*

Gaud A (1905) Note entomologique. Bulletin de la Murithienne 34: 277–283.*

Gehrig J (1965) Neue Käferfunde im Allschwilerwald. Mitteilungen der Entomologischen Gesellschaft Basel 15(3): 41–43.*

Germann C (2010) Die Rüsselkäfer (Coleoptera, Curculionoidea) der Schweiz – Checkliste mit Verbreitungsangaben nach biogeografischen Regionen. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 83: 41–118.

Germann C, Geiser M, Luka H, Sprecher E, Schatz I (2015) Käfer (Coleoptera) im Gebiet des Furkapasses, Kantone Uri und Wallis. Entomo Helvetica 8: 71–79.*

Gerstmeier R (1998) Checkered Beetles. Illustrated Key to the Cleridae of the Western Palaearctic. Magraf Verlag, Weikersheim, 241 pp.

Geis K-U (2001) Nochmals zum autochthonen Vorkommen von *Tarsostenus univittatus* (Rossi) (Col., Cleridae), zusammen mit *Trogoxylon impressum* (Com.) (Col., Lyctidae) in Südbaden. Mitteilungen der Entomologischen Vereins Stuttgart 36: 63–64.

Gfeller W (1987) Bemerkenswerte Käferfunde (Coleoptera) in der Schweiz, insbesondere im Tessin in den Jahren 1985–1987. Mitteilungen der Entomologischen Gesellschaft Basel 37(4): 183–186.*

Gfeller W (1992) Bemerkenswerte Käferfunde in der Schweiz, insbesondere in den Jahren 1988 bis 1992. 3. Beitrag zur Faunistik und Ökologie der Käfer in der Schweiz. Mitteilungen der Entomologischen Gesellschaft Basel 42(4): 163–168.

Gimmel ML, Bocáková M, Gunter NL, Leschen RAB (2019) Comprehensive phylogeny of the Cleroidea (Coleoptera: Cucujiformia). Systematic Entomology. https://doi.org/10.1111/syen.12338

Handschin E (1963) Die Coleopteren des schweizerischen Nationalparkes und seiner Umgebung. Ergebnisse der wissenschaftlichen Untersuchungen im schweizerischen Nationalpark. Band VIII. Lüdin, Liestal, 302 pp.

Hartmann K, Sprecher E (1990) Ein Beitrag zur Insektenfauna des Arlesheimer Waldes, unter besonderer Berücksichtigung der holzbewohnenden Käfer. Tätigkeitsberichte Naturforschende Gesellschaft Baselland 36: 75–124.*

Heer O (1841a) Die Kaefer der Schweiz, mit besonderer Berücksichtigung ihrer geographischen Verbreitung. Erster Theil, Dritte Lieferung. Petitpierre, Neuchatel, 79 pp.*

Heer O (1841b) Fauna coleopterorum helvetica. Pars 1. Turici: Impensis Orelii, Fuesslini et Sociorum, 652 pp.*

Herger P (1980) Die Insektenfauna des Hochmoores Balmoos bei Hasle, Kanton Luzern. V. Coleoptera (Käfer) – 1. Teil. Entomologische Berichte Luzern 4: 2–14.*

Herger P (1981a) Die Insektenfauna des Hochmoores Balmoos bei Hasle, Kanton Luzern. XII. Coleoptera (Käfer) – 2. Teil: Cantharoidea. Entomologische Berichte Luzern 6: 72–79.*

Herger P (1981b) Zur Insektenfauna des Siedereiteiches bei Hochdorf, Kanton Luzern. VI. Coleoptera (Käfer) – 1. Teil. Entomologische Berichte Luzern 5: 74–82.*

Herger P (1981c) Zur Insektenfauna der Umgebung des Brisen-Haldigrates, 1200–2400 m, Kanton Nidwalden. III. Coleoptera (Käfer) – 1. Teil. Entomologische Berichte Luzern 6: 64–71.*

Herger P (1982a) Zur Insektenfauna der Umgebung der Vogelwarte Sempach, Kanton Luzern. X. Coleoptera (Käfer) – 1. Teil. Entomologische Berichte Luzern 8: 68–82.*

Herger P (1982b) Zur Insektenfauna vom Pilatus-Kulm, 2060 m, Kanton Nidwalden. III. Coleoptera (Käfer) – 1. Teil. Entomologische Berichte Luzern 8: 48–56.*

Herger P (1983a) Käferfunde aus Littau, Kanton Luzern. Entomologische Berichte Luzern 9: 116–120.*

Herger P (1983b) Zur Insektenfauna der Umgebung von Baldegg, Kanton Luzern. Baldegg-Institut. III. Coleoptera 1 (ohne Staphylinidae und Curculionidae) (Käfer). Entomologische Berichte Luzern 10: 69–74 u. Anhang 81–88.*

Herger P (1983c) Zur Insektenfauna der Umgebung von Ettiswil, Kanton Luzern. III. Coleoptera 1 (ohne Staphylinidae und Curculionidae) (Käfer). Entomologische Berichte Luzern 10: 75–80 u. Anhang 81–88.*

Herger P (1986) Zur Insektenfauna von Rigi-Kulm, 1600–1797 m, Kanton Schwyz. IV. Coleoptera 1: Carabidae – Scolytidae (ohne Staphylinidae). Entomologische Berichte Luzern 15: 1–11.*

Herger P (1987) Zur Insektenfauna von Gersau-Oberholz, Kanton Schwyz. IV. Coleoptera 1: Carabidae – Scolytidae (ohne Staphylinidae und Chrysomelidae). Entomologische Berichte Luzern 17: 1–19.*

Herger P (1989) Käferbeifänge aus 36 Borkenkäfer-Pheromonfallen im Forstrevier Rigi-Süd, 530–1620 m, Kanton Luzern, 1988 (Coleoptera). Entomologische Berichte Luzern 21: 33–44.*

Herger P (1990) Zur Insektenfauna des Urserentales, Furkastrasse 2000 m, Kanton Uri. IV. Coleoptera (Käfer). Entomologische Berichte Luzern 23: 23–28.*

Herger P (1991) Zur Insektenfauna von Obergütsch (500–600 m), Stadt Luzern. V. Coleoptera 3 (ohne Staphylinidae, Elateridae und Curculionidae). Entomologische Berichte Luzern 25: 27–40.*

Herger P (1992) Zur Insektenfauna vom Vogelmoos (775 m) bei Neudorf, Kanton Luzern. VI. Coleoptera 1 (ohne Staphylinidae, Elateridae, Chrysomelidae u. Curculionidae). Entomologische Berichte Luzern 28: 45–60.*

Herger P (1993) Zur Insektenfauna vom Airolo, Lüvina, 1200 m, Kanton Tessin. IV. Coleoptera 1: (ohne Nitidulidae, Cryptophagidae, Chrysomelidae). Entomologische Berichte Luzern 30: 13–30.*

Herger P (1994a) Die Käfersammlung von Josef Roos (1908–1992) – Ein Beitrag zur Käferfauna der Talschaft Entlebuch, Kanton Luzern (Coleoptera). Entomologische Berichte Luzern 32: 1–12.*

Herger P (1994b) Käfer aus Lichtfallen im Engadin, 1840 – 2170 m, Kanton Graubünden. Mit Erstnachweis von *Attalus alpinus* Giraud (Malachiidae) für die Schweiz in diesem Jahrhundert (Coleoptera). Entomologische Berichte Luzern 32: 115–118.

Herger P (1995a) Käfer aus einer Lichtfalle bei Ins, Landwirtschaftliche Schule 430 m, Kanton Bern. – 1. Teil (Coleoptera). Entomologische Berichte Luzern 33: 57–66.*

Herger P (1995b) Käfer aus einer Lichtfalle bei Wädenswil, Sandhof, 518 m, Kanton Zürich (Coleoptera). Entomologische Berichte Luzern 34: 13–18.*

Herger P (1998a) Nachweise von *Tenebroides fuscus* (Goeze, 1777) in der hochmontanen Stufe des Napfgebietes (Coleoptera: Trogositidae). Entomologische Berichte Luzern 39: 105–106.

Herger P (1998b) Zur Insektenfauna des Kantons Schaffhausen (Hallau-Egg und Löhningen). III. Coleoptera (Käfer). Entomologische Berichte Luzern 39: 113–126.*

Herger P (1999a) Zur Insektenfauna vom Hochmoor Forenmoos, 970 m, Eigental, Kanton Luzern. IV. Coleoptera (Käfer). Entomologische Berichte Luzern 41: 1–16.*

Herger P (1999b) Zur Käferfauna im Entlebuch, Kanton Luzern: Käferfänge in Doppleschwand, Aebnetgüetli 850 m (Coleoptera). Entomologische Berichte Luzern 41: 17–22.*

Herger P (2002) Zur Insektenfauna vom Rüss-Spitz (Kanton Zug), 388 m, bei Maschwanden ZH. V. Coleoptera 1 (Käfer). Entomologische Berichte Luzern 47: 1–24.*

Herger P (2004) Zur Insektenfauna vom Hanenriet bei Giswil, 470 m, Kanton Obwalden. III. Coleoptera 1 (Käfer). Entomologische Berichte Luzern 51: 1–18.*

Herger P (2005) Zur Insektenfauna des Flachmoores Wauwilermoos, 498 m, Kanton Luzern. III. Coleoptera 1 (Käfer). Entomologische Berichte Luzern 53: 1–20.*

Herger P (2006) Zur Insektenfauna von Altdorf und Umgebung, Kanton Uri. 2. Reussdelta bei Seedorf, 435 m. IV. Coleoptera 2: Allgemeiner Überblick und Artenliste 2. Teil (ohne Staphylinidae und Curculionidae). Entomologische Berichte Luzern 55: 1–20.*

Herger P (2007a) Zur Insektenfauna der Umgebung von Lauerz, Kanton Schwyz. 1. Sägel (455 m) und Schuttwald (480 m). VII. Coleoptera 2: Allgemeiner Überblick und Artenliste 2. Teil (ohne Staphylinidae und Curculionidae). Entomologische Berichte Luzern 57: 47–70.*

Herger P (2007b) Zur Insektenfauna der Umgebung von Lauerz, Kanton Schwyz. 2. Schwändi (650m). V. Coleoptera 2: Allgemeiner Überblick und Artenliste 2. Teil (ohne Staphylinidae und Curculionidae). Entomologische Berichte Luzern 57: 71–78.*

Herger P, Germann C (2015) Käfer (Coleoptera) vom östlichen Napfgebiet (Romoos und Umgebung), Kanton Luzern. Entomo Helvetica 8: 59–64.*

Herger P, Uhlig M (1990a) Zur Insektenfauna vom Fronalpstock (Kulm 1990 m und Oberfeld, 1860 m), Kanton Schwyz. IV. Coleoptera (Käfer). Entomologische Berichte Luzern 24: 107–114.*

Herger P, Uhlig M (1990b) Zur Insektenfauna von Hospental, Kanton Uri. III. Coleoptera (Käfer). Entomologische Berichte Luzern 23: 15–22.*

Herger P, Germann C, Uhlig M, Vogel J, Geiser M, Kirejtshuk A (2015) Käfer aus Lichtfängen am Monte San Giorgio bei Serpiano, Kanton Tessin (Coleoptera). Entomo Helvetica 8: 89–96.*

Heyden von L (1863) Beitrag zur Coleopterenfauna des Ober-Engadins, insbesondere der Umgegend von St. Moritz. Jahresberichte der naturforschenden Gesellschaft Graubündens 8: 1–52.

Heyden von L (1864) Nachtrag zum Beitrag der Coleopterenfauna des Oberengadins, insbesondere der Umgegend von St. Moritz. Jahresberichte der naturforschenden Gesellschaft Graubündens 9: 1–16.

Heyden von L (1871) Supplement zum Beitrag der Coleopterenfauna des Ober-Engadins, insbesondere der Umgegend von St. Moritz. Jahresberichte der naturforschenden Gesellschaft Graubündens 16: 27–49.*

Hubenthal W (1916) Über *Opilo germanus* Chevrolat. Entomologische Blätter 12: 258–260.

Huber B, Büche B (2014) Vielfalt der Totholzkäferfauna im Urwald Scatlè, Breil/Brigels (Schweiz, Graubünden) (Coleoptera). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 87: 311–326.*

Huber C, Kobel E (1994) Zum Vorkommen von *Tenebroides fuscus* (Goeze, 1777) in der Schweiz (Coleoptera, Trogositidae). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 67: 1–5.

Hugentobler H (1959) Beitrag zur Kenntnis der Käferfauna des Thurgaus. Mitteilungen der Thurgauischen Naturforschenden Gesellschaft 38: 5–116.*

Hugentobler H (1966) Beitrag zur Kenntnis der Käfer der Nordostschweiz. Naturwissenschaftlichen Gesellschaft St. Gallen, 248 pp.*

Hunt H, Bergsten J, Levkanicova Z, Papadopoulou A, St. John O, Wild R, Hammond PM, Ahrens D, Balke M, Caterino MS, Gómez-Zurita J, Ribera I, Barraclough TG, Bocáková M, Bocák L, Vogler AP (2007) A comprehensive phylogeny of beetles reveals the evolutionary origins of a superradiation. Science 318: 1913–1916. https://doi.org/10.1126/science.1146954

Jaccard H (1890) Catalogue des Coléoptères récoltés à Aigle et environs. Bulletin de la Murithienne 19–20: 21–60.

Jelínek J (2007) Biphyllidae [547–548]. In: Löbl I, Smetana A (Eds) (2007) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea – Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 935 pp.

Jörger JB (1914) Ein Beitrag zur Coleopteren-Fauna des Rigi. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 12: 190–193.*

Juillerat P, Bäumler B, Bornand C, Gygax A, Jutzi M, Möhl A, Nyffeler R, Sager L, Santiago H, Eggenberg S (2017) Checklist 2017 der Gefässpflanzenflora der Schweiz / de la flore vasculaire de la Suisse / della flora vascolare della Svizzera. Info Flora, 380 pp.

Kahlen M, Hellrigl K (1996) Ordnung Coleoptera-Käfer [393–511]. In: Hellrigl K (Ed.) Die Tierwelt Südtirols. Naturmuseum Südtirol, Bozen, 831 pp.

Kiesenwetter von H (1859) Kleinere Mittheilungen. Über die Fauna von Ragaz. Berliner Entomologische Zeitschrift 3: 339–345. https://doi.org/10.1002/mmnd.47918590307 *

Kiesenwetter von H (1861) Eine entomologische Excursion in das Wallis und nach dem Monte Rosa im Sommer 1861. Berliner Entomologische Zeitschrift 5: 360–395.

Killias E (1860) Zoologische Mittheilungen. 2. Insectenverzeichniss aus Puschlav. Jahresbericht der Naturforschenden Gesellschaft Graubündens 7: 102–108.

Köhler F (2000) Erster Nachtrag zum Verzeichnis der Käfer Deutschlands. Entomologische Nachrichten und Berichte, Dresden, 44(1): 60–84.

Köhler F (2011) 2. Nachtrag zum „Verzeichnis der Käfer Deutschlands“ (Köhler, Klausnitzer 1998) (Coleoptera). Entomologische Nachrichten und Berichte, Dresden, 55: 109–174, 247–254.

Köhler F, Klausnitzer B (1998) Entomofauna Germanica. Verzeichnis der Käfer Deutschlands. Entomologische Nachrichten und Berichte, Dresden, Beiheft 4: 1–185.

Kolibáč J (1992) Species of the genera *Thanasimus* Latreille and *Korynetes* Herbst in central Europe (Coleoptera, Cleridae). Acta entomologica Bohemoslovaca 89: 309–314.

Kolibáč J (1993) Observations on *Ancyrona* Reitter, 1876 with a key to Central European Trogositidae (Coleoptera, Trogositidae). Nachrichtenblatt der Bayerischen Entomologen 42(1): 16–22.

Kolibáč J (2007) Trogossitidae [364–366]. In: Löbl I, Smetana A (Eds) (2007) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea – Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 935 pp.

Kolibáč J (2013) Trogossitidae: A review of the beetle family, with a catalogue and keys. ZooKeys 366: 1–194. https://doi.org/10.3897/zookeys.366.6172

Kolibáč J (2018) Icones insectorum Europae centralis. Coleoptera: Cleroidea: Phloiophilidae, Acanthocnemidae, Trogossitidae, Thanerocleridae, Cleridae. Folia Heyrovskyana, series B 33: 1–29.

Kolibáč J, Majer K, Švihla V (2005) Cleroidea. Beetles of the superfamily Cleroidea in the Czech and Slovak Republics and neighbouring areas. Clarion production, Praha, 186 pp.

Korge H (1960) Faunistische Neuigkeiten aus Deutschland: *Opilo germanus*. Entomologische Blätter 56: 185–186.

Lachat T, Pauli D, Gonseth Y, Klaus G, Scheidegger C, Vittoz P, Walter T (2010) Evolution de la biodiversité en Suisse depuis 1900. Avons-nous touché le fond? Zürich, Bristol-Stiftung; Bern, Stuttgart, Wien, Haupt, 433 pp.

Liberti G (1985) IV contributo alla conoscenza del genere *Danacea* Cast. (Col., Dasytidae). Descrizione del sottogenere nuovo *Allodanacea* e revisione delle specie italiane. Annali del Museo civico di Storia naturale « G. Doria » di Genova 85: 333–362.

Liberti G (1989) V contributo alla conoscenza del genere *Danacea* Cast. (Coleoptera, Dasytidae). Revisione delle specie italiane del II e del III gruppo. Entomologica Basiliensa 13: 279–302.

Liberti G (2009a) The *Danacea* of the Balkan Peninsula. A revision (Coleoptera Dasytidae). Memorie della Società entomologica italiana 88: 17–116. https://doi.org/10.4081/memorieSEI.2009.17

Liberti G (2009b) The Dasytidae (Coleoptera) of Sardinia. Zootaxa 2318: 339–385.

Liberti G (2012) A contribution to the knowledge of the european *Trichoceble* Thomson, 1859 (Coleoptera, Cleroidea, Dasytidae). Annali del Museo civico di Storia naturale « G. Doria » di Genova 104: 191–252.

Liberti G, Constantin R (2009) The *Enicopus* Stephens, 1830 species east of the Iberian peninsula: *E. ater* (Fabricius, 1898) and *E. pilosus* (Scopoli, 1763) (Coleoptera, Dasytidae). Annali del Museo civico di Storia naturale « G. Doria » di Genova 100: 293–321.

Liberti G, Constantin R (2011) Notes synonymiques et taxonomiques sur *Dasytes gonocerus* Mulsant, Rey, 1868, et *D. incertus* Schilsky, 1895 (Coleoptera, Cleroidea, Dasytidae). Bulletin de la Société entomologique de France 116 (2): 165–168.

Liberti G, Focarile A (2005) I Dasytidae del Cantone Ticino (Coleoptera, Cleroidea). Bolletino della Società Ticinese di Scienza Naturali 93: 19–39.

Linder A (1937) Beitrag zur Coleopteren-Fauna der Schweiz. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 17: 172–175.*

Linder A (1941) La collection de coléoptères du Chanoine Cerutti. Bulletin de la Murithienne 59: 129–134.

Linder A (1946) 2. Beitrag zur Coleopteren-Fauna der Schweiz. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 20: 197–207.

Linder A (1953) 3. Beitrag zur Coleopteren-Fauna der Schweiz. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 26(1): 63–71.

Linder A (1967) Nachtrag zum Verzeichnis der Bündner Coleopteren von Dr. E. Killias. Jahresbericht der Naturforschenden Gesellschaft Graubünden 93: 78–109.

Linder A (1968) 4. Beitrag zur Coleopteren-Fauna der Schweiz. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 41: 211–232.

Liniger E (1886) Ein Aufenthalt im Wallis. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 7: 286–294.*

Lohse GA, Lucht WH (Eds) (1992) Die Käfer Mitteleuropas. 2. Supplementband mit Katalogteil. Goecke, Evers, Krefeld, 375 pp.

Löbl I (2007) Byturidae [546–547]. In: Löbl I, Smetana A (Eds) (2007) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea – Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 935 pp. https://doi.org/10.1163/9789004260894

Löbl I, Smetana A (2007) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea – Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 935 pp. https://doi.org/10.1163/9789004260894

Löbl I, Rolčík J, Kolibáč J, Gerstmeier R (2007) Cleridae [367–384]. In: Löbl I, Smetana A (Eds) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea – Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 935 pp. https://doi.org/10.1163/9789004260894

Luka H, Nagel P, Feldmann B, Luka A, Gonseth Y (2009) Checkliste der Kurzflügelkäfer der Schweiz (Coleoptera: Staphylinidae ohne

Pselaphinae). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 82: 61–100.

Marggi W, Luka H (2001) Laufkäfer der Schweiz – Gesamtliste 2001 (Coleoptera: Carabidae). Checklist 2001, Carabidae of Switzerland. Opuscula Biogeographica Basileensia 1, 37 pp.

Mayor A (2007a) Dasytidae, Malachiidae [388–454]. In: Löbl I, Smetana A (Eds) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea – Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 935 pp.

Mayor A (2007b) Phloiophilidae [363–364]. In: Löbl I, Smetana A (Eds) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea – Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 935 pp.

Meier C, Sauter W (1989) Zur Kenntnis der Insektenfauna eines Auwaldreservates an der Aare bei Villnachern AG. Mitteilungen der Aaragauischen Naturforschenden Gesellschaft 32: 217–258.*

Michaud A (1937) Observations sur la Faune entomologique du Val d'Orvin. Bulletin de la Société Neuchâteloise des Sciences Naturelles 62: 84–98.*

Monnerat C, Chittaro Y, Sanchez A, Gonseth Y (2015a) Critères et procédure d'élaboration de listes taxonomiques nationales: le cas des Buprestidae, Cerambycidae, Lucanidae et Cetoniidae (Coleoptera) de Suisse. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 88: 155–172.

Monnerat C, Chittaro Y, Sanchez A, Gonseth Y (2015b) Liste commentée des Lucanidae, Cetoniidae, Buprestidae et Cerambycidae (Coleoptera) de Suisse. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 88: 173–228.

Mory CE (1894) Eine coleopterologische Sammelreise in Graubünden. Societas entomologica 8: 148–149, 162.*

Mory CE (1898) Liste der 1898 im Jouxthal gesammelten Coleopteren. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 10: 469–473.*

Müller JA (1904) 3. Beitrag zur Coleopteren-Fauna der Kantone St. Gallen und Appenzell. Berichte der St. Gallischen Naturwissenschaftlichen Gesellschaft 10: 201–218.

Müller JA (1912) Verzeichnis der Käfer Vorarlbergs. Sonderabdruck aus dem 48. Jahresbericht des Landesmuseumsvereins Vorarlberg, Bregenz, 203 pp.

Niehuis M (2013) Die Buntkäfer in Rheinland-Pfalz und im Saarland. Gesellschaft für Naturschutz und Or nithologie Rheinland-Pfalz e.v. (GNOR), Mainz, 683 pp.

Pardo Alcaide A (1962) Malachiidae del Mediterráneo occidental (Coleoptera). Eos 38(2): 263–298.

Plata Negrache P (2009) Descripción de *Ebaeus jperezvalcarceli*, especie nueva de España y estudio de los *Ebaeus* del grupo *collaris* de la cuenca del Mediterráneo occidental (Coleoptera: Malachiidae). Boletín Sociedad Entomológica Aragonesa 45: 39–52.

Plata Negrache P (2012) Estudio de la Subfamilia Malachiinae Fleming en Andalucía. Fotocopias Campus, Domingo Pérez Batista, La Laguna, 203 pp.

Rätzer A (1888) Nachträge zur Fauna coleopterorum Helvetiae besonderes aus dem Gebiete des berner Seelandes, des Jura und der Walliseralpen. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 8: 20–42.

Rehfous M (1955) Contribution à l›étude des Insectes des Champignons. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 28: 1–106.*

Reibnitz J, Graf R, Coray A (2013) Verzeichnis der Ciidae (Coleoptera) der Schweiz mit Angaben zur Nomenklatur und Ökologie. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 86: 63–88.

Rühl F (1887) Beitrag zur Coleopterenfauna des Averser-Thales. Societas entomologica 2: 90–91.*

Sanchez A, Chittaro Y (2017) Inventaire des Coléoptères saproxyliques des pinèdes du Val d'Anniviers (VS). Bulletin de la Murithienne 134: 21–34.*

Sanchez A, Chittaro Y (2018) Liste commentée des Histeridae et Sphaeritidae de Suisse (Coleoptera, Histeroidea). Entomologische Blätter und Coleoptera 114: 335–352.

Sanchez A, Chittaro Y, Gonseth Y (2018) Préférences écologiques des coléoptères saproxyliques emblématiques de Suisse. Schweizerische Zeitschrift für Forstwesen 169(3): 158–165. https://doi.org/10.3188/szf.2018.0158

Sanchez A, Chittaro Y, Monnerat C (2015) Coléoptères nouveaux ou redécouverts pour la Suisse ou l'une de ses régions biogéographiques. Entomo Helvetica 8: 119–132.

Sanchez A, Chittaro Y, Monnerat C, Gonseth Y (2016) Les coléoptères saproxyliques emblématiques de Suisse, indicateurs de la qualité de nos forêts et milieux boisés. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 89: 261–280.

Schacht W (1879) Contributions à la faune entomologique du Valais. III. Contribution à la faune des coléoptères du Valais. Bulletin de la Murithienne 9: 43–54.

Scherler P (1981) Notes coléoptérologiques. Bulletin Romand d'Entomologie 1: 17–22.*

Scherler P (1992) JORLOG, études entomologique des parcelles 06, 38, 39, 40, 41 et 42. Echantillonnage des Coléoptères. Bulletin Romand d'Entomogie 10: 59–80.*

Scherler P (1995) Les Coléoptères de la Grande Cariçaie (rive sud-est du lac de Neuchâtel). Bulletin Romand d'Entomologie 13: 31–54.

Scherler P, Sekaly V, Toumayeff G (1989) Coléoptères de la réserve du Bois de Chênes, dans la région de Ferreyres-Moiry. Bulletin Romand d›Entomologie 7: 11–29.*

Sprecher E, Luka H, Germann C, Luka A, Klausnitzer B, Graff P (2008) Käfer. [308–331]. In: Baur B, Billen W, Burckhardt D (Eds) Vielfalt zwischen den Gehegen: wildlebende Tiere und Pflanzen im Zoo Basel. Monographien der Entomologischen Gesellschaft Basel 3.

Stäger R (1951) Biologische Beobachtungen an Käfern im Wallis. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 24: 125–128.*

Stierlin G (1863) Verzeichniss der während einer entomologischen Exkursion nach dem Engadin im Juni 1862 gesammelten Käfer. Mittheilungen der Schweizerischen Entomologischen Gesellschaft 1: 57–66.

Stierlin G (1863–1864) Zusammenstellung der durch Herrn Meyer-Dür in Tessin und Oberengadin beobachteten und eingesammelten Coleopteren. Mittheilungen der Schweizerischen Entomologischen Gesellschaft 1: 155–172.

Stierlin G (1875) Verzeichniss der gesammelten Käfer. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 4: 465–468.*

Stierlin G (1880) Beiträge zur Kenntnis der Käferfauna des Kant. Wallis und der D*ichotrachelus*-Arten. Mittheilungen der Schweizerischen Entomologischen Gesellschaft 5: 541–551.*

Stierlin G (1883) Zweiter Nachtrag zur Fauna coleopterorum helvetica. Neue Denkschriften der schweizerischen Gesellschaft für die gesammten Naturwissenschaften 8(3): 1–98.

Stierlin G (1898) Fauna coleopterorum helvetica. Die Käfer-Fauna der Schweiz nach der analytischen Methode. II. Theil. Bolli & Böcherer, Schaffhausen, 662 pp.

Stierlin G (1900) Fauna coleopterorum helvetica. Die Käfer-Fauna der Schweiz nach der analytischen Methode. I. Theil. Bolli & Böcherer, Schaffhausen, 667 pp.

Stierlin G (1906) Coleopteren-Fauna der Gegend von Schaffhausen. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 11: 167–220.*

Stierlin G, Gautard VV (1867) Fauna coleopterorum helvetica. Die Käfer-Fauna der Schweiz. Schaffhausen und Vevey, 372 pp.

Täschler M (1872) Beitrag zur Coleopteren-Fauna der Kantone St. Gallen und Appenzell. Berichte der Tätigkeiten der St. Galler Naturwissenschaftlichen Gesellschaft, 39–249.*

Tihelka E (2016) First record of *Opilo germanus* Chevrolat, 1843 (Coleoptera: Cleridae) from Italy with remarks on its distribution in Europe. Natura Sloveniae 18(2): 63–68.

Tronquet M (2014) Catalogue des Coléoptères de France. Perpignan, Association Roussillonnaise d'Entomologie, 1056 pp.

Tshernyshev SE (2009) *Anthomalachius*, a new genus of soft-winger flower beetles (Coleoptera, Malachiidae: Malachiinae). Zootaxa 2094: 23–35.

Uhlig M, Uhlig B (2006) Zur Käferfauna der Schweiz (Coleoptera ohne Staphylinidae). Entomologische Berichte Luzern 56: 1–20.*

Walter T, Wolf M, Plattner M (2003) Holzbewohnende Käfer im Naturschutzgebiet Wildenstein. Mitteilungen der Naturforschenden Gesellschaften beider Basel 7: 263–285.*

Welti S (1998) Totholzabhängige Käfer (Coleoptera) und Totholzangebot im Sihlwald (Kt. Zürich). Diplomarbeit, Universität Zürich, 61 pp.*

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PENSOFT

Alpine Entomology

A new species of *Rhantus* diving beetles from the wetlands of the City of Bogota and surroundings (Coleoptera, Dytiscidae, Colymbetinae)

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Abstract

The Colombian species of the genus *Rhantus* are reviewed. *Rhantus bogotensis* **sp. nov.** is described and illustrated, based on specimens collected in the Altiplano of the Bogota region. It is compared with the similar species *Rhantus franzi*, *R. vicinus*, and *R. crypticus*. The Ecuadorian species *Rhantus crypticus* was found for the first time in the highlands of Nariño department. This is a new record for Colombia. Five species of *Rhantus* are presently known from Colombia.

Key Words

Dytiscidae
Rhantus
new species
new records
Bogota
Colombia

Introduction

Diving beetles of the genus *Rhantus* Dejean, 1833 are moderately large Dytiscidae, with body lengths of 8–14 mm. The species can be rather abundant in shallow stagnant water habitats usually with rich emergent vegetation. Few species occur in creeks (Balke and Ramsdale 2006). *Rhantus* species avoid wet tropical climate, so that the vast majority of tropical species do actually occur on higher altitudes with cooler climates (Balke 2001; Morinière et al. 2016). Neotropical species were reviewed by several authors in a series of more recent publications (Trémouilles 1984; Balke 1990, 1992, 1993, 1998; Peck and Balke 1993; Balke et al. 2002; Balke et al., in prep.). To date, three species were known from Colombia, *R. andinus* Balke, 1998, *R. franzi* Balke, 1998 and *R. vicinus* (Aubé, 1838). *Rhantus crypticus* Balke, 1992, described from Ecuador, has also been found in southern Colombia recently (new record given below). Here we add a fifth, hitherto undescribed species from the wetlands right in and around the city of Bogota.

Materials and methods

The beetles were studied with a Leica M205C stereo microscope at 10–160×. Habitus images were taken with a Canon EOS 550D camera fitted with a 65 mm Canon macro lens, attached to a Stackmaster macro rail (Stonemaster: http://www.stonemaster-onlineshop.de). Illumination was with two Canon Speedlite 430EX III-RT flashlights and translucent paper diffusors. Photographs of genitalia, surface sculpture and the claws were taken with a digital imaging system composed of a Can-

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on 5DS camera with, with a 10× Mitutoyo ELWD Plan Apo objective attached to a Carl Zeiss Jena Sonnar 3.5 / 135 MC as focus lens. Illumination was with four LED segments SN-1 from Stonemaster. Image stacks were generated using the Stackmaster macro rail (Stonemaster), and images were then assembled with the computer software Helicon Focus 4.77TM.

The following acronyms are used in the text: ICN-UNAL (Colombian National Collection of Insects, Natural Sciences Institute, Universidad Nacional de Colombia); ZSM (SNSB-Zoologische Staatssammlung, München, Germany), vouchers temporarily stored for further comparative morphological work.

Results

Rhantus bogotensis sp. nov.

http://zoobank.org/39B9B98B-9B70-4A56-9361-D87B38716289

Figs 1B, 2A, B, D, E, F, 3A–G, 4

Type locality. Colombia, Bogota city, Juan Amarillo / Tibabuyes wetland.

Holotype. Male (ICN-UNAL): "Colombia, Bogotá D.C., Bogotá, Humedal Tibabuyes, 2,500m, 25.ix.2003, 4.7187, -74.0976; dry mounted out of an Ethanol vial labelled "Coleoptera Dytiscidae 356, Rhantus, det. M. Laython 2016"; "HOLOTYPE *Rhantus bogotensis* sp. nov. Balke, Ospina-Torres, Megna, Laython & Hendrich, 2019" [red printed label].

240 Paratypes. 2 exx, same data as holotype (ICN-ICN-UNAL); 1 ex., "Colombia: Bogota, La Florida, 2,436m, 19.iv.2017, 4.728, -74.142, Y.S. Megna & N. Stiven (12)", (MB 7823) (ZSM); 118 exx, "Colombia, Cundinamarca, Humedal La Florida, 2,400m, 19.xi.2018, 4.729 -74.143, Ospina, Balke & Megna (COL_MB_2018_08)" (ICN-UNAL, ZSM); 119 exx, "Colombia, Cundinamarca, Humedal La Florida, 2,400m, 22.xi.2018, 4.729 -74.143, Ospina, Balke & Megna (COL_MB_2018_12)" (ICN-UNAL, ZSM). All specimens bear our red printed paratype labels.

Description. Holotype. A medium sized *Rhantus* species, total length of holotype 11.3 mm, length without head 10.2 mm, greatest width 5.9 mm.

Colour: Head black with contrasting orange marks as in Fig. 1B. Pronotum yellow orange, base as well discal patch somewhat black. Elytron orange with black irrora-

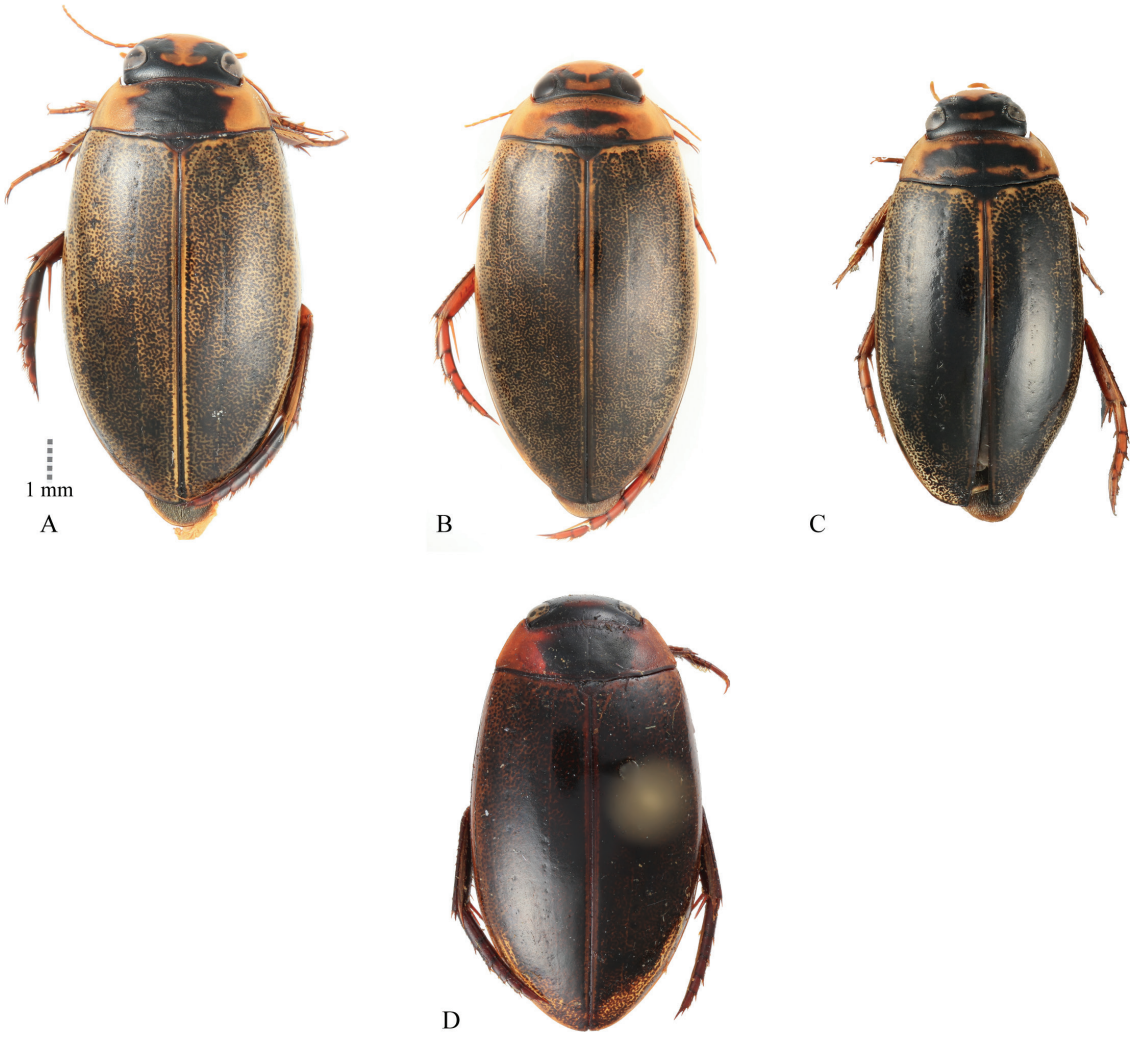


Figure 1. Dorsal habitus of *Rhantus andinus* (**A**), *R. bogotensis* sp. nov. (**B**), *R. vicinus* (**C**), *R. franzi* (**D**).



Figure 2. *Rhantus* spp.: Pronotal margin of *R. bogotensis* sp. nov. female (**A**), male (**B**); *R. vicinus* female (**C**); *R. bogotensis*: surface sculpture on head, frons (**D**), middle part of pronotum with base and disc (**E**) elytron, basal area (**F**).

tions. Body appendages, prothorax, prosternal process, epipleuron, coxae, postcoxal process and hind margins of abdominal sternites orange to dark ferruginous, rest of venter black.

Surface sculpture: Head with irregular meshes and dense, distinct punctation, no microreticulation (MR) visible (Fig. 2D); clypeus with double punctation only. Pronotum with irregular meshes and dense, distinct double punctation, disc with double punctation only; no MR visible on pronotum (Fig. 2E). Elytron with distinct, irregular polygonal meshes and fine punctation; with distinct though sometimes faint MR within the meshes (Fig. 2F).

Structures: Pronotum with broad and conspicuous lateral bead which does however not reach the anterior angle (Fig. 2B). Lateral wings of metaventrite triangular; hind wings fully developed. Last ventrite rounded apically.

Tarsal characters: Protarsal claws (Fig. 3F, G) with anterior and posterior claw of almost equal length, posterior claw slightly longer and about the same length as tarsomere V. Claws slender and with no particular modification (e.g. not dentate). Mesotarsal claws sinuate, with posterior claw shorter and more strongly curved than anterior claw, shorter than fifth protarsomere (Fig. 3D, E). Pro- and mesotarsomeres 1–3 not dilated laterally (Fig. 3D, F), with four transverse rows of stalked suction discs ventrally. Number of discs per row (tarsomere on which row occurs given in parentheses): 5(I)/6(I)/6(II)/5(III).

Genital structure: Median lobe of aedeagus as in Fig. 3B, C, in lateral view appearing of longish curvature; parameres with a fringe of yellow hairs which are apically acute, not trumpet shaped (Fig. 3A).

Female: Color and surface sculpture as in male. Tarsomere without stalked suction discs ventrally. The anterior margin of the anterior corner of pronotum (Fig. 2A, white asterisk) thicker than in male specimens (Fig. 2B).

Variation. Body size varies from 11.0–12.1 mm. The discal dark spot on pronotum can be obsolete, or slightly more extended than in Fig. 1B, the same is true for the basal dark spot. Both can be approaching but do not connect.

Etymology. Named after the type locality.

Comparative notes. A species well delineated from the other Colombian *Rhantus* of similar size by the following set of features:

Rhantus franzi, described from the Cauca Valley and Ecuador (holotype male studied here) is similar in size but with pronotal coloration more similar to *R. andinus* (Fig. 1A, D). The protarsal claws are similar to *R. bogotensis* sp. nov. (Fig. 3L), but the anterior mesotarsal claw is simply curved in *R. franzi* (Fig. 3M, N) and not more broadly triangular as in *R. bogotensis* sp. nov. (Fig. 3D, E). The posterior mesotarsal claw is missing in the holotype of *R. franzi* studied here (and tarsus missing on other side of body). The median lobe of aedeagus only slightly more elongate in *R. franzi* (Fig. 3K).

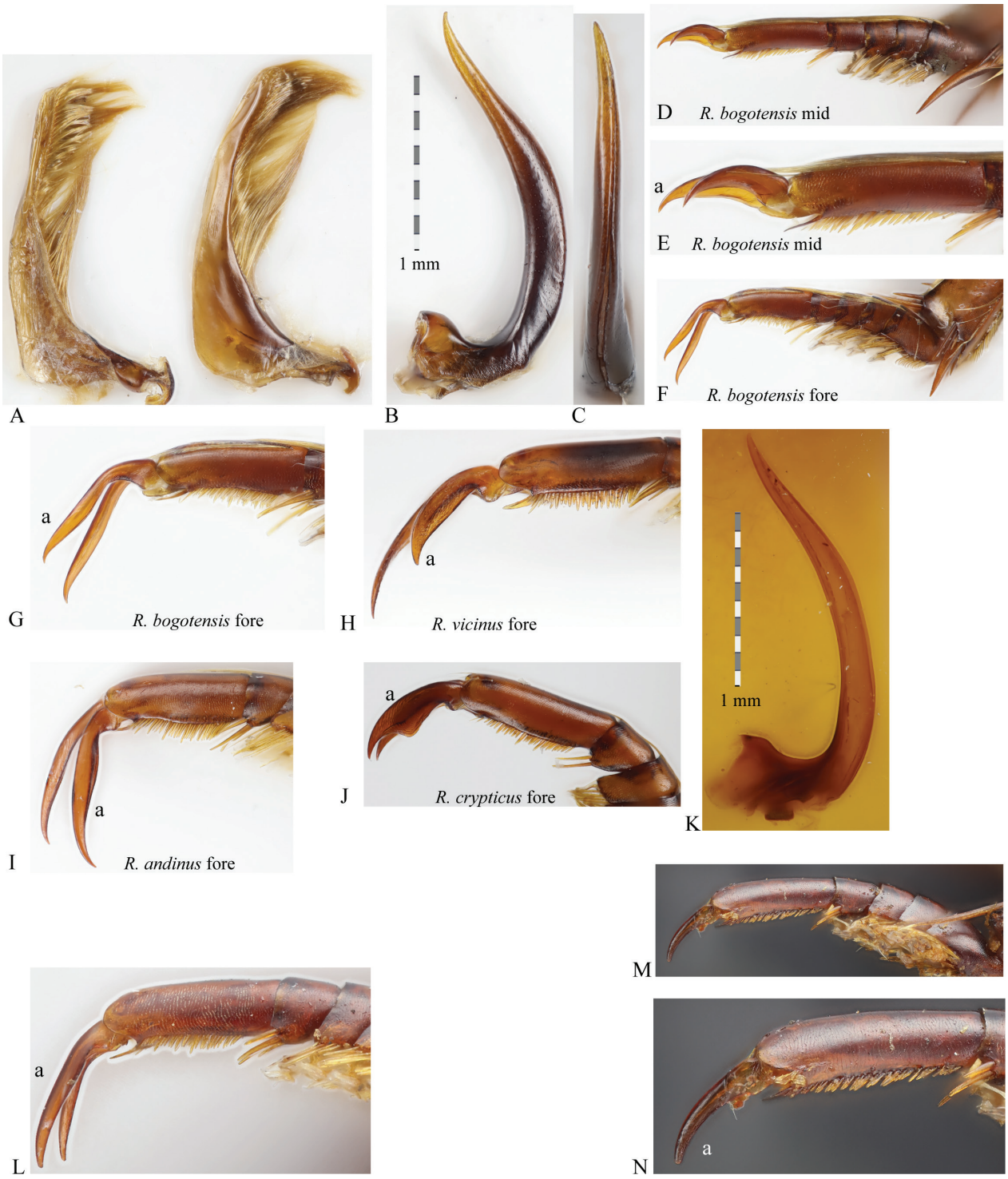


Figure 3. *Rhantus* spp., males: *Rhantus bogotensis* sp. nov. parameres (**A**), median lobe of aedeagus in lateral view (**B**), same in ventral view (**C**), mesotarsus (**D**), mesotarsomere V and claws (**E**), foretarsus (**F**), protarsomere V and claws (**G**); *R. vicinus*: protarsomere V and claws (**H**); *R. andinus*: protarsomere V and claws (**I**); *R. crypticus*: protarsomere V and claws (**J**); *R. franzi* median lobe of aedeagus in lateral view (**K**), protarsomere III–V and claws (**L**), mesotarsus (**M**), mesotarsomere V and anterior claw, posterior claw missing (**N**). "a" denotes anterior claw.

Males of *R. vicinus* and *R. crypticus* have the pro- and mesotarsomeres 1–3 distinctly dilated laterally, see Fig. 3J (not so in *R. bogotensis* sp. nov., Fig. 3F).

Males of *R. vicinus* and *R. crypticus* have the protarsal claws of unequal length and shape (Fig. 3H, J), anterior one much shorter and broader than posterior, with dent like shape in *R. crypticus* (Fig. 3J) (subequal in *R. bogotensis* sp. nov., Fig. 3F, G). The protarsal and mesotarsal claws of *R. andinus* (Fig. 3I) are similar to *R. bogoten-*

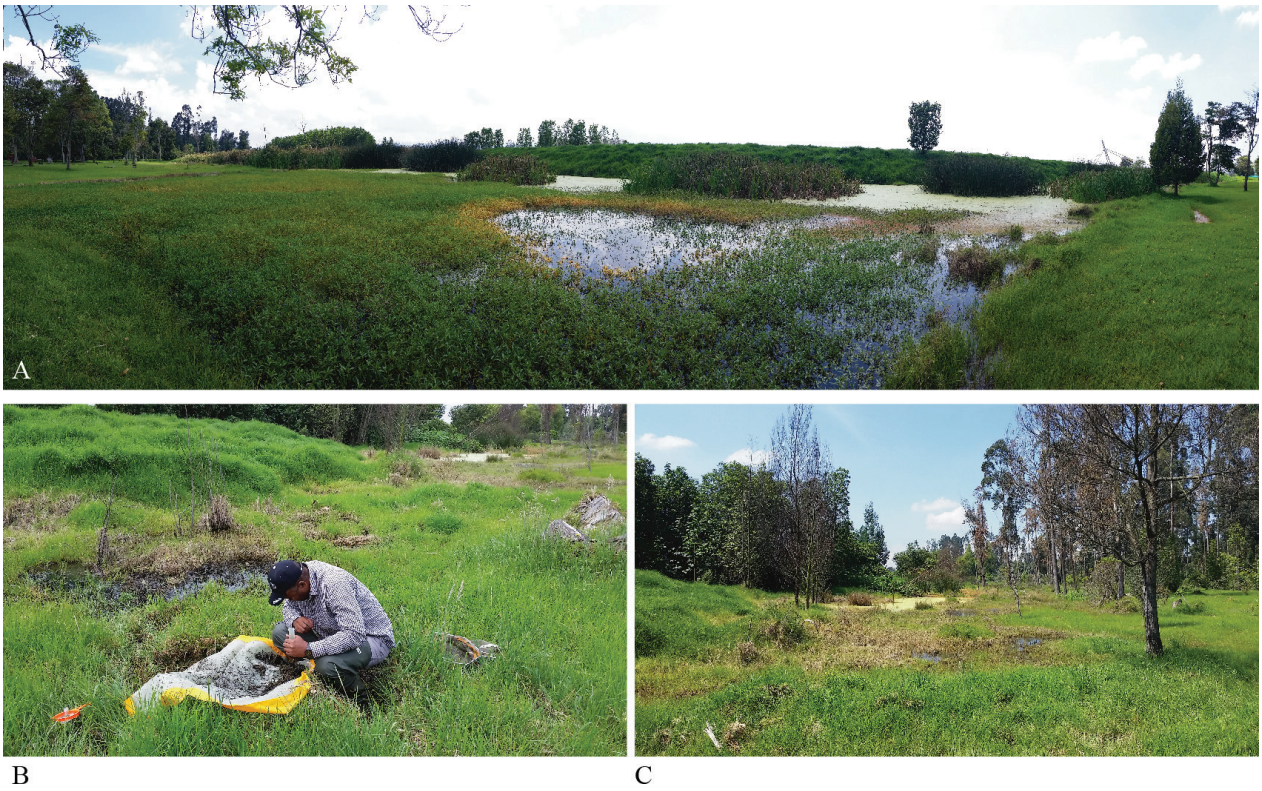


Figure 4. Habitat of *Rhantus bogotensis* sp. nov. in the Altiplano of Bogota, Colombia. Florida wetland, deeper water bodies where we did encounter only very few specimens (**A**), shallow ponds, most likely ephemeral (**B, C**).

sis sp. nov., but the beetles are easily separable by body size and coloration alone (Fig. 1A, B).

Females of *R. vicinus* and *R. crypticus* have the anterior angle of the pronotum distinctly extended (Fig. 2C, arrow). This is not the case in *R. bogotensis* sp. nov. (Fig. 2A).

Specimens of *R. vicinus* (Fig. 1C) and *R. crypticus* are generally of darker appearance than *R. bogotensis* sp. nov. (Fig. 1B).

Distribution. Altiplano of the Bogota region.

Habitat. Collected from richly vegetated ponds in full sun or slightly shaded, in abundance from flooded mats of grasses (Fig. 4B, C). Bottom of these habitats was usually black, foul smelling mud. In the La Florida wetland, the beetles seemed to avoid larger, deeper water bodies, possibly to avoid predation by fish (Fig. 4A).

Notes. Collected with aquatic nets as well as bottle traps. In association with the following other Dytiscidae: *R. andinus* (abundant), *R. vicinus* (only few, this species is abundant on higher elevations as well as in the Páramos above the altiplano of Bogota), two species of *Copelatus* Erichson, 1832 and *Liodessus bogotensis* Guignot, 1953, as well as different Hydrophilidae.

Rhantus crypticus Balke, 1992

Fig. 3J

New record for Colombia. Voucher specimens are from the following localities (5 per locality, ICN-UNAL and ZSM): Colombia: Nariño, Tuquerres, 3,681 m, 07.v.2017, 1.095, -77.694, Y. S. Megna & C. E. Ruiz (24); Colombia: Nariño, Pasto, 3,440 m, 05.v.2017, 1.176, -77.342, Y. S. Megna & C. E. Ruiz (20); Colombia: Nariño, Tuquerres, 3,820 m , 10.v.2017, 0.941, -77.863, Y. S. Megna & C. E. Ruiz (28); Colombia: Nariño, Tuquerres, 3,776 m , 07.v.2017, 1.087, -77.711, Y. S. Megna & C. E. Ruiz (25); Colombia: Nariño, Putumayo, 3,196 m, 02.v.2017, 1.133, -77.100, Y. S. Megna & C. E. Ruiz (18); Colombia: Nariño, Pasto, 2,775m, 02.v.2017, 1.116, -77.166, Y. S. Megna & C. E. Ruiz (17).

Discussion

Based on recent fieldwork in Colombia, we discovered a new species of diving beetles right in the capital area of the country. *Rhantus bogotensis* sp. nov. is apparantly rather abundant in richly vegetated stagnant water bodies in the Altiplano of Bogota. We also report the species *Rhantus crypticus* Balke, 1992, described from Ecuador, from Colombia for the first time. Both species belong to the Neotropical clade (Morinière et al. 2016) including *Rhantus signatus* (Fabricius, 1775) and related species, originally established based on the general shape of the median lobe (Balke 1992, 1993; Balke et al. 2002). This work was made possible through a close cooperation between Colombian, Cuban and German researchers, which has been established to advance our knowledge of Andean aquatic beetles.

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References

Balke M (1990) *Rhantus souzannae* sp. nov. from Costa Rica (Coleoptera: Dytiscidae). Aquatic Insects 12: 19–22. https://doi.org/10.1080/01650429009361383

Balke M (1992) Taxonomische Untersuchungen an neotropischen Wasserkäfern der Gattung *Rhantus* Dejean. Reichenbachia 29: 27–39.

Balke M (1993) Neotropische Wasserkäfer der Gattung *Rhantus* Dejean. IV. Liste und Notizen über die „großen" Arten (Coleoptera: Dytiscidae). Reichenbachia 30: 21–32.

Balke M (1998) Updating the Pacific, Indomalayan and Neotropical *Rhantus*-fauna Coleoptera: Dytiscidae). Koleopterologische Rundschau 68: 71–79.

Balke M (2001) Biogeography and classification of New Guinean Colymbetini (Coleoptera: Dytiscidae: Colymbetinae). Invertebrate taxonomy 15: 259–275. https://doi.org/10.1071/IT98008

Balke M, Ramsdale AS (2006) *Rhantus englundi* sp. nov. from Tubuai Island, French Polynesia (Coleoptera: Dytiscidae). Koleopterologische Rundschau 76: 51–54.

Balke M, Hájek J, Hendrich L (2017) Generic reclassification of species formerly included in *Rhantus* Dejean (Coleoptera, Dytiscidae, Colymbetinae). Zootaxa 4258. No.1: 91–100. https://doi.org/10.11646/zootaxa.4258.1.7

Balke M, Roughley RE, Sondermann W, Spangler PJ (2002) Diving beetles of the genus *Rhantus* in Costa Rica: Taxonomy and biogeography, with notes on South American species (Coleoptera: Dytiscidae). Studies on Neotropical Fauna and Environment 37: 263–271. https://doi.org/10.1076/snfe.37.3.263.8565

Fabricius JCh (1792) Entomologia systematica emendata et aucta. Secundum classes, ordines, genera, species adjectis synonymis, locis, observationibus, descriptionibus. Tom. I. Pars II. København, Denmark: C.G. Proft, 538 pp. https://doi.org/10.5962/bhl.title.122153

Kodada J, Hendrich L, Balke M (2018) *Tepuidessus grulai* sp. nov. from Acopán Tepui in Venezuela (Coleoptera: Dytiscidae: Hydroporinae: Bidessini). Zootaxa 4434(3): 561–572. https://doi.org/10.11646/zootaxa.4434.3.10

Nilsson AN, Hájek J (2019) A world catalogue of the family Dytiscidae (Coleoptera, Adephaga), 307 pp. http://www.waterbeetles.eu [Internet version 1.I.2019]

Miller KB, Nilsson AN (2003) Homology and terminology: Communicating information about rotated structures in water beetles. Latissimus 17: 1–4.

Morinière J, Van Dam MH, Hawlitschek O, Bergsten J, Michat MC, Hendrich L, Ribera I, Toussaint EF, Balke M (2016) Phylogenetic niche conservatism explains an inverse latitudinal diversity gradient in freshwater arthropods. Scientific reports 6: 26340. https://doi.org/10.1038/srep26340

Peck SB, Balke M (1993) A synopsis of the Dytiscidae of the Galapagos Islands, Ecuador, with description of *Rhantus galapagoensis* sp. nov. (Coleoptera: Dytiscidae). The Canadian Entomologist 125: 259–266. https://doi.org/10.4039/Ent125259-2

Spangler PJ (1981) New and interesting water beetles from Mt. Roraima and Ptari-tepui, Venezuela (Coleoptera: Dytiscidae and Hydrophilidae). Aquatic Insects 3: 1–11. https://doi.org/10.1080/01650428109361037

Trémouilles ER (1984) El género *Rhantus* Dejean en la Argentina (Coleoptera, Dytiscidae). Physis, Buenos Aires, B 42(102): 9–24.

Waterhouse CO (1895) Insects collected by Messrs. JJ Quelch and F. McConnell on the summit of Mount Roraima. The Annals and Magazine of Natural History, Zoology, Botany and Geology (SeR. 6) 15: 494–497. https://doi.org/10.1080/00222939508680209

Zimmerman JR, Smith RL (1975) The genus *Rhantus* (Coleoptera: Dytiscidae) in North America. Part I. General account of the species. Transactions of the American Entomological Society 101: 33–123.

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PENSOFT

Alpine Entomology

Liste commentée des Bostrichoidea et Derodontoidea de Suisse (Coleoptera: Bostrichiformia, Derodontiformia)

Annotated checklist of Bostrichoidea and Derodontoidea of Switzerland (Coleoptera: Bostrichiformia, Derodontiformia)

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distribution

Résumé

Une liste actualisée des espèces suisses appartenant aux superfamilles des Bostrichoidea et des Derodontoidea est présentée et brièvement commentée. Au total, 151 espèces appartenant aux familles des Bostrichidae (11 espèces), Dermestidae (41), Ptinidae (96), Derodontidae (2) et Nosodendridae (1) sont considérées comme indigènes ou naturalisées en Suisse sur la base de 19'820 occurrences issues de l'identification de spécimens de musées et de collections privées, ainsi que de la littérature. En parallèle, 68 taxa annoncés de Suisse par le passé sont exclus de la liste car insuffisamment documentés ou provenant uniquement d'importations isolées d'espèces allochtones non établies.

Abstract

An updated checklist of the Swiss species belonging to the superfamilies Bostrichoidea and Derodontoidea is presented and briefly discussed. One hundred fifty-one species belonging to the families Bostrichidae (11 species), Dermestidae (41), Ptinidae (96), Derondontidae (2) and Nosodendridae (1) are considered indigenous or naturalized in Switzerland. This list is based on 19'820 records obtained from the identification of specimens held in museum and private collections, and the literature. In parallel, 68 taxa that were recorded from Switzerland in the past are excluded from this list, either due to insufficient documentation or because they represent isolated cases of introductions of non-indigenous species that never became established in Switzerland.

Introduction

Selon la classification de Bouchard et al. (2011), la série des Bostrichiformia inclus les Bostrichidae, les Dermestidae, les Endecatomidae et les Ptinidae au sein de la superfamille des Bostrichoidea. La série des Derodontiformia regroupe quant à elle, dans la superfamille des Derodontoidea, les Derodontidae, les Nosodendridae et les Jacobsoniidae. A l'échelle suisse, ces deux superfamilles n'ont plus fait l'objet de listes nationales détaillées depuis les publications de Stierlin and Gautard (1867) et de Stierlin (1898, 1900).

Compte tenu de l'évolution importante des connaissances systématiques et chorologiques au cours des cent dernières années, une mise à jour de la liste faunistique des Bostrichoidea et des Derodontoidea de Suisse s'avérait donc nécessaire. Basé sur un important travail de révision des collections suisses et sur une analyse critique de la littérature, cet article propose une liste commentée actualisée de l'en-

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semble des espèces de Bostrichoidea et Derodontoidea signalées de Suisse. Les espèces indigènes et naturalisées sont distinguées des espèces annoncées par erreur, insuffisamment documentées ou provenant d'importations isolées.

Matériel et méthode

Afin de disposer de l'ensemble de l'information disponible et être ainsi à même d'évaluer au mieux l'appartenance des espèces à la faune de Suisse, nous avons procédé à un relevé exhaustif du matériel des principales collections muséales suisses. Les collections des institutions suivantes ont donc été consultées et relevées dans leur intégralité (les noms des personnes de contact sont indiqués entre parenthèses):

AGRO Agroscope-Changins (anciennement SFRA), Nyon (Stève Breitenmoser)
BNM Bündner Natur-Museum, Chur (Stephan Liersch)
ETH Eidgenössische-Technische Hochschule, Zürich (Rod Eastwood, Michael Greeff)
HGSB Musée de l'Hospice du Grand-Saint-Bernard (Chanoine Jean-Pierre Voutaz)
KMLI Archäologie und Museum Baselland, Liestal (Marc Limat)
MHNF Musée d'histoire naturelle de Fribourg (Peter Wandeler)
MHNG Muséum d'histoire naturelle de Genève (Giulio Cuccodoro)
MHNN Musée d'histoire naturelle de Neuchâtel (Jessica Litman)
MHNS Musée de la nature du Valais, Sion (Nicolas Kramar, Sonja Gerber)
MSNL Museo cantonale di storia naturale, Lugano (Lucia Pollini, Michele Abderhalden)
MZA Museum zu Allerheiligen, Schaffhausen (Urs Weibel)
MZL Musée cantonal de zoologie, Lausanne (Anne Freitag)
NMAA Naturama, Aarau (Janine Mazenauer)
NMB Naturhistorisches Museum Basel (Matthias Borer)
NMBE Naturhistorisches Museum der Burgergemeinde Bern (Hannes Baur)
NMLU Natur-Museum, Luzern (Marco Bernasconi, Peter Herger)
NMTG Naturmuseum Thurgau, Frauenfeld (Barbara Richner)
NMSG Naturmuseum, St. Gallen (Priska Seri)
NMSO Naturmuseum, Solothurn (Christoph Germann, Marc Neumann)
SPZH Schädlingsprävention und –beratung, Zürich (Marcus Schmidt, Gabi Müller, Isabelle Landau-Lüscher)

Les collections privées des personnes suivantes ont également été prises en compte: Sylvie Barbalat (Neuchâtel NE), Ulrich Bense (D-Mössingen), Mickaël Blanc (F-Sciez), Hansjörg Brägger (Bischofszell TG), Stève Breitenmoser (Givrins VD), Marie-Christine et Yannick Chittaro (Conthey VS), Vivien Cosandey (Essertines-sur-Rolle VD), Adrienne Frei (Zürich ZH), Michael Gilgen et Lea Kamber (Bangerten bei Dieterswil BE), Roman Graf (Horw LU), Jiří Háva (CZ-Prague), Andreas Herrmann (D-Stade), René Hoess (Bern BE), Barbara Huber (Thusis GR), Laurent Juillerat (Chézard-St-Martin NE), Wilfried Löderbusch (D-Markdorf), Christian Monnerat (Neuchâtel NE), Andreas Sanchez (Sion VS), Alexander Szallies (Wädenswil ZH), Arnaud Vallat (Neuchâtel NE) et Thomas Walter (Reckenholz ZH).

Tout le matériel examiné a été identifié ou revu par les auteurs ou par des spécialistes européens (voir remerciements).

L'ensemble des données disponibles dans la littérature suisse a également été compilé. Les références des publications consultées sont intégralement mentionnées dans la bibliographie. Celles qui ne sont pas citées dans le texte de cet article sont signalées par un astérisque (*).

Les ouvrages et articles suivants ont été utilisés pour l'identification des espèces: Cymorek (1969), Freude (1969), Lohse (1969,1979), Bellés (1990), Español (1992), Kalík (1992), Lohse and Lucht (1992), Laclos and Büche (2008a, 2008b, 2009a, 2009b), Allemand (2011a, 2011b), Brustel et al. (2013), Zahradník (2013), Calmont (2016), Dodelin (2016), Dodelin and Bouyon (2017), Viñolas and Recalde Irurzun (2018) et Lan-Yu and Geis (2019).

Sans indication explicite, les informations générales sur la distribution des espèces sont tirées du «Catalogue of Palaearctic Coleoptera» édité par Löbl and Smetana (2007), qui n'est alors pas cité dans les textes consacrés aux espèces. Les ouvrages utilisés pour l'identification ont également fourni de précieuses informations sur la répartition des espèces, de même que les synthèses de Callot (2018) pour l'Alsace, de Tronquet (2014) pour la France, de Brandstetter and Kapp (1998) pour le Liechtenstein et le Vorarlberg autrichien, de Köhler and Klausnitzer (1998) et de Köhler (2000, 2011) pour l'Allemagne et de Kahlen and Hellrigl (1996) pour le Sud-Tyrol italien, ainsi que les travaux de Nardi and Háva (2013) sur les Dermestidae d'Italie et de Geis (2002, 2014) sur les Bostrichidae importés en Europe centrale.

La nomenclature et systématique suivies sont celles du « Catalogue of Palaearctic Coleoptera » pour les Ptinidae (Borowski and Zahradník 2007), pour les Derodontidae (Háva 2007b), pour les Endecatomindae (Löbl 2007) et pour les Nosodendridae (Steinhammer 2007). Pour les Bostrichidae et les Dermestidae nous avons par contre suivi respectivement Borowski and Węgrzynowicz (2007) et Háva (2018). Par rapport à ces documents de référence, nous avons néanmoins considéré les exceptions suivantes:

– *Paranovelsis incognitus* Háva, 2003 est considéré comme synonyme de *Paranovelsis aequalis* (Sharp, 1902) suite au travail de Háva and Herrmann (2018), et nous avons donc opté pour ce dernier.

– nous avons suivi Ivie (2010) et avons considéré *Sinoxylon sexdentatum* (A. G. Olivier, 1790) comme nom valide à la place de *S. muricatum* (Linnaeus, 1767).
– après avoir examiné l'holotype et les paratypes d'*Ernobius besucheti* Zahradník, 2000 conservés au MHNG, nous partageons l'avis d'Allemand and Barnouin (2014) quant à la probable synonymie de ce taxon avec *E. mulsanti mulsanti* Kiesenwetter, 1877 et ne considérons donc pas *E. besucheti* dans notre liste.
– nous avons suivi la mise en synonymie d'*Episernus ganglbaueri* Schilsky, 1898 avec *E. angulicollis* C. G. Thomson, 1863 (Dodelin 2016). Les spécimens alpins identifiés comme « *ganglbaueri* » sur la base des articles antennaires très courts (Laclos and Büche 2009b, Allemand and Barnouin 2014) sont maintenant à rattacher à *Episernus taygetanus alpestris* Dodelin & Bouyon, 2017.
– nous avons tenu compte de la description de *Dermestes* (*Dermestinus*) *szekessyi kazakh* (Háva 2019) et attribuons les citations européennes de *D. szekessyi* Kalík, 1950 à la sous-espèce nominale.

Pour la classification supérieure, nous avons suivi Bouchard et al. (2011), et ce bien que certains travaux récents de phylogénie moléculaire discutent la valeur et la position taxonomiques de plusieurs sous-familles de Ptinidae (Bell and Philips 2012), de tribus de Bostrichidae notamment (Liu and Schönitzer 2011), et que la position systématique des Nosodendridae doive être revue (Zhang et al. 2018).

Pour les plantes et champignons cités dans le document, nous avons respectivement suivi les choix taxonomiques de Juillerat et al. (2017) et de la base de données nationale SwissFungi (swissfungi.wsl.ch).

Une fois l'ensemble de l'information disponible, nous avons suivi la procédure proposée par Monnerat et al. (2015a) pour statuer sur l'indigénat des espèces en Suisse. Ainsi, nous n'avons pas retenu une espèce si les données relatives ne satisfaisaient pas au minimum jugé nécessaire (étiquetage univoque, collections fiables, …).

Les espèces suivies d'une lettre et d'un chiffre en gras (« **C1** » par exemple) font l'objet d'un commentaire. C'est le cas notamment pour les espèces les plus rares (connues de moins de quinze occurrences en Suisse) pour lesquelles l'ensemble des spécimens examinés et toutes les observations publiées sont mentionnés, afin de documenter et de justifier leur prise en compte. D'autres espèces ne font l'objet que de commentaires d'ordre taxonomique ou chorologique.

Les spécimens examinés et les données issues de la littérature sont présentés par ordre chronologique de découverte ou de publication, puis par ordre alphabétique des localités en fonction des informations disponibles. Toutes les occurrences sont citées sur le schéma suivant: nombre d'exemplaires, localité pour les données anciennes ou commune et canton abrégé pour les données récentes (à partir de l'an 2000), date, collectionneur, déterminateur, collection, acronyme officiel du musée où l'insecte est déposé lorsque cela est le cas.

Pour les spécimens examinés, détaillés sous «Matériel examiné», les informations qui concernent la localité et la date sont indiquées telles qu'elles figurent sur l'étiquette. Les interprétations des abréviations alphabétiques sont mentionnées entre crochets « [ ] ». Dans les collections anciennes, le collectionneur (leg.) n'est pas toujours mentionné textuellement sur les étiquettes. Nous avons donc généralement préféré la mention « coll. » jugée plus adéquate. Dans de nombreux cas, le nom du détenteur de la collection ne figure pas sur les étiquettes. Néanmoins, en fonction de l'expérience acquise dans les relevés de collections, l'attribution de certains types d'étiquettes et/ou d'écritures à une collection particulière s'est souvent avérée possible.

La collection de Charles Maerky, déposée au Muséum d'histoire naturelle de Genève, est considérée depuis longtemps comme problématique (Monnerat et al. 2015a). Mis à part les individus provenant de sa collection (« coll. Maerky C. »), elle contient également des insectes issus d'autres collections (mentionnées alors « ex coll. Melly A. » par exemple) et pour lesquelles les étiquettes originales font défaut. De ce fait, et afin de ne pas perdre l'information quant au fait que ces insectes appartiennent à la collection de Maerky C., nous avons retenu la mention de « coll. Maerky C. » pour l'intégralité de sa collection.

Pour les données issues de la littérature, détaillées sous « Données publiées », nous avons retenu la localité telle que mentionnée dans la citation originale. La personne « source » (et non pas le legit) est considérée comme l'auteur dans la publication et mentionnée par exemple comme suit: « Ormontsthal par Venetz I. (Stierlin and Gautard 1867) ». Lorsque la même localité est citée à plusieurs reprises, seule la plus ancienne est retenue ici, les localités annoncées dans les publications ultérieures étant généralement reprises telles quelles et parfois même tronquées.

Parmi les données citées dans le document, que ce soit sous « Matériel examiné » ou sous « Données publiées », celles que nous considérons comme insuffisantes pour être retenues sont précédées d'un nombre, noté comme suit « [1)] », qui fait référence aux différentes catégories de sources d'erreurs identifiées et détaillées dans Monnerat et al. (2015a), à savoir:

1) données sources invérifiables
2) déterminations erronées
3) spécimens issus de collections problématiques
4) spécimens d'origine inconnue attribués à des localités suisses
5) double étiquetage, interprétation ou recopie erronées du nom de la localité d'origine
6) confusion entre localité d'origine, lieu d'élevage ou d'éclosion des spécimens et de dépôt de la collection
7) localités non suisses ou localités étrangères homonymes
8) incohérences chorologiques ou écologiques

Autres abréviations utilisées: coll.=collection, det.=déterminateur, ex.=exemplaire, leg.=collectionneur, s.l.= sensu lato (sens large), cantons suisses abrégés (AG=Ar-

govie, BE = Berne, BS = Bâle-Ville, BL = Bâle-Campagne, GR = Grisons, NW = Nidwald, SG = Saint-Gall, SH = Schaffhouse, SZ = Schwytz, TI = Tessin, TG = Thurgovie, VD = Vaud, VS = Valais, ZG = Zoug, ZH = Zurich).

Résultats

Liste des Bostrichoidea et Derodontoidea de Suisse

Les auteurs considèrent que les 151 espèces mentionnées en gras dans cette liste forment ou ont formé des populations en Suisse, même si pour bon nombre d'entre elles les informations disponibles sont rares et ponctuelles. Sont également considérées ici plusieurs espèces allochtones, originaires d'autres régions du monde, qui maintiennent (ou ont maintenu) des populations en continu en Suisse durant plusieurs années, y compris dans le cas d'espèces uniquement synanthropes. Ces espèces sont (ou ont été) établies en Suisse et font (ou ont fait) partie de sa faune résidente.

Les 68 taxa indiqués entre crochets « [ ] » dans la liste ne doivent par contre pas être considérés comme appartenant à la faune suisse, tout du moins jusqu'à ce que de nouvelles données viennent infirmer cette opinion. Sont associées à cette catégorie des espèces et sous-espèces dont les individus de référence émanent de collections problématiques, telles que celles de Charles Maerky ou de Max Täschler (Monnerat et al. 2015a), mentionnées de Suisse par erreur suite à des identifications erronées ou encore citées dans des publications anciennes comme celle de Stierlin and Gautard (1867) sans individus de référence et considérées comme douteuses. Certaines sont potentielles pour la Suisse mais leur indigénat reste à confirmer, les données disponibles n'étant pas suffisantes à l'heure actuelle. Sont également considérées ici des espèces allochtones assurément trouvées en Suisse mais dont l'observation résulte à chaque fois d'importations nouvelles, attestées ou probables.

Afin de faciliter leur recherche dans ce document, les taxa apparaissent dans l'ordre alphabétique des superfamilles, des familles, des sous-familles, des genres, des sous-genres, des espèces et des sous-espèces.

L'ensemble des informations collectées représente un total de 19'820 occurrences pour les familles traitées. Les cartes de répartition actualisées de toutes les espèces retenues pour la Suisse sont disponibles sur le serveur cartographique d'info fauna – CSCF (Centre suisse de cartographie de la faune) (https://lepus.unine.ch/carto/). L'ensemble des données validées a également été déposé sur GBIF.org (https://doi.org/10.15468/dl.ia9yaj).

BOSTRICHOIDEA

BOSTRICHIDAE

Bostrichinae Latreille, 1802
[*Apate monachus* Fabricius, 1775] **C1**
***Bostrichus capucinus* (Linnaeus, 1758)**
[*Bostrychoplites cornutus* (A. G. Olivier, 1790)] **C2**
[*Heterobostrychus aequalis* (Waterhouse, 1884)] **C3**
[*Heterobostrychus brunneus* (Murray, 1867)] **C4**
***Lichenophanes varius* (Illiger, 1801) C5**
***Scobicia chevrieri* (A. Villa & J.B. Villa, 1835)**
[*Scobicia pustulata* (Fabricius, 1801)] **C6**
[*Sinoxylon anale* Lesne, 1897] **C7**
***Sinoxylon perforans* (Schrank, 1789) C8**
[*Sinoxylon sexdentatum* (A. G. Olivier, 1790)] **C9**
[*Sinoxylon* sp.] **C10**
[*Sinoxylon unidentatum* (Fabricius, 1801)] **C11**
[*Xylomeira tridens* (Fabricius, 1792)] **C12**
***Xylopertha retusa* (A. G. Olivier, 1790)**
[*Xylopertha praeusta* (Germar, 1817)] **C13**

Dinoderinae Thomson, 1863
[*Dinoderus* (*Dinoderus*) *bifoveolatus* (Wollaston, 1858)] **C14**
[*Dinoderus* (*Dinoderus*) *brevis* Horn, 1878] **C15**
[*Dinoderus* (*Dinoderus*) *minutus* (Fabricius, 1775)] **C16**
[*Rhyzopertha dominica* (Fabricius, 1792)] **C17**
[*Stephanopachys linearis* (Kugelann, 1792)] **C18**
***Stephanopachys substriatus* (Paykull, 1800) C19**

Lyctinae Billberg, 1820
[*Lyctus africanus* Lesne, 1907] **C20**
***Lyctus brunneus* (Stephens, 1830)**
[*Lyctus carbonarius* Waltl, 1832] **C21**
***Lyctus cavicollis* (LeConte, 1866)**
[*Lyctus hipposideros* Lesne, 1908] **C22**
***Lyctus linearis* (Goeze, 1777)**
[*Lyctus pubescens* Panzer, 1793] **C23**
[*Lyctus sinensis* Lesne, 1911] **C24**
[*Minthea rugicollis* (Walker, 1858)] **C25**
[*Trogoxylon aequale* Wollaston, 1867] **C26**
***Trogoxylon impressum* (Comolli, 1837)**
[*Trogoxylon praeustum* (Erichson, 1847)] **C27**

Psoinae Blanchard, 1851
***Psoa dubia* (P. Rossi, 1792) C28**

DERMESTIDAE

Attageninae Laporte de Castelnau, 1840
***Attagenus* (*Attagenus*) *brunneus* Faldermann, 1835 C29**
***Attagenus* (*Attagenus*) *pellio* (Linnaeus, 1758)**
[*Attagenus* (*Attagenus*) *quadrimaculatus* Kraatz, 1858] **C30**
[*Attagenus* (*Attagenus*) *rossii* Ganglbauer, 1904] **C31**
***Attagenus* (*Attagenus*) *schaefferi schaefferi* (Herbst, 1791) C32**
***Attagenus* (*Attagenus*) *smirnovi* Zhantiev, 1973**
***Attagenus* (*Attagenus*) *trifasciatus* (Fabricius, 1787)**
[*Attagenus* (*Attagenus*) *unicolor japonicus* Reitter, 1877] **C33**
***Attagenus* (*Attagenus*) *unicolor unicolor* (Brahm, 1790)**
[*Paranovelsis aequalis* (Sharp, 1902)] **C34**
[*Paranovelsis pantherinus* (Ahrens, 1814)] **C35**
***Paranovelsis punctatus* (Scopoli, 1772)**

Dermestinae Latreille, 1804
[*Dermestes* (*Dermestes*) *ater* DeGeer, 1774] **C36**
***Dermestes* (*Dermestes*) *bicolor bicolor* Fabricius, 1781**
***Dermestes* (*Dermestes*) *haemorrhoidalis* Küster, 1852**

***Dermestes* (*Dermestes*) *lardarius* Linnaeus, 1758**
[*Dermestes* (*Dermestes*) *peruvianus* Laporte, 1840] **C37**
***Dermestes* (*Dermestinus*) *aurichalceus* Küster, 1846 C38**
[*Dermestes* (*Dermestinus*) *carnivorus* Fabricius, 1775] **C39**
[*Dermestes* (*Dermestinus*) *erichsoni* Ganglbauer, 1904] **C40**
***Dermestes* (*Dermestinus*) *frischii* Kugelann, 1792**
***Dermestes* (*Dermestinus*) *gyllenhalii gyllenhalii* Laporte, 1840 C41**
***Dermestes* (*Dermestinus*) *laniarius laniarius* Illiger, 1802**
***Dermestes* (*Dermestinus*) *maculatus* DeGeer, 1774**
***Dermestes* (*Dermestinus*) *murinus murinus* Linnaeus, 1758**
***Dermestes* (*Dermestinus*) *mustelinus* Erichson, 1846 C42**
***Dermestes* (*Dermestinus*) *szekessyi szekessyi* Kalík, 1950 C43**
***Dermestes* (*Dermestinus*) *undulatus* Brahm, 1790**
***Dermestes* (*Montandonia*) *olivieri* Lepesme, 1839 C44**

Megatominae Leach, 1815
***Anthrenocerus australis* (Hope, 1843) C45**
***Anthrenus* (*Anthrenus*) *angustefasciatus* Ganglbauer, 1904 C46**
[*Anthrenus* (*Anthrenus*) *flavipes flavipes* LeConte, 1854] **C47**
[*Anthrenus* (*Anthrenus*) *festivus* Erichson, 1846] **C48**
***Anthrenus* (*Anthrenus*) *goliath* Saulcy, 1868 C49**
***Anthrenus* (*Anthrenus*) *pimpinellae pimpinellae* Fabricius, 1775**
***Anthrenus* (*Anthrenus*) *scrophulariae scrophulariae* (Linnaeus, 1758)**
[*Anthrenus* (*Florilinus*) *flavidus* Solsky, 1876] **C50**
***Anthrenus* (*Florilinus*) *museorum* (Linnaeus, 1761)**
***Anthrenus* (*Helocerus*) *fuscus* Olivier, 1789**
[*Anthrenus* (*Nathrenus*) *molitor* Aubé, 1850] **C51**
***Anthrenus* (*Nathrenus*) *verbasci* (Linnaeus, 1767)**
***Ctesias* (*Ctesias*) *serra* (Fabricius, 1792)**
[*Globicornis* (*Globicornis*) *fasciata* (Fairmaire & Brisout de Barneville, 1859)] **C52**
***Globicornis* (*Globicornis*) *luckowi* Herrmann, Háva & Kadej, 2011 C53**
***Globicornis* (*Globicornis*) *nigripes* (Fabricius, 1792)**
[*Globicornis* (*Globicornis*) *tristis* (Reitter, 1881)] **C54**
***Globicornis* (*Hadrotoma*) *corticalis* (Eichhoff, 1863)**
***Globicornis* (*Hadrotoma*) *emarginata* (Gyllenhal, 1808) C55**
***Globicornis* (*Hadrotoma*) *sulcata* (Brisout de Barneville, 1866) C56**
***Megatoma* (*Megatoma*) *undata* (Linnaeus, 1758)**
[*Phradonoma villosulum* (Duftschmid, 1825)] **C57**
***Reesa vespulae* (Milliron, 1939)**
***Trogoderma angustum* (Solier, 1849)**
***Trogoderma glabrum* (Herbst, 1783)**
[*Trogoderma granarium* Everts, 189] **C58**
[*Trogoderma inclusum* LeConte, 1854] **C59**
***Trogoderma versicolor* (Creutzer, 1799) C60**

Orphilinae LeConte, 1861
***Orphilus niger* (P. Rossi, 1790)**

Thoractinae Agassiz, 1846
[*Thorictus grandicollis* s.l. Germar, 1842] **C61**

Trinodinae Casey, 1900
***Trinodes hirtus* (Fabricius, 1781)**

ENDECATOMIDAE

[*Endecatomus reticulatus* (Herbst, 1793)] **C62**

PTINIDAE

Anobiinae Fleming, 1821
***Anobium hederae* Ihssen, 1949**
***Anobium inexspectatum* Lohse, 1954**
***Anobium punctatum* (DeGeer, 1774)**
***Cacotemnus rufipes* (Fabricius, 1792)**
***Cacotemnus thomsoni* (Kraatz, 1881) C63**
***Gastrallus immarginatus* (P. W. J. Müller, 1821)**
***Gastrallus laevigatus* (A. G. Olivier, 1790)**
***Hadrobregmus denticollis* (Creutzer, 1796)**
***Hadrobregmus pertinax* (Linnaeus, 1758)**
***Hemicoelus canaliculatus* C. G. Thomson, 1863**
***Hemicoelus costatus* (Aragona, 1830)**
***Hemicoelus fulvicornis* Sturm, 1837**
[*Hemicoelus rufipennis* (Duftschmid, 1825)] **C64**
***Microbregma emarginatum* (Duftschmid, 1825)**
***Nicobium castaneum* (A. G. Olivier, 1790) C65**
***Oligomerus brunneus* (A. G. Olivier, 1790)**
***Oligomerus ptilinoides* (Wollaston, 1854)**
***Priobium carpini* (Herbst, 1793) C66**
***Stegobium paniceum* (Linnaeus, 1758)**

Dorcatominae Thomson, 1859
***Anitys rubens* (J. J. Hoffmann, 1803) C67**
***Caenocara affine* (Sturm, 1837) C68**
***Caenocara bovistae* (J. J. Hoffmann, 1803)**
***Caenocara subglobosum* (Mulsant, & Rey, 1864) C69**
***Dorcatoma* (*Dorcatoma*) *dresdensis* Herbst, 1792**
***Dorcatoma* (*Dorcatoma*) *lomnickii* Reitter, 1903 C70**
***Dorcatoma* (*Dorcatoma*) *punctulata* Mulsant & Rey, 1864**
***Dorcatoma* (*Psilodorcatoma*) *androgyna* Büche, 2001 C71**
***Dorcatoma* (*Psilodorcatoma*) *chrysomelina* Sturm, 1837**
***Dorcatoma* (*Psilodorcatoma*) *minor* Zahradník, 1993 C72**
***Dorcatoma* (*Psilodorcatoma*) *setosella setosella* Mulsant & Rey, 1864**
***Dorcatoma* (*Psilodorcatoma*) *substriata* Hummel, 1829**
***Dorcatoma* (*Sternitodorcatoma*) *flavicornis* (Fabricius, 1792)**
***Stagetus borealis* Israelson, 1971 C73**
***Stagetus pilula* (Aubé, 1861) C74**

Dryophilinae Gistel, 1848
***Dryophilus anobioides* Chevrolat, 1832 C75**
[*Dryophilus longicollis* (Mulsant & Rey, 1853)] **C76**
***Dryophilus pusillus* (Gyllenhal, 1808)**
***Grynobius planus* (Fabricius, 1787)**
***Homophthalmus rugicollis* (Mulsant & Rey, 1853) C77**

Ernobiinae Pic, 1912
***Episernus angulicollis* C. G. Thomson, 1863 C78**

***Episernus gentilis* (Rosenhauer, 1847)**
***Episernus granulatus* J. Weise, 1887**
***Episernus striatellus* (C. N. F. Brisout de Barneville, 1863)**
***Episernus taygetanus alpestris* Dodelin & Bouyon, 2017 C79**
***Ernobius abietinus* (Gyllenhal, 1808)**
***Ernobius abietis* (Fabricius, 1792)**
***Ernobius angusticollis* (Ratzeburg, 1837)**
***Ernobius explanatus phobos* (Gottwald, 1971) C80**
***Ernobius freudei* Lohse, 1970 C81**
[*Ernobius gigas* (Mulsant & Rey, 1863)] **C82**
***Ernobius kiesenwetteri* Schilsky, 1898**
***Ernobius laticollis* Pic, 1927 C83**
***Ernobius longicornis* (Sturm, 1837) C84**
***Ernobius mollis mollis* (Linnaeus, 1758)**
***Ernobius mulsanti mulsanti* Kiesenwetter, 1877 C85**
***Ernobius nigrinus* (Sturm, 1837)**
***Ernobius parens* (Mulsant & Rey, 1863) C86**
***Ernobius pini pini* (Sturm, 1837)**
***Hyperisus declive* (Dufour, 1843)**
***Hyperisus plumbeum* (Illiger, 1801)**
***Ochina latreillii* (Bonelli, 1812) C87**
***Ochina ptinoides* (Marsham, 1802)**
[*Ozognathus cornutus* (LeConte, 1859)] **C88**
***Xestobium austriacum* Reitter, 1890 C89**
***Xestobium rufovillosum* (DeGeer, 1774)**

Eucradinae LeConte, 1861
[*Hedobia pubescens* (A. G. Olivier, 1790)] **C90**
***Ptinomorphus imperialis* (Linnaeus, 1767)**
***Ptinomorphus regalis* (Duftschmid, 1825)**

Mesocoelopodinae Mulsant & Rey, 1864
***Mesocoelopus niger* (P. W. J. Müller, 1821)**

Ptilininae Shuckard, 1840
***Ptilinus fuscus* (Geoffroy, 1785)**
***Ptilinus pectinicornis* (Linnaeus, 1758)**

Ptininae Latreille, 1802
***Dignomus irroratus* Küster, 1852 C91**
***Epauloecus unicolor* (Piller & Mitterpacher, 1783)**
[*Eurostodes quisquiliarum* (Baudi di Selve, 1874)] **C92**
***Gibbium psylloides* (Czenpinski, 1778)**
[*Mezium affine* Boieldieu, 1856] **C93**
***Niptus hololeucus* (Faldermann, 1835)**
[*Pseudeurostus anemophilus* Chobaut, 1901] **C94**
***Pseudeurostus frigidus* (Boieldieu, 1854)**
[*Ptinus* (*Bruchoptinus*) *italicus* Aragona, 1830] **C95**
[*Ptinus* (*Bruchoptinus*) *palliatus* Perris, 1847] **C96**
***Ptinus* (*Bruchoptinus*) *rufipes* A. G. Olivier, 1790**
***Ptinus* (*Cyphoderes*) *bidens* A. G. Olivier, 1790**
***Ptinus* (*Cyphoderes*) *catalonicus* Bellés, 2002 C97**
***Ptinus* (*Cyphoderes*) *raptor* Sturm, 1837**
[*Ptinus* (*Cyphoderes*) *schlerethi* (Reitter, 1884)] **C98**
***Ptinus* (*Gynopterus*) *aubei* Boieldieu, 1854 C99**
***Ptinus* (*Gynopterus*) *dubius* Sturm, 1837**
***Ptinus* (*Gynopterus*) *sexpunctatus* Panzer, 1789**
***Ptinus* (*Gynopterus*) *variegatus* P. Rossi, 1792 C100**
[*Ptinus* (*Pseudoptinus*) *auberti* Abeille de Perrin, 1869] **C101**
***Ptinus* (*Pseudoptinus*) *capellae* Reitter, 1880 C102**
***Ptinus* (*Pseudoptinus*) *coarticollis* Sturm, 1837 C103**
***Ptinus* (*Pseudoptinus*) *lichenum* Marsham, 1802**
***Ptinus* (*Ptinus*) *bicinctus* Sturm, 1837 C104**
***Ptinus* (*Ptinus*) *calcaratus* Kiesenwetter, 1877 C105**
***Ptinus* (*Ptinus*) *fur* (Linnaeus, 1758)**
***Ptinus* (*Ptinus*) *latro* Fabricius, 1775**
[*Ptinus* (*Ptinus*) *perplexus* Mulsant & Rey, 1854] **C106**
[*Ptinus* (*Ptinus*) *pilosus* P. W. J. Müller, 1821] **C107**
[*Ptinus* (*Ptinus*) *podolicus* Iablokoff-Khnzorian & Karapetyan, 1991] **C108**
***Ptinus* (*Ptinus*) *pusillus* Sturm, 1837 C109**
[*Ptinus* (*Ptinus*) *spitzyi* A. Villa & G. B. Villa, 1838] **C110**
***Ptinus* (*Ptinus*) *subpilosus* Sturm, 1837**
[*Ptinus* (*Ptinus*) *villiger* (Reitter, 1884)] **C111**
[*Ptinus* (*Tectoptinus*) *tectus* Boieldieu, 1856] **C112**
[*Sphaericus* (*Sphaericus*) *pinguis* (Wollaston, 1854)] **C113**
[*Trigonogenius globosus* (Solier, 1849)] **C114**

Xyletininae Gistel, 1856
[*Lasioderma haemorrhoidale* (Illiger, 1807)] **C115**
[*Lasioderma laeve* (Illiger, 1807)] **C116**
***Lasioderma redtenbacheri redtenbacheri* (Bach, 1852)**
***Lasioderma serricorne* (Fabricius, 1792)**
[*Metholcus phoenicis* (Fairmaire, 1859)] **C117**
***Xyletinus* (*Xyletinus*) *ater* (Creutzer, 1796)**
***Xyletinus* (*Xyletinus*) *fibyensis* Lundblad, 1949 C118**
***Xyletinus* (*Xyletinus*) *laticollis* (Duftschmid, 1825)**
***Xyletinus* (*Xyletinus*) *longitarsis longitarsis* Jansson, 1942 C119**
[*Xyletinus* (*Xyletinus*) *pectinatus pectinatus* (Fabricius, 1792)] **C120**
***Xyletinus* (*Xyletinus*) *planicollis* Lohse, 1957 C121**
***Xyletinus* (*Xyletinus*) *vaederoeensis* Lundberg, 1969 C122**

DERODONTOIDEA

DERODONTIDAE

Derodontinae LeConte, 1861
***Derodontus macularis* (Fuss, 1850) C123**

Laricobiinae Mulsant & Rey, 1864
***Laricobius erichsonii* Rosenhauer, 1846**

NOSODENDRIDAE

***Nosodendron* (*Nosodendron*) *fasciculare* (Olivier, 1790)**

Commentaire sur quelques espèces

C1) [*Apate monachus*]

Données publiées. [1,6,8]Basel, 1956, Probe von südamerikanischem (Kuba) Zigarren (Wyniger 1957).

Commentaire. Originaire d'Afrique de l'ouest, cette espèce est maintenant largement répandue dans les ré-

gions afrotropicale, néotropicale et dans le sud-ouest de la région paléarctique (Geis 2002). Elle a été importée plusieurs fois en Europe centrale, dont une fois en Suisse avec des cigares cubains. *A. monachus* ne fait pas partie de la faune suisse.

C2) [*Bostrychoplites cornutus*]

Matériel examiné. [4,6,8)]1 ex., Genève, ds. caisse, 4.1994, leg. & det. Besuchet C., MHNG.

Commentaire. Cette espèce afrotropicale (Geis 2002) a été occasionellement importée en Europe, dont une fois en Suisse avec une caisse de provenance inconnue. L'espèce n'appartient pas à la faune suisse.

C3) [*Heterobostrychus aequalis*]

Matériel examiné. [4,6,8)]1 ex., Genève ou St. Gall ? [sic], éclos d'une planche, leg. Niquille, MHNG.

Données publiées. [4,6,8)]Schweiz, 2013, Verpackungsholzkontrollen im Inland und an der Grenze (Meier et al. 2014).

Commentaire. Un individu de cette espèce est conservé au MHNG. S'il a bien éclos en Suisse, l'étiquette n'apporte aucune information quant à son lieu de découverte, les deux localités mentionnées étant distantes de près de 350 km (!). L'espèce étant originellement présente en Inde, en Asie du sud-est, à Madagscar et aux Comores (Geis 2002), cette donnée suisse résulte assurément d'une importation de bois comme cela a également été le cas des spécimens découverts en 2013 lors de contrôles de bois d'emballages.

C4) [*Heterobostrychus brunneus*]

Matériel examiné. [4,6,8)]1 ex., Zürich ZH, aus Trommel aus Afrika, 22.10.2003, leg. & coll. Anonymous, SPZH.

Commentaire. Originaire de la région afrotropicale (Geis 2002), cette espèce a été trouvée une fois en Suisse «dans un tambour importé d'Afrique». Elle ne fait pas partie de la faune indigène.

C5) *Lichenophanes varius*

Matériel examiné. [3)]1 ex., Kt. Basel, coll. Linder A., ex coll. Täschler M., ETH; [3)]1 ex., Bâle, 4.6.1910, coll. Gaud A., MZL; 1 ex., Tessin, Mezzana, 7.-13.9.1965, leg. SFRA, MHNG; 2 ex., Arlesheim BL, 6.-7.2012, leg. Bense U., MHNN; 1 ex., Iffwil BE, 10.6.2012, leg. & coll. Gilgen M. & Kamber L.

Données publiées. [1)]Basel par Heer O. (Stierlin and Gautard 1867); [1)]2 ex., Chiasso, ai prati del Penz [Bosco Penz], 17.6.1914 par Fontana P. (Fontana 1925; donnée reprise ensuite sous Chiasso, 18.4.1914 dans Fontana (1947)).

Commentaire. Cette espèce saproxylique rare est connue d'à peine trois données valides en Suisse. Elle colonise localement les forêts matures (chênaies et hétraies principalement) d'Europe, d'Afrique du Nord et d'Asie. Les spécimens d'Arlesheim ont éclos d'un morceau de bois provenant de la cime d'un hêtre (*Fagus sylvatica*) alors que celui d'Iffwil a été trouvé dans des copeaux de bois provenant d'un tronc de hêtre.

C6) [*Scobicia pustulata*]

Données publiées. [1)]Genf par Chevrier F. et [1)]Genf par Tournier H. (Stierlin and Gautard 1867); [1)]1 ex., Chiasso, Tannino, 1.7.1930 par Fontana P. (Fontana 1947).

Commentaire. Bien qu'annoncée dans d'anciennes références bibliographiques suisses, nous n'avons toutefois pas connaissance de spécimens se référant à cette espèce. Tous les individus du genre *Scobicia* que nous avons examinés, avec l'aide également de J. Borowski, se rapportaient en réalité à l'espèce voisine *S. chevrieri*. *S. pustulata*, présente en France seulement dans la région méditerranéene et en Corse (Brustel 2014), n'est pas retenue pour la Suisse.

C7) [*Sinoxylon anale*]

Matériel examiné. [4,6,8)]1 ex., Embrach ZH, Embraport, 25.6.2002, leg. & coll. Anonymous, SPZH; [6,8)]1 ex., Fehraltorf ZH, Holzpallete aus Indien, 12.7.2007, leg. & coll. Anonymous, SPZH; [6,7,8)]2 ex., Basel BS, Zoll, eingeschleppt mit Waren aus Indien, 8.2010, leg. Anonymous, det. Borowski J., coll. Geiser M., NMBE & NMB; [4,6,8)]1 ex., Ossingen ZH, 2.5.2013, leg. & coll. Anonymous, SPZH.

Données publiées. [1,4,6,8)]Schweiz, 2016, Verpackungsholzkontrollen im Inland (Meier et al. 2017).

Commentaire. Cette espèce originaire des régions orientale (Inde et Asie du sud-est) et d'Australie a été importée dans plusieurs pays d'Europe (Geis 2002), dont quelques fois en Suisse. Elle ne s'y est pas établie.

C8) *Sinoxylon perforans*

Matériel examiné. [3)]3 ex., Aigle, 16.7., coll. Maerky C., MHNG; 1 ex., Misox, coll. Zschookke A., NMAA; [3)]3 ex., Lavey, 14.5.1905, coll. Gaud A., MZL; 1 ex., Biasca, s/ vigne, 25.5.1935, leg. & coll. Poluzzi C., MHNG; 6 ex., Tessin, Biasca, 25.5.1935, Leg. [Poluzzi C.], AGRO & MZL; 1 ex., Tessin, 4.1945, coll. Günthart E., ETH; 1 ex., Tessin, 10.4.1945, leg. Anonymous, coll. Martin H., MZL; 4 ex., Kt. Tessin, Bellinzona, 7.1950, leg. [Besuchet C.], coll. Linder A., ETH; 30 ex., Tessin, Bellinzone, ds. sarment de vigne, 23.7.1950, leg. Besuchet C., MHNG & MZL; 1 ex., Mezzana TI, 19.7.1963, coll. Bovey P., ETH; 8 ex., Biasca TI, 21.7.1963, leg. Poluzzi C., ETH & MHNG; 1 ex., Someo TI, 18.4.2018, leg. & coll. Brägger H.

Données publiées. [1)]St-Maurice par Forel A. (Favre 1890); [1)]Misox, 1882 (Caflisch 1894).

Commentaire. Cette espèce méridionale se développant principalement dans la vigne (*Vitis vinifera*) a été mentionnée pour la première fois en Suisse en 1882: «l'espèce nuisible a envahi des vignes du Misox dans les années 1882–1884, et n'a plus été observée depuis » (Caflisch 1894). Quelques observations ont encore été

reportées occasionellement dans des vignes au Tessin jusqu'en 1963, où elle semble y avoir maintenu des populations, puis à nouveau en 2018.

C9) [*Sinoxylon sexdentatum*]

Matériel examiné. [3)]3 ex., Bernex, coll. Maerky C., MHNG; [3)]2 ex., Misox, coll. Killas E., BNM; [3)]1 ex., Genève, Bernex, 5.6., coll. Maerky C., MHNG; [3)]1 ex., Alpes, Plans s/Bex, 23.7., coll. Maerky C., MHNG; [6,8)]1 ex., Genève (centre), appt. [appartement], 12.1989, leg. Vit S., MHNG; [8)]2 ex., Tessin, S. Pietro, Mte Albano, 5.1992, leg. SFRA, MHNG.

Données publiées. [1)]Lavey im Kant. Waadt par Forel et [1)]Locarno par Isenschmid M. (Stierlin 1883).

Commentaire. Cette espèce, qui colonise notamment l'Europe méridionale, n'a été trouvée qu'une seule fois en nature en Suisse, dans l'extrême sud du Tessin (au moyen d'un piège lumineux selon les indications complémentaires figurant sur les étiquettes de provenance). La plupart des autres spécimens examinés proviennent de collections problématiques, alors qu'un individu a été trouvé dans un appartement à Genève suite à une probable importation. Cette espèce, connue pour causer des dégâts à la vigne, semble n'avoir jamais formé de populations continues sur notre territoire, au contraire de l'espèce voisine *S. perforans* (voir C8). Restée sans suite, la donnée du Tessin résulte donc vraisemblablement d'une importation unique.

C10) [*Sinoxylon* sp.]

Matériel examiné. [4,6,8)]2 ex., Genève, caisses d'expédition, leg. Besuchet C., det. Borowski J., MHNG.

Commentaire. Les spécimens trouvés à Genève sont très abîmés (antennes absentes) si bien qu'une identification spécifique ne s'avère pas possible. J. Borowski (comm. pers.) indique néanmoins qu'il pourrait s'agir de *S. tignarium* Lesne, 1902, *S. sudanicum* Lesne, 1895 ou *S. unidentatum* (Fabricius, 1801), autant d'espèces allochtones en Europe. Quoi qu'il en soit, l'indication «caisses d'expédition» ne laisse planer aucun doute quant au fait que ces spécimens ont été importés en Suisse.

C11) [*Sinoxylon unidentatum*]

Données publiées. [4,6,8)]Schweiz, 2013, Verpackungsholzkontrollen im Inland und an der Grenze (Meier et al. 2014);[1,4,6,8)]Schweiz, 2016, Verpackungsholzkontrollen im Inland und an der Grenze (Meier et al. 2017).

Commentaire. Répandue en Asie du sud-est (Geis 2014), cette espèce a été importée à plusieurs reprises en Europe et notamment en Suisse en 2013 et 2016 où elle a été découverte lors de contrôles de bois d'emballages. L'espèce n'est pas établie en Suisse.

C12) [*Xylomeira tridens*]

Matériel examiné. [4,6,8)]1 ex., Genève, Chêne-Bougeries, rose trémière, 9.1991, leg. & det. Besuchet C., MHNG.

Données publiées. [4,6,8)]Genève (Besuchet et al. 2012).

Commentaire. Cette espèce néotropicale a été trouvée une fois à Genève à la suite d'une importation isolée («d'une rose trémière [*Alcea rosea*]») comme l'indiquaient déjà Besuchet et al. (2012). L'espèce ne s'est pas établie en Suisse.

C13) [*Xylopertha praeusta*]

Matériel examiné. [3,4,6,8)]1 ex., Genève, leg. & coll. Anonymous, MHNG.

Commentaire. Cette espèce est présente au Portugal, en Espagne, en Italie, en Croatie, en Afrique du Nord et en France. Dans ce dernier pays, elle se limite uniquement à la région méditerranéene et à la Corse (Brustel 2014), ce qui ne soutient guère une présence dans la région genevoise. En outre, l'unique spécimen «suisse» examiné porte une étiquette très lacunaire (sans informations de date, de collecteur,…). L'espèce n'est donc pas retenue pour la Suisse.

C14) [*Dinoderus* (*Dinoderus*) *bifoveolatus*]

Matériel examiné. [4,6,8)]6 ex., Zürich, 14.11.1941, leg. Allenspach V., coll. Allenspach V. & Linder A., ETH, NMB & MHNG; [4,6,8)]2 ex., Kt. Solothurn, Solothurn, 6.1955, leg. & coll. Linder A., ETH; [4,6,8)] 8 ex., Soleure, 15.6.1955, leg. & coll. Scherler P., NMBE.

Données publiées. [4,6,8)]6 ex., Zürich (in Gerstenvorrätten – Hühnerfutter), 11.1941 par Allenspach V. (Linder 1946).

Commentaire. Cette espèce pantropicale, maintenant cosmopolite, a été importée deux fois en Suisse, en 1941 et en 1955. Ces importations isolées (notamment dans de l' «orge stocké – aliment pour les poules» en 1941) sont restées sans suites et l'espèce ne s'est pas établie en Suisse.

C15) [*Dinoderus* (*Dinoderus*) *brevis*]

Matériel examiné. [6,8)]1 ex., Zürich (Im Holzinstrument aus Madagascar), 7.1993, leg. Gerloff C., ETH; [6,8)]2 ex., Zollikon (ex Bambus aus Thailand), 15.10.1993, leg. Anonymous, ETH.

Commentaire. Cette espèce originaire de la région indomalaise (Geis 2002) a été importée dans plusieurs pays d'Europe. Elle a été signalée deux fois en Suisse en 1993, dans du bois provenant respectivement de Madagascar et de Thaïlande, mais ne s'y est pas établie.

C16) [*Dinoderus* (*Dinoderus*) *minutus*]

Matériel examiné. [4,6,8)]1 ex., Wila ZH, 21.7.2011, leg. & coll. Anonymous, det. Schmidt M., SPZH; [4,6,8)]2 ex., Thun BE, 18.5.2017, leg. Marggi W., det. Germann C., NMSO.

Données publiées. [4,6,8)]2 ex., Thun (Mikado-Stäbchen), 18.5.2017 et [4,6,8)]1 ex., Thun, 7.6.2017, par Marggi W. (Marggi and Germann 2018).

Commentaire. Les spécimens découverts en Suisse en 2017 ont éclos de baguettes de «Mikado» en bambou de

provenance inconnue. Quant au spécimen découvert en 2011, il est très probablement aussi issu d'une importation. Cette espèce cosmopolite, originaire d'Asie du sud-est et importée isolément dans de nombreux pays d'Europe, n'est pas capable de s'établir en Suisse (Marggi and Germann 2018).

C17) [*Rhyzopertha dominica*]

Matériel examiné. [4,6,8)]2 ex., Kt. Bern, Thun, 5.1934, leg. & coll. Linder A., ETH; [4,6,8)]4 ex., Zürich, 14.11.1941, leg. & coll. Allenspach V., NMB; [4,6,8)]4 ex., Morges, dans dépôts d'orge, 1942, leg. & coll. Anonymous, MHNG; [4,6,8)]7 ex., Vaud, Renens, silo, 8.1942, leg. Bovey P., MHNG; [4,6,8)]4 ex., Zürich, 11.1942, leg. & coll. Allenspach V., NMB & MHNG; [4,6,8)]2 ex., Kt. Bern, Thun, 4.1943, leg. & coll. Linder A., ETH; [6,8)]3 ex., Vaud, Lausanne, 13.3.1958, dans orge provenant de Syrie, leg. Besuchet C., MHNG; [4,6,8)]12 ex., Dielsdorf, 5.1975, leg. & coll. Allenspach V., NMB; [4,6,8)]2 ex., Dielsdorf, Zuchtmaterial der Firma Maag, 6.1982, leg. & coll. Anonymous, AGRO; [4,6,8)]1 ex., Embrach ZH, 22.9.1995, leg. & coll. Anonymous, SPZH; [4,6,8)]1 ex., Sulgen TG, 19.10.2001, leg. & coll. Anonymous, SPZH; [4,6,8)]1 ex., Regensdorf ZH, 8.11.2005, leg. & coll. Anonymous, SPZH; [4,6,8)]1 ex., Küsnacht ZH, 12.11.2008, leg. & coll. Anonymous, SPZH; [4,6,8)]1 ex., Remetschwil AG, 27.2.2012, leg. & coll. Anonymous, SPZH; [4,6,8)]2 ex., Domat/Ems, GR, 1.6.2017, leg. Lämmli N., coll. Chittaro Y.

Données publiées. [4,6,8)]2 ex., Thun (aus eine Mühle erhalten), 1934 et [4,6,8)]2 ex., Thun, 4.1943 par Linder A. (Linder 1946).

Commentaire. Les spécimens «suisses» examinés de cette espèce pantropicale, maintenant cosmopolite, proviennent vraisemblement tous d'importations isolées avec des denrées alimentaires. Il ne semble pas y avoir eu de populations continues sur de longues périodes en Suisse, si bien qu'elle n'est pas considérée comme établie, contrairement à l'avis de Besuchet C. (comm. pers., in Wittenberg et al. 2006).

C18) [*Stephanopachys linearis*]

Données publiées. [1)][Suisse] par H. (Bremi-Wolf 1856); [1)]Matt par Heer O. (Stierlin and Gautard 1867).

Commentaire. Bien que citée dans la littérature ancienne, aucun exemplaire se rapportant à cette espèce n'existe dans les collections consultées. L'espèce n'est donc pas retenue pour la Suisse bien qu'elle y soit potentielle, étant connue notamment de France (Hautes-Alpes, Corse et Pyrénées-Orientales selon Brustel et al. 2013), d'Allemagne, d'Italie et d'Autriche.

C19) *Stephanopachys substriatus*

Matériel examiné. 1 ex., Chandolin, coll. Favre E., HGSB; 1 ex., Chur, coll. Killias E., MHNG; 1 ex., Sion, coll. Favre E., HGSB; [3)]1 ex., Sitten [Sion], coll. Linder A., ex coll. Täschler M., ETH; 1 ex., Valais, leg. & coll. Anonymous, MZL; 1 ex., Binn, 16.7., coll. Favre E., HGSB; 5 ex., Vevey, 23.5.1945, leg. & coll. Günthart E., ETH; 3 ex., Vevey, dans une tannerie, 6.1945, leg. de Beaumont J., MHNG; 8 ex., Vevey, Tannerie, 6.1945, leg. & coll. Anonymous, MZL; 2 ex., Zermatt VS, 21.8.2014, leg. & coll. Sanchez A.

Données publiées. [1)]Sitten par Gautard V. (Stierlin and Gautard 1867); Chur par Killias E. (Stierlin 1883); Sion et Chandolin par Favre E. (Favre 1890); 2 ex., Zermatt VS, 21.8.2014, par Sanchez A. (Chittaro and Sanchez 2017).

Commentaire. Largement répandue à l'échelle paléarctique, cette espèce n'est connue en Suisse que de quelques localités des Alpes. Les spécimens de Vevey, récoltés dans une tannerie en plaine, ont probalement éclos de bois provenant des Préalpes vaudoises. *S. substriatus* semble se développer préférerentiellement dans le mélèze (*Larix decidua*) selon Brustel et al. (2013).

C20) [*Lyctus africanus*]

Matériel examiné. [4,6,8)]21 ex., Genève, appartement, 29.3.1968, leg. Besuchet C., MHNG; [4,6,8)]1 ex., Genève, Meyrin, appartement, 28.6.1974, leg. Besuchet C., MHNG; [4,6,8)]3 ex., Genève, Grange-Canal, appartement, 1.2.1984 et 9.2.1984, leg. Besuchet C., MHNG; [4,6,8)]1 ex., Genève, Chêne-Bourg, droguerie, 30.6.1986 et 9.3.1987, leg. Standhammer M., MHNG; [4,6,8)]1 ex., Weinfelden, 10.8.1997, leg. Sameli K., det. Blöchlinger H., NMTG; [4,6,8)]1 ex., Landschlacht, 10.3.1999, leg. Hagmann, det. Blöchlinger H., NMTG; [4,6,8)]1 ex., Zürich ZH, 13.10.2003, leg. & coll. Anonymous, det. Landau-Lüscher I., SPZH; [4,6,8)]1 ex., Zürich ZH, 22.6.2006, leg. & coll. Anonymous, det. Schmidt M., SPZH; [4,6,8)]1 ex., Maur ZH, 17.7.2008, leg. & coll. Anonymous, SPZH; [4,6,8)]1 ex., Zürich ZH, 14.7.2010, leg. & coll. Anonymous, SPZH; [6,8)]1 ex., Basel BS, Zoll, eingeschleppt mit Waren aus Indien, 8.2010, leg. Anonymous, det. Borowski J., coll. Geiser M., NMBE; [4,6,8)]1 ex., Opfikon ZH, 31.1.2012, leg. & coll. Anonymous, SPZH; [4,6,8)]1 ex., Zürich ZH, 22.8.2012, leg. & coll. Anonymous, det. Schmidt M., SPZH; [4,6,8)]1 ex., Kirchberg SG, 18.7.2014, leg. & coll. Anonymous, det. Schmidt M., SPZH; [4,6,8)]1 ex., Zürich ZH, 17.8.2018, leg. & coll. Anonymous, det. Schmidt M., SPZH;

Données publiées. [1)]Schweiz, 1975 et 1980 (Graf 1981).

Commentaire. Cette espèce, vraisemblablement originaire de la région afrotropicale (Geis 2002), a été importée plusieurs fois en Europe et notamment en Suisse. Il semble s'agir à chaque fois de nouvelles importations et l'espèce n'a pas l'air de s'y être (encore) établie.

C21) [*Lyctus carbonarius*]

Données publiées. [1,4,6,8)]SZ [Suisse] (Borowski 2007).

Commentaire. Originaire des Etats-Unis et du Mexique (Geis 2002), cette espèce a été importée plusieurs fois en Europe. Citée de Suisse également (Borowski 2007), nous n'avons cependant pas connaissance de données ou de spécimens venant soutenir cette citation.

C22) [*Lyctus hipposideros*]

Données publiées. [1)]Schweiz, 1981, det. Cymorek S. (Graf 1981).

Commentaire. Cette espèce afrotropicale (Geis 2002) a été importée à plusieurs reprises en Europe: en Finlande, en Italie et en Suisse. Bien que nous n'ayons pas connaissance de donnée précise relative à son annonce en Suisse, *L. hipposideros* figure dans la liste des Lyctidae de Suisse (Graf 1981) sur la base de spécimens (hélas non retrouvés) identifiés par S. Cymorek. Dans tous les cas, l'espèce n'a plus été signalée dans notre pays depuis 1981 et son importation isolée ne fait pas l'ombre d'un doute.

C23) [*Lyctus pubescens*]

Données publiées. [1)]Dübendorf par Bremi-Wolf J.J., [1)] Mettmenstätten par Stutz J.J. et [1)]Zürich par Heer O. (Dietrich 1865); [1)]Basel par Imhof L. et [1)]Genf par Tournier H. (Stierlin and Gautard 1867); [1)]Balgach par Kubli H. et [1)]Val Entremont par Joris C. (Stierlin 1883); [1)]Orsières par Favre E. (Favre 1890); [1)]Aigle par Jaccard H. (Jaccard 1890); [1)]Schaffhausen (Stierlin 1900); [2)]Bisbino,[2)]Tannino et [2)]Chiasso par Fontana P. (Fontana 1947).

Commentaire. S'il existe bien de nombreuses annonces dans la littérature suisse, nous n'avons toutefois pas retrouvé de spécimens relatifs à cette espèce dans les collections consultées. Tous les individus examinés figurant sous *L. pubescens* étaient en réalité des *L. linearis*. Bien que cité de nombreux pays européens et assez répandu en France (Brustel 2014), *L. pubescens* n'est pas retenu pour la Suisse.

C24) [*Lyctus sinensis*]

Données publiées. [6,8)]Plusieurs larves, Kanton Thurgau, 2011, dans palettes provenant de Chine (Meier et al. 2012).

Commentaire. Des larves de L. sinensis (identifiées par des méthodes génétiques, Doris Hölling comm. pers.) ont été découvertes en Suisse en 2011 dans des palettes en bois provenant de Chine. Originaire de la région est-paléarctique (Chine, Japon) et introduit en Australie (Geis 2002), cette espèce ne s'est pas établie en Suisse et n'est donc pas retenue.

C25) [*Minthea rugicollis*]

Données publiées. [4,6,8)]Schweiz, 2015, Verpackungsholzkontrollen im Inland und an der Grenze (Meier et al. 2016).

Commentaire. Annoncée initialement sous *Minthea* sp. dans Meier et al. (2016), l'identification spécifique a pu être précisée ultérieurement. Des individus ont été interceptés en 2015 lors de contrôles de bois d'emballages. Cette espèce pantropicale a été introduite isolément dans plusieurs pays, d'Europe centrale notamment (Geis 2002) mais ne peut s'y établir.

C26) [*Trogoxylon aequale*]

Données publiées. [1)]Schweiz, 1978, det. Cymorek S. (Graf 1981).

Commentaire. Cette espèce d'Amérique centrale et du sud (Geis 2002) a été introduite plusieurs fois en Europe. Bien que nous n'ayons pas connaissance de donnée précise relative à son annonce en Suisse, *T. aequale* figure dans la liste des Lyctidae de Suisse (Graf 1981) sur la base de spécimens (hélas non retrouvés) identifiés par S. Cymorek. Dans tous les cas, l'espèce n'a plus été signalée dans notre pays depuis 1978 et son importation isolée ne fait pas l'ombre d'un doute.

C27) [*Trogoxylon praeustum*]

Matériel examiné. [4,6,8)]2 ex., Kt. Bern, Bern, 8.1975, leg. & coll. Linder A., det. Borowski J., ETH; [6,8)]25 ex., Genève, dans statuette venant du Mexique, 3.1977, leg. Besuchet C., det. Borowski J., MHNG.

Commentaire. Cette espèce, originaire d'Amérique centrale et du sud, a été importée occasionellement en Finlande, en Allemagne et en Suisse (Geis 2002). Dans ce dernier pays, les spécimens trouvés à Genève ont été importés avec une statuette en bois provenant du Mexique, alors que l'origine des spécimens «bernois» est inconnue. L'espèce ne s'est pas établie en Suisse.

C28) *Psoa dubia*

Matériel examiné. 1 ex., Dongio TI, 27.5.2005, leg. & coll. Brägger H.

Commentaire. *P. dubia* est retenu pour la Suisse sur la base d'un spécimen capturé au Tessin, en lisière forestière, au moyen d'un filet fauchoir (Brägger H., comm. pers.). Présente principalement en Europe méridionale, l'espèce est connue notamment du Sud-Tyrol italien (Kahlen and Hellrigl 1996) et du quart sud-est de la France et de Corse (Brustel 2014). Bien que les informations à disposition soient limitées, elle est considérée comme indigène en Suisse, aucun élément ne laissant supposer à une éventuelle introduction.

C29) *Attagenus* (*Attagenus*) *brunneus*

Matériel examiné. 3 ex., Tessin, Biasca, 15.7.1951, leg. Wolf J. P., det. Herrmann A., ETH; 1 ex., Kt. Tessin, Chiasso, 7.1954, leg. & coll. Linder A., ETH; 1 ex., Kt. Tessin, Locarno, 7.1965, leg. & coll. Linder A., ETH; 1 ex., Kt. Tessin, Locarno, 8.1965, leg. & coll. Linder A., ETH; 1 ex., Kt. Tessin, Rovio, 7.1970, leg. & coll. Linder A., ETH.

Données publiées. [1)]Genf par Lasserre H. (Heer 1841a); [1)]Genf par Tournier H. (Stierlin and Gautard 1867); [1)]Martigny par Favre E. (Favre 1890).

Commentaire. Cette espèce, très largement répartie en Europe, en Afrique du Nord et en Asie, a été trouvée au cours du siècle dernier dans plusieurs localités du Tessin où elle y a vraisemblablement formé des populations. Elle est donc considérée comme indigène en Suisse.

C30) [*Attagenus* (*Attagenus*) *quadrimaculatus*]

Matériel examiné. [3)]1 ex., Genève, La London [Allondon], coll. Maerky C., det. Kalík V., MHNG.

Commentaire. Le seul spécimen examiné provient d'une collection problématique et l'espèce ne doit donc pas être considérée comme appartenant à la faune de Suisse. *A. quadrimaculatus* est présent dans le sud-est de l'Europe, ainsi qu'en Israël et en Jordanie.

C31) [*Attagenus* (*Attagenus*) *rossii*]

Matériel examiné. [3)]1 ex., Genève, coll. Maerky C., ex coll. Frey-Gessner E., det. Kalík V., MHNG.

Commentaire. Le seul spécimen «suisse» examiné provient d'une collection problématique qui ne doit pas être considérée. *A. rossii* est connu du sud de l'Europe, d'Algérie et de Tunisie, et n'est pas présent en Suisse.

C32) *Attagenus* (*Attagenus*) *schaefferi schaefferi*

Matériel examiné. [4,6)]1 ex., Basel, leg. & coll. Anonymous, MHNG; 1 ex., Brusio GR, 20.–21.6.1967, leg. & coll. Allenspach V., NMB; 1 ex., Scuol GR, 1.7.2018, leg. & coll. Brägger H.

Données publiées. [1)]Dübendorf par Bremi-Wolf J.J. (Heer 1841a); [1)]Entremont et [1)]Gadmen par Rätzer A. (Rätzer 1888); [1)]Zizers (Caflisch 1894); [1)]Basel (Stierlin 1900).

Commentaire. Bien que l'espèce soit assez répandue en Europe, seuls deux spécimens du sud et de l'est des Grisons attestent de sa présence en Suisse. L'exemplaire étiqueté de Basel est très ancien et sa provenance incertaine, si bien qu'il ne doit pas être considéré.

C33) [*Attagenus* (*Attagenus*) *unicolor japonicus*]

Matériel examiné. [4,6,8)] 3 ex., Sarmenstorf AG, 7.2002, leg. Neumann F., det. & coll. Háva J.

Commentaire. Si la sous-espèce nominale est maintenant établie et largement répandue en Europe, ce n'est pas le cas de la sous-espèce *japonicus.* D'origine asiatique, cette sous-espèce a été signalée en Europe en Roumanie et en Suisse (Háva 2003b). Dans ce dernier pays, trois exemplaires ont été capturés en 2002 en Argovie, probablement à la suite d'une importation.

C34) [*Paranovelsis aequalis*]

Données publiées. [1,4)]1 ex., Vevey, 13.7.2013 par Bornand P., det. Háva J. (Háva and Bornand 2013).

Commentaire. Háva and Bornand (2013) ont annoncé cette espèce comme nouvelle pour la Suisse sous *Attagenus incognitus* Háva, 2003, une espèce récemment synonymisée avec *P. aequalis* (Háva and Herrmann 2018). Originaire d'Amérique, *P. aequalis* a vraisemblabement été importé en Europe d'abord en Espagne, puis a été signalé dans plusieurs autres pays (Suisse, Finlande, France, Roumanie) (Háva and Herrmann 2018). En Suisse, un individu a été photographié sur une ombellifère (Háva and Bornand 2013) à proximité d'une fabrique (Bornand P., comm. pers.). Dans l'attente d'éventuelles données supplémentaires, l'espèce n'est pas considérée comme suisse à l'heure actuelle.

C35) [*Paranovelsis pantherinus*]

Données publiées. [1)]In Schleitheim im Kant. Schaffhausen par Stierlin G. (Stierlin and Gautard 1867).

Commentaire. Cette espèce est signalée de nombreux pays d'Europe centrale et orientale. Bien que potentielle, sa présence en Suisse n'est pour l'instant pas confirmée, la citation de littérature étant très ancienne et demeurant invérifiable.

C36) [*Dermestes* (*Dermestes*) *ater*]

Matériel examiné. [6,8)]2 ex., Basel, in Japanseide, leg. Seiler P., coll. Stöcklin N., det. Kalík V., NMB; [6,8)]1 ex., Genève (dans une collect. de crabes, poissons, etc. de l'Ile Maurice), 10., leg. & coll. Anonymous, det. Kalík V., MHNG; [6,8)]1 ex., Basel, aus Fischmehl aus Erythrea, 5.1955, leg. & coll. Anonymous, det. Kalík V., NMB; [4,6,8)]1 ex., Meilen ZH, 22.8.2001, leg. & coll. Anonymous, det. Landau-Lüscher I., SPZH; [4,6,8)]1 ex., Muttenz BL, 2003, leg. & coll. Brenneisen S.; [6,8)]2 ex., Neuchâtel NE, dans élevage de grillons importés de Hollande, 20.8.2007, leg. Claude B., MHNN.

Données publiées. [1)]Wallis par Venetz I. (Stierlin and Gautard 1867); [1)]2 ex., Chiasso, 12.1914 par Fontana P. (Fontana 1925).

Commentaire. Lorsque des informations complémentaires figurent sur les étiquettes des spécimens examinés, leur importation en Suisse ne fait aucun doute. Maintenant cosmopolite, il n'existe cependant aucune évidence de reproduction de cette espèce tropicale en Suisse et elle n'est pas considérée comme établie.

C37) [*Dermestes* (*Dermestes*) *peruvianus*]

Matériel examiné. [4,6,8)]1 ex., Genève, Les Halles, 5.1961, leg. Besuchet C., det. Kalík V., MHNG.

Commentaire. Un seul spécimen de cette espèce subcosmopolite a été capturé en Suisse. Contrairement à l'espèce voisine *D. haemorrhoidalis*, *D. peruvianus* ne s'est pas établi en Suisse et son observation résulte assurément d'une importation isolée restée sans suite.

C38) *Dermestes* (*Dermestinus*) *aurichalceus*

Matériel examiné. 1 ex., Kt.Wallis, Bovernier, leg. [Cerutti N.], coll. Linder A., ETH; 5 ex., Kt.Wallis, Siders, leg. Anonymous, coll. Linder A., ETH; 3 ex., Martigny, coll. Rätzer A., NMBE; 1 ex., Siders, leg. & coll. Anonymous, MHNG; 5 ex., Sierre, leg. & coll. Anonymous, MHNG; 8 ex., Sierre, coll. Bugnion E., MZL; 4 ex., Sierre, coll. Favre E., MHNG; 1 ex., Wallis, leg. & coll. Anonymous, MHNG; 4 ex., Wallis, leg. & coll. Anonymous, coll. Böschenstein G., NMSH; [3)]1 ex., Genève, Lancy, 14.5., coll. Maerky C., MHNG;; [3)]2 ex., Alpes, Martigny, 4.7., coll. Maerky C., MHNG; [3)]1 ex.,

Alpes, Sierre, 4.7., coll. Maerky C., MHNG; [3)]2 ex., Alpes, St. Maurice, 10.7., coll. Maerky C., MHNG; [3)]2 ex., Alpes, Sierre, 1.8., coll. Maerky C., MHNG; 1 ex., Kt.Wallis, Siders, 7.1884, leg. & coll. Anonymous, coll. Linder A., ETH; 5 ex., Siders, 20.7.1884, coll. [Rätzer A.], NMBE & NMSO; [6)]2 ex., Büren, 5.1886, coll Rätzer A., NMSO; 1 ex., Sierre, 4.9.1895, coll. Bugnion E., MZL; 2 ex., Sierre, 15.6.1927, coll. Gaud A., MZL; [6)]1 ex., Basel, 7.2.1952, Im Raupenkasten bei *Thaum. pityoc*. [*Thaumetopoea pityocampa*] vielleicht von Meran [Trentin-Haut-Adige] oder mit Föhren v. Basel, leg. Wolf J. P., MHNG; 11 ex., Vex VS, 21.3.2014–12.5.2015, leg. & coll. Chittaro Y.; 2 ex., Vex VS, 24.3.2015, leg. & coll. Chittaro Y.; 1 ex., Varen VS, 29.5.–8.6.2015, leg. & coll. Chittaro Y.; 1 ex., Leuk VS, 17.–28.4.2018, leg. & coll. Sanchez A; 1 ex., Grengiols VS, 17.4.–25.5.2018, leg. & coll. Sanchez A.

Données publiées. [1)]Siders par Tournier H. (Stierlin 1883); [1)]Sierre par Steck-Hofmann T. (Rätzer 1888); Sierre par Favre E. (Favre 1890); [1)]Aigle par Jaccard H. (Jaccard 1890); Bovernier par Cerutti N. (Linder 1941); 3 ex., Vex VS, 21.3.–12.4.2014 par Chittaro Y. (Sanchez et al. 2015).

Commentaire. Cette espèce n'est connue que d'Afrique du Nord (Maroc et Tunisie), de France, d'Italie, d'Espagne et de Suisse, où sa présence n'est attestée que par quelques spécimens capturés en Valais. La donnée de Basel résulte en effet assurément d'une importation (comme mentionné sur l'étiquette du spécimen), l'espèce-hôte *Thaumetopoea pityocampa* (Denis & Schiffermüller, 1775) n'étant pas présente au nord de la Suisse, ni en Allemagne. L'espèce a été retrouvée récemment en Valais, après plusieurs décennies sans observations, au moyen de pièges d'interception placés dans des pinèdes, et deux individus ont été capturés en vol vers midi le 24.3.2015. Le fait que *D. aurichalceus* se développe dans des nids de chenilles processionaires du pin et que sa période d'apparition soit précoce dans l'année expliquent probablement en grande partie le peu de données à disposition.

C39) [*Dermestes* (*Dermestinus*) *carnivorus*]

Matériel examiné. [4,6,8)]1 ex., Genève, Les Halles, 5.1970, leg. Besuchet C., det. & coll. Háva J.

Commentaire. Originaire d'Amérique centrale et du sud, cette espèce est citée d'un grand nombre de pays européens, dont la Suisse (Háva 2007a). Bien qu'elle soit considérée cosmopolite et qu'un spécimen ait été capturé à Genève en 1970, l'espèce n'est pas établie dans notre pays.

C40) [*Dermestes* (*Dermestinus*) *erichsoni*]

Données publiées. [1)]Aigle par Chav.,[1)]Basel par J., [1)]Genf par Chevrier F. & Lasserre H., [1)]Malans par Amstein J.R., [1)]Nyon par Ter., [1)]Pomy par Mellet L. (Heer 1841a); [1)] Peney bei Genf par Tournier H., [1)]Vevey par Gautard V., [1)] Wallis par Venetz I., [1)]Zürich par Dietrich K. (Stierlin and Gautard 1867).

Commentaire. Bien que l'espèce soit largement répandue à l'échelle paléarctique, nous n'avons toutefois pas connaissance de spécimens de référence venant soutenir son annonce en Suisse. Les nombreuses citations de la littérature suisse, sous « *D. tesselatus* F. » sont en effet très anciennes et invérifiables et l'espèce n'est pas retenue en fonction des éléments à disposition. En France, *D. erichsoni* se rencontre au sud de la Loire, en Ardèche, dans l'Aude mais surtout sur le littoral méditerranéen et en Corse (Alonso 2014).

C41) *Dermestes* (*Dermestinus*) *gyllenhalii gyllenhalii*

Matériel examiné. [3)]1 ex., Alpes, [Illisible], coll. Maerky C., det. Kalík V., MHNG; 1 ex., Fully VS, 8.5.2013, leg. Chittaro Y, det. & coll. Herrmann A.; 1 ex., Niedergesteln VS, 12.3.2015, leg. & coll. Chittaro Y.

Données publiées. 1 ex., Fully VS, 8.5.2013 par Chittaro Y. (Sanchez et al. 2015).

Commentaire. Seuls deux exemplaires valides, capturés récemment dans la plaine du Rhône valaisanne, viennent confirmer la présence en Suisse de *D. gyllenhalii*, une espèce pourtant largement répandue à l'échelle paléarctique.

C42) *Dermestes* (*Dermestinus*) *mustelinus*

Matériel examiné. [3)]1 ex., Alpes, Schwytz, coll. Maerky C., ex coll. Frey-Gessner E., det. Kalík V., MHNG; [3)]1 ex., Suisse, Sierre, coll. Maerky C., det. Kalík V., MHNG; 1 ex., Châtelaine, 19.6.1935, leg. Simonet J., det. Kalík V., MHNG; 1 ex., Val Verzasca, Frasco, coll. Pochon H., MHNF.

Données publiées. [1)]Siders (Stierlin 1900).

Commentaire. Cette espèce est retenue pour la Suisse sur la base d'un unique spécimen mâle provenant de Châtelaine à Genève. Les deux exemplaires de la collection Maerky, problématique, ne doivent pas être considérés, alors que celui de Frasco est une femelle, ce qui ne permet pas d'assurer de façon certaine l'identification spécifique. *D. mustelinus* est signalé de toute la France (Alonso 2014), d'Italie, de Pologne, du Portugal et d'Espagne (Háva 2007a), mais démenti d'Allemagne par Köhler and Klausnitzer (1998).

C43) *Dermestes* (*Dermestinus*) *szekessyi szekessyi*

Matériel examiné. 1 ex, Kanton Aargau, Samerstorf [Sarmenstorf], 7.2004, leg. Neumann F., det. & coll. Háva J.

Commentaire. Si l'espèce est largement répandue à l'échelle paléarctique (Háva 2007a), nous n'avons connaissance que d'un seul spécimen capturé en Suisse. Probablement résidente en Suisse (Háva J., comm. pers.), des captures supplémentaires seraient néanmoins bienvenues pour confirmer son indigénat.

C44) *Dermestes* (*Montandonia*) *olivieri*

Matériel examiné. [3)]1 ex., Suisse, coll. Maerky C., det. Kalík V., MHNG; [3)]1 ex., Suisse, coll. Maerky C., ex coll. Melly A., det. Kalík V., MHNG; [3)]1 ex., Genève, Cointrin,

7.6., coll. Maerky C., det. Kalík V., MHNG; [3)]1 ex., Tessin, 7.6.1906, coll. Gaud A., MZL; 1 ex., Mendrisio, 20.5.1930, leg. & coll. Allenspach V., NMB; 1 ex., Kt. TI, Mendrisio, 5.1951, leg. Lautner J., MHNG.

Commentaire. Deux spécimens capturés en 1930 et 1951 au sud du Tessin, dans la continuité de ses observations italiennes (Nardi and Háva 2013), confirment la présence de *D. olivieri* en Suisse. Les autres spécimens examinés sont issus de collections problématiques et ne doivent pas être considérés.

C45) *Anthrenocerus australis*

Matériel examiné. 3 ex., Zürich ZH, 22.1.2003, leg. & coll. Anonymous, SPZH; 1 ex., Zürich ZH, 26.3.2003, leg. & coll. Anonymous, det. Landau-Lüscher I., SPZH; 1 ex., Zürich ZH, 13.6.2006, leg. & coll. Anonymous, det. Schmidt M., SPZH; 1 ex., Schöfflisdorf ZH, 15.4.2011, leg. & coll. Anonymous, det. Schmidt M., SPZH; 1 ex., Zürich ZH, 14.5.2014, leg. & coll. Anonymous, det. Schmidt M., SPZH; 1 ex., Adliswil ZH, 27.2.2015, leg. & coll. Anonymous, SPZH; 1 ex., Steinmaur ZH, 2.3.2015, leg. & coll. Anonymous, det. Landau-Lüscher I., SPZH; 10 ex., Zürich ZH, 6.3.2015, leg. & coll. Anonymous, det. Landau-Lüscher I., SPZH; 1 ex., Zürich ZH, 13.7.2015, leg. & coll. Anonymous, det. Schmidt M., SPZH; 2 ex., Stein am Rhein SH, 4.4.2016, leg. & coll. Anonymous, det. Landau-Lüscher I., SPZH; 1 ex., Zürich ZH, 28.1.2019, leg. & coll. Anonymous, det. Schmidt M., SPZH.

Données publiées. 3 ex., Zürich ZH (Schädlingsbekämpfung), 30.1.2003 par Schmidt M. (Herrmann and Háva 2006).

Commentaire. *A. australis*, originaire d'Australie, de Nouvelle Guinée, de Nouvelle-Zélande et de Tasmanie, a été introduit en Europe et y est en expansion. Cette espèce synanthrope a déjà été signalée plusieurs fois en Suisse depuis sa découverte en 2003 (Herrmann and Háva 2006). Elle semble maintenant s'y être établie, dans la région zürichoise notamment, au vu de l'abondance de données récentes.

C46) *Anthrenus* (*Anthrenus*) *angustefasciatus*

Matériel examiné. nombreux exemplaires du Valais, du Tessin et du Plateau suisse.

Données publiées. 3 ex., Kanton Aargau, Samerstorf [Sarmenstorf], 7.2004 par Neumann F., det. Háva J. (Háva et al. 2013).

Commentaire. Cette espèce a été mentionnée pour la première fois en Suisse seulement très récemment, sur la base de spécimens capturés en 2004 en Argovie (Háva et al. 2013). Des spécimens plus anciens d'*A. angustefasciatus* ont néanmoins été retrouvés dans des collections muséales au sein des *A. pimpinellae*, une espèce très proche morphologiquement (Kadej et al. 2007). Principalement réparti en région méditerranéenne, *A. angustefasciatus* semble résident depuis longtemps dans les régions chaudes de la Suisse (Valais, Tessin) mais colonise également depuis peu le Plateau suisse et est en expansion vers le nord de l'Europe (Háva and Herrmann 2014, Foster and Holloway 2015).

C47) [*Anthrenus* (*Anthrenus*) *flavipes flavipes*]

Matériel examiné. [3,4,6,8)]1 ex., Bern, leg. & coll. Anonymous, det. Kalík V., NMBE; [3,4,6,8)]1 ex., Wallis, leg. Seiler P., coll. Stöcklin N, det. Kalík V., NMB; [4,6,8)]13 ex., Maison Maag [Dielsdorf] ZH, 9.1951 et 19.9.1951, leg. Besuchet C., MHNG; [4,6,8)]14 ex., Kt. Zürich, Zürich, 9.1951, leg. & coll. Linder A., ETH; [4,6,8)]6 ex., Zurich ZH, importé, 9.1951, leg. Besuchet C., coll. Toumayeff G., MHNG; [4,6,8)]6 ex., Maison Maag SA [Dielsdorf] ZH, s. lainages, 3.1952, leg. . Anonymous, coll. Besuchet C., MZL; [4,6,8)]2 ex., Liebefeld, 1960, coll. Schenker, NMBE; [4,6,8)]1 ex., Oberrieden ZH, 14.9.1993, leg. & coll. Anonymous, det. Landau-Lüscher I., SPZH.

Commentaire. Cette espèce, à l'origine orientale, est maintenant largement répandue dans les régions chaudes du monde. Elle a été trouvée à plusieurs reprises en Suisse également, mais n'y est pas établie. Toutes les découvertes suisses sont liées à des importations isolées, plusieurs captures ayant été effectuées dans les locaux d'une entreprise phytosanitaire (Maag SA).

C48) [*Anthrenus* (*Anthrenus*) *festivus*]

Données publiées. [2,8)]7 ex., Euseigne im Wallis, 6.1937 par Linder A. (Linder 1946).

Commentaire. Les spécimens cités par Linder (1946) ont été retrouvés dans sa collection (ETH) et étaient en réalité des *A. angustefasciatus*. *A. festivus* colonise le littoral méditérannéen du Portugal, des Baléares, de Sicile, de Sardaigne, du Maroc, de Tunisie, de Chypre, d'Israël et de France (Alonso 2014) et ne fait pas partie de la faune suisse.

C49) *Anthrenus* (*Anthrenus*) *goliath*

Matériel examiné. 1 ex., Salorino, 30.5.1935, leg. & coll. Allenspach V., MHNG; 1 ex., Quinten, 25.6.1944, leg. & coll. Allenspach V., MHNG; 1 ex., Selma/Calanca GR, 7.7.1994, leg. & coll. Scherler P., NMBE.

Données publiées. [1)]1 ex., Generoso, 1923 par Fontana P. (Fontana 1925); [1)]Chiasso (Fontana 1947); [2)]Genève (Besuchet et al. 2012).

Commentaire. En Suisse, un seul individu mâle (de Salorino au Tessin) atteste de manière certaine la présence de cette espèce dans notre pays. Deux autres individus femelles, de Selma/Calanca et de Quinten, se rapportent néanmoins aussi probablement à cette espèce répandue dans le sud de l'Europe et en Afrique du Nord. Les spécimens de Genève cités par Besuchet et al. (2012) étaient par contre des *A. angustefasciatus*.

C50) [*Anthrenus* (*Florilinus*) *flavidus*]

Matériel examiné. [4,6,8)]2 ex., Bern, leg. Anonymous, coll. Anonymous & Scherler P., det. Kalík V., NMBE.

Commentaire. Cette espèce, principalement répandue en Asie, n'est connue en Europe que de Pologne. Les spécimens «suisses», très anciens et de localisation peu précise, résultent donc vraisemblablement d'erreurs d'étiquettage. L'espèce n'est pas retenue pour la faune suisse.

C51) [*Anthrenus* (*Nathrenus*) *molitor*]

Données publiées. [1)]Fully par Favre E. (Favre 1890).

Commentaire. Annoncée par Favre (1890) comme nouvelle pour la Suisse, il n'existe cependant pas d'exemplaire de cette espèce en collection qui vienne soutenir son affirmation. Largement répandue en France (Alonso 2014), dans le sud de l'Europe et en Afrique du Nord, elle semble toutefois absente de Suisse.

C52) [*Globicornis* (*Globicornis*) *fasciata*]

Données publiées. [1)]Peney bei Genf par Tournier H. (Stierlin and Gautard 1867).

Commentaire. Seule une citation de la littérature, invérifiable et très ancienne, annonce *G. fasciata* pour la Suisse. L'espèce n'est donc pas retenue bien qu'elle demeure potentielle, étant connue notamment d'Alsace (Callot 2018) et du Wurtemberg (Köhler 2000),

C53) *Globicornis* (*Globicornis*) *luckowi*

Données publiées. 1 ex., Graubünden, Val Bregaglia, Soglio, 10.6.2008 par Luckow D., det. & coll. Herrmann A. (Herrmann et al. 2011) (Holotype mâle).

Commentaire. Décrite en 2011 sur la base d'un spécimen mâle provenant du Val Bregaglia, dans le sud de la Suisse, cette espèce est maintenant aussi connue d'Italie (Háva et al. 2013).

C54) [*Globicornis* (*Globicornis*) *tristis*]

Matériel examiné. 1 ex, Kanton Aargau, Samerstorf [Sarmenstorf], 7.2004, leg. Neumann F., det. & coll. Háva J.

Commentaire. Connu de Chypre, de Grêce et d'Italie, *G. tristis* est également annoncé de Suisse par Háva (2015). Un spécimen y a été capturé en Argovie en 2004. Cette capture résulte probablement d'une importation et l'espèce n'est pas retenue.

C55) *Globicornis* (*Hadrotoma*) *emarginata*

Matériel examiné. 1 ex., Chur, coll. Killias E., MHNG; 1 ex., Genève, coll. Böschenstein G, NMSH; 1 ex., Peney, leg. & coll. Anonymous, MHNG; 1 ex., Siselen BE, 11.1872, coll. Rätzer A., det. Kalík V., NMBE; [3)]1 ex., Valais, 25.7.1926, coll. Mathey A., det. Kalík V., NMBE.

Données publiées. [1)]Genf par Chevrier F. et [1)]Nyon par M. (Heer 1841a); [1)]Aigle par Heer O. et Peney bei Genf par Tournier H. (Stierlin and Gautard 1867).

Commentaire. Très largement répandue en Europe, cette espèce n'est pourtant attestée que par quelques spécimens valides en Suisse. Elle y est beaucoup plus rare que l'espèce voisine *G. corticalis*. En France, *G. emarginata* semble principalement répandu au nord de la Loire, alors que *G. corticalis* est plutôt présent au sud (Alonso 2014).

C56) *Globicornis* (*Hadrotoma*) *sulcata*

Données publiées. 1 ex., Pfäfers SG, 26.5.2009, det. & coll. Háva J. (Háva and Herrmann 2014).

Commentaire. Cette espèce n'est connue que de France, d'Italie, d'Espagne et, depuis peu, de Suisse (Háva and Herrmann 2014). Probablement résidente en Suisse (Háva J., comm. pers.), des captures supplémentaires seraient néanmoins bienvenues pour confirmer son indigénat.

C57) [*Phradonoma villosulum*]

Matériel examiné. 1 ex, Kanton Aargau, Samerstorf [Sarmenstorf], 7.2004, leg. Neumann F., det. & coll. Háva J.

Commentaire. Cette espèce, bien répandue en Europe centrale, a été capturée une seule fois en Suisse, en 2004 en Argovie, à la suite d'une probable importation. Elle n'est donc pas retenue.

C58) [*Trogoderma granarium*]

Matériel examiné. [4,6,8)]20 ex., 5.1975, Dielsdorf ZH Maag, leg. & coll. Allenspach V., det. Besuchet C., NMB & MHNG; [4,6,8)]1 ex., Zürich, 10.8.1999, leg. Schmidt M., det. & coll. Herrmann A.; [4,6,8)]1 ex., Zürich ZH, 19.8.2003, leg. & coll. Anonymous, det. Landau-Lüscher I., SPZH; [4,6,8)]1 ex., Zürich ZH, 16.10.2003, leg. & coll. Anonymous, det. Landau-Lüscher I., SPZH.

Commentaire. Originaire vraisemblablement d'Inde mais devenue presque cosmopolite, cette espèce est une des plus redoutées des locaux de stockage alimentaire (Lepesme 1944, Delobel and Tran 1993). En Suisse, elle a été capturée à plusieurs reprises dans la région zürichoise. Ces observations semblent toujours résulter d'importations isolées et l'espèce ne semble pas (encore?) s'être établie. Elle n'est donc pas retenue pour la faune de Suisse.

C59) [*Trogoderma inclusum*]

Matériel examiné. [4,6,8)]1 ex., Genève, dans conservatoire botanique, 9.5.1984, leg. Besuchet C., det. Kalík V., MHNG.

Commentaire. Un spécimen, attribué avec un léger doute («?») par Kalík V. à cette espèce subcosmopolite, a été capturé dans le conservatoire botanique de la ville de Genève. Au vu de son lieu de découverte, il ne fait aucun doute qu'il s'agissait là d'une importation isolée restée sans suite.

C60) *Trogoderma versicolor*

Matériel examiné. [3)]1 ex., Basel, leg. Seiler P., coll. Stöcklin N., NMB; [3)]1 ex., Jura, Berne, coll. Maerky C., det. Kalík V., MHNG; [3)]1 ex., Jura, Chasseral, 20.6.,

coll. Maerky C., det. Kalík V., MHNG; 1 ex., Kt. Tessin, Chiasso, 7.1954, leg. & coll. Linder A., det. Herrmann A., ETH; [4,6,8)]8 ex., Orbe VD, Nestlé SA, 1987, leg. & coll. Anonymous, MHNG; [4,6,8)]2 ex., Genève, Pl. des Nations, 15.7.1987, leg. Steffen J., det. Besuchet C., MHNG; [4,6,8)]1 ex., Basel, silo de céréales, 11.8.1998, leg. Dorn K., det. Besuchet C., MHNG; 2 ex., Zürich ZH, 23.5.2003, leg. & coll. Anonymous, det. Landau-Lüscher I., SPZH; 1 ex., Gingins VD, 12.6.–7.7.2015, leg. &, coll. Breitenmoser S.

Données publiées. [1)]Schaffhausen par Stierlin G. (Stierlin and Gautard 1867); [1)]Grabs par Kubli H. (Stierlin 1883); [1,7)]versant sud du St-Bernard [Col du Grand Saint-Bernard] par Favre E. (Favre 1890); [1)]Basel (Stierlin 1900); Zoo Basel, secteur B (Sprecher et al. 2008)

Commentaire. Plusieurs spécimens de cette espèce cosmopolite ont été capturés en Suisse. Si la majorité ont été collectés dans des lieux de stockage de denrées alimentaires et résultent donc assurément d'importations, le spécimen de 2015 a été capturé à l'aide d'un «piège à bière» placé sur un chêne sénescent isolé dans un pâturage boisé (Breitenmoser S., comm. pers.). L'espèce semble donc maintenant établie en Suisse aussi.

C61) [*Thorictus grandicollis* s.l.]

Données publiées. [1)][Suisse] (Bremi-Wolf 1856).

Commentaire. Il n'existe aucun spécimen en collection venant soutenir la citation de la littérature, très ancienne et sans précision. En France, cette espèce myrmécophile se limite au littoral méditerranéen (Alonso 2014). *T. grandicollis* ne fait pas partie de notre faune.

C62) [*Endecatomus reticulatus*]

Matériel examiné. [3)]2 ex., Schaffhausen, coll. Linder A., ex coll. Täschler M., ETH.

Données publiées. [1)]Genf par Chevrier F. (Stierlin and Gautard 1867).

Commentaire. Les seuls spécimens suisses examinés proviennent d'une collection problématique, alors que la citation de la littérature est invérifiable. Présente dans les pays limitrophes, cette espèce mycétophage très rare est potentielle en Suisse, mais cela demande confirmation.

C63) *Cacotemnus thomsoni* (Kraatz, 1881)

Matériel examiné. 1 ex., V. Somvix [GR], 8.1895, coll. Kaiser J., MHNG; 1 ex., Conthey VS, 18.–30.7.2013, leg. & coll. Chittaro Y., det. Büche B.

Commentaire. Cette espèce boréoalpine très rare (Allemand and Barnouin 2014) n'a été capturée qu'à deux reprises en Suisse. Le spécimen de 2013 a été capturé au moyen d'un piège d'interception placé dans une pessière à 1500 m. d'altitude.

C64) [*Hemicoelus rufipennis*]

Données publiées. [1)]?, Siselen par Rätzer A. (Rätzer 1888).

Commentaire. A l'heure actuelle, il n'existe aucun spécimen de référence venant soutenir l'unique citation de la littérature disponible en Suisse, citation déjà considérée comme douteuse en 1888 (avec un «?»). Connue d'Europe centrale et du sud-est, sa présence en France reste également à confirmer (Allemand and Barnouin 2014).

C65) *Nicobium castaneum*

Matériel examiné. [3)]1 ex., Alpes, Mattmark, 16.7., coll. Maerky C., MHNG; [3)]1 ex., Genève, Carouge, 4.5., coll. Maerky C., MHNG; 2 ex., Kt. Tess., Salorino, 7.1940, leg. Lautner J., NMB; [6,8)]2 ex., Bonvillars VD, vieux meuble, 14.8.1963, leg. Steffen J., MHNG; 1 ex., Tessin, Tenero, 3.–16.7.1966, leg. SFRA, MHNG; 1 ex., Tessin, Tenero, 8.1968, leg. SFRA, MHNG; [6,8)]4 ex., Bern Stadt, 2.8.1971, leg. Pochon H., coll. Pochon H. & Linder A., MHNF & ETH; 1 ex., Tessin, Caviano, 7.1975, leg. Besuchet C., MHNG; 1 ex., Somazzo, Toretta-O. TI, 11.-20.7.1985, leg. Reser-Rezbanyai L., NMLU; 1 ex., Meride, San Antonio TI, 1.–11.8.1989, leg. Reser-Rezbanyai L., NMLU; 1 ex., Meride, San Antonio TI, 1.–11.7.1991, leg. Reser-Rezbanyai L., NMLU; 4 ex., Meride, Ost, San Antonio TI, 11.–20.7.1991, leg. Reser-Rezbanyai L., MHNG & NMLU; 1 ex., Tessin, S. Pietro, Mt. Albano, 7.1991, leg. SFRA, MHNG; 7 ex., Meride, San Antonio TI, 21.–31.7.1991, leg. Reser-Rezbanyai L., NMLU.

Données publiées. 1 ex., Salorino bei Mendrisio, 7.1940 par Lautner J. (Linder 1953).

Commentaire. Plusieurs spécimens de cette espèce subcosmopolite ont été capturés en Suisse, principalement au moyen de pièges lumineux. Si elle semble résidente au sud des Alpes, ses observations de Bonvillars VD et de Bern BE sont par contre probablement liées à des importations de bois («vieux meuble» pour Bonvillars), comme cela a déjà été constaté dans plusieurs pays européens (Zahradník 2013).

C66) *Priobium carpini*

Matériel examiné. [3)]1 ex., Alpes, Orsières, 7.8., coll. Maerky C., MHNG; 3 ex., Basel, 8.7.1945, leg. & coll. Straub-Danzeisen F., MHNG & NMB; 2 ex., Basel, 12.7.1945, leg. & coll. Straub-Danzeisen F., MHNG & NMB; 5 ex., Basel, 7.1946, leg. Straub-Danzeisen F., MHNG & NMB; 1 ex., Basel Stadt, Rüdlistr. 47, im Zimmer, 7.1946, leg. Straub-Danzeisen F., NMB; 1 ex., Kt. SZ, Sihlsee, 10.9.1950, leg. Lautner J., NMB;1 ex., Genève, Chancy, 2.7.1974, leg. Besuchet C., MHNG; 1 ex., Luzern-Obergütsch, Gütschwald, 29.7.1986, leg. Reser-Rezbanyai L., NMLU; 1 ex., Maschwanden, Rüss-Spitz ZH/ZG, 29.7.1987, leg. Reser-Rezbanyai L., NMLU; 6 ex., Valais, Fully, 7.1990, leg. SFRA, MHNG; 1 ex., Tessin, S. Pietro, Mt. Albano, 7.1991, leg. SFRA, MHNG; 7 ex., Oberrieden ZH, 7. 1995, leg. Ronner, ETH; 3 ex., Steckborn, TG, 7.2019, leg. Anonymous, NMB.

Données publiées. 1 ex., Kanton ZG, Rüss-Spitz, (Herger 2002).

Commentaire. Largement répandue en Europe, cette espèce est pourtant rare en Suisse. Sa présence n'y est attestée que par la capture de quelques spécimens isolés.

C67) *Anitys rubens*

Matériel examiné. [3)]1 ex., Genève, Rouelbeau, 22.5., coll. Maerky C., MHNG; 1 ex., Orvin BE, 5.4.2017, leg. & coll. Chittaro Y.; 20 ex., Orvin BE, 1.6.2017, leg. & coll. Chittaro Y.

Données publiées. 1 ex. (mort) et nombreuses larve, Orvin BE, 5.4.2017; 20 ex. et quelques larves, Orvin BE, 1.6.2017 par Chittaro Y. (Chittaro and Sanchez 2018).

Commentaire. *A. rubens* n'a été découvert en Suisse que très récemment, la donnée de Genève n'étant pas à considérer (collection problématique). Plusieurs larves et adultes ont été découverts en 2017 dans la carie rouge d'un tronc de chêne (*Quercus* sp.) sur pied (Chittaro and Sanchez 2018). Cette espèce saproxylique est généralement rare et sporadique dans toute son aire de répartition qui couvre une grande partie de l'Europe centrale et occidentale.

C68) *Caenocara affine*

Matériel examiné. 1 ex., Chiasso, 3.6.1939, coll. Fontana P., MSNL; 1 ex., Kt. Graubünden, Grono, 5.1952, leg. & coll. Linder A., ETH; 1 ex., Tessin, Rovio, 15.7.1980, leg. & coll. Scherler P., NMBE; 1 ex., Valais, Fully, 6.1990, leg. SFRA, MHNG; 2 ex., Cavigliano TI, 4.–17.6.2013, leg. & coll. Chittaro Y.

Données publiées. Chiasso par Fontana P. (Fontana 1947); Grono par Linder A. (Linder 1967); [2)]Serpiano TI par Reser-Rezbanyai L. (Herger et al. 2015).

Commentaire. Répandue notamment en Europe centrale et méridionale, la présence de cette espèce est attestée en Suisse par quelques spécimens mâles provenant du sud des Alpes et du Valais (Fig. 1). Les spécimens de Serpiano se sont avérés être des *C. subglobosum* (voir C69).

C69) *Caenocara subglobosum*

Matériel examiné. 1 ex., Lugano, 24.7.1919, coll. Gaud A., MZL; 1 ex., Kt. Tessin, Locarno, 7.1947, leg. & coll. Linder A., ETH; 1 ex., Mte. Boglia TI, 14.6.1982, leg. & coll. Scherler P., NMBE; 1 ex., Tessin, Carona, 17.6.1987, leg. & coll. Scherler P., NMBE; 1 ex., Arzo TI, 30.6.1988 leg. & coll. Scherler P., NMBE; 1 ex., Meride, Serpiano TI, 11.–21.7.1995, leg. Reser-Rezbanyai L., NMLU; 1 ex., Meride, Serpiano, TI, 11.–21.6.1997, leg. Reser-Rezbanyai L., NMLU; 3 ex., Tessin, Loderio, 23.9.1998, leg. Besuchet C., MHNG.

Données publiées. [1)]Rancate TI (Beleg in coll. nicht gefunden) par Linder A. (Allenspach 1978).

Commentaire. Seuls quelques spécimens tessinois (Fig. 1) attestent de la présence en Suisse de cette espèce largement

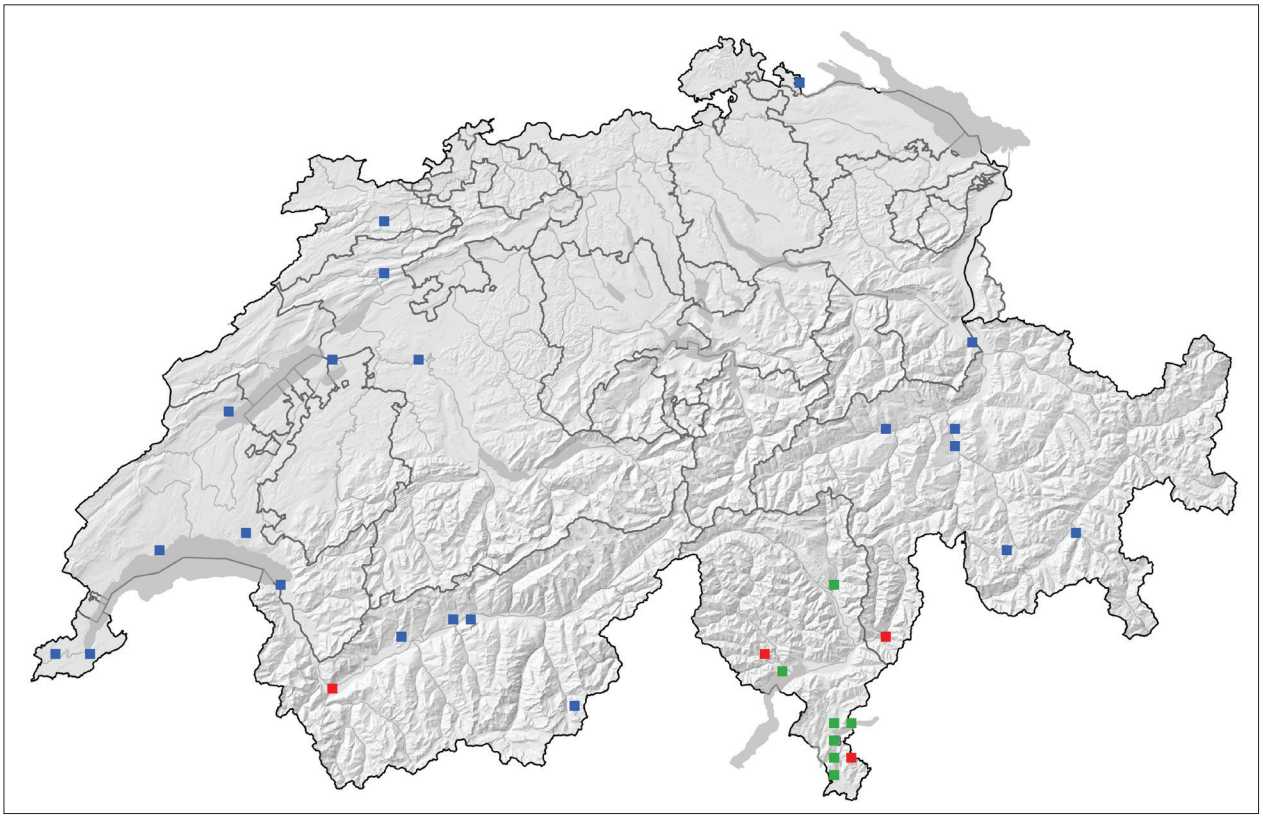


Figure 1. Répartition des espèces du genre *Caenocara* en Suisse: *C. affine* (en rouge), *C. bovistae* (en bleu) et *C. subglobosum* (en vert). Les limites cantonales suisses sont indiquées.

répandue en Europe. Comme les autres espèces du genre *Caenocara*, *C. subglobosum* est liée aux champignons des genres *Lycoperdon* et *Bovista* (Lohse 1969).

C70) *Dorcatoma* (*Dorcatoma*) *lomnickii*

Matériel examiné. 4 ex., Stansstad NW, 7.2013, leg., det. & coll. Graf R.

Données publiées. 4 ex., Lopper NW, champignon prélevé le 12.7.2013, éclosion 11.2014, par Graf R. (Graf 2016).

Commentaire: Les quatres spécimens suisses ont éclos d'un champignon (*Fomes fomentarius*) trouvé dans une hêtraie exposée au sud, à Stansstad (Graf 2016). Cette localité est la plus occidentale connue pour *D. lomnickii*, une espèce présente en Biélorussie, en Pologne, en Slovaquie, en Russie (Borowski and Zahradník 2007), ainsi qu'en Allemagne et en Autriche (Büche B., comm. pers., in Graf 2016).

C71) *Dorcatoma* (*Psilodorcatoma*) *androgyna*

Matériel examiné. 1 ex., Fully VS, 29.5.–5.6.2015, leg. & coll. Chittaro Y., det. Büche B.

Données publiées. Fully, Châtaigneraie, par Chittaro Y. (Chittaro and Sanchez 2016).

Commentaire. Décrite récemment (Büche 2001), cette espèce n'est connue que d'Autriche, d'Allemagne, de France et, depuis 2015, de Suisse. Un individu mâle y a été capturé dans une vieille châtaigneraie (Chittaro and Sanchez 2016). Selon Büche and Möller (2005), l'espèce ne se développerait que dans des champignons (*Fomes fomentarius* et *Ganoderma* spp.) de gros volumes, liés à des zones forestières présentant une offre continue et importante en bois mort.

C72) *Dorcatoma* (*Psilodorcatoma*) *minor*

Matériel examiné. 10 larves (élevées), Bettingen BS, 1.8.2012, leg., det. & coll. Coray A., NMB; 4 ex., Noville VD, 20.5.–22.6.2016, leg. & coll. Chittaro Y., det. Büche B.; 2 ex., Noville VD, 30.5.–15.6.2017, leg. & coll. Chittaro Y.

Données publiées. 10 larves (élevées), Bettingen BS, 1.8.2012 (adultes 5.2013), par Coray A. et 4 ex., Noville VD, 20.5.–22.6.2016 par Chittaro Y. (Chittaro and Sanchez 2017).

Commentaire. Assez largement répandue en Europe, cette espèce n'a pourtant été mise en évidence en Suisse que très récemment. Les individus de Bettingen BS ont été élevés à partir d'un morceau d'amadouvier (*Fomes fomentarius*), alors que ceux de Noville ont été capturés au moyen de pièges d'interceptions placés dans une forêt riveraine (Chittaro and Sanchez 2017).

C73) *Stagetus borealis*

Matériel examiné. 1 ex., Ollon VD, 31.5.–12.6.2013, leg. & coll. Chittaro Y., det. Büche B.

Données publiées. 1 ex., Ollon, 31.5.–12.6.2013, par Chittaro Y. (Sanchez et al. 2015).

Commentaire. La distribution de cette espèce liée aux résineux est extrêment morcelée, *S. borealis* n'étant connu que de Russie, de Scandinavie, d'Autriche, ainsi que des Pyrénées, des Alpes françaises (Massif des Ecrins, 2017, leg. Dodelin B., comm. pers.) et du Massif central (2016 et 2017, leg. Calmont B., Dodelin B., comm. pers.). Un seul individu mâle, capturé dans une pinède du Chablais vaudois, vient pour l'heure confirmer sa présence dans notre pays (Sanchez et al. 2015).

C74) *Stagetus pilula*

Matériel examiné. 1 ex., Genève, sous Russin, 5.–6.1990, leg. Besuchet C., det. Zahradník P., MHNG.

Commentaire. Cette espèce est annoncée de nombreux pays d'Europe, mais aussi d'Afrique du Nord et du Moyen-Orient. En Suisse, elle n'est connue que d'un seul spécimen, identifié par P. Zahradník. S'agissant d'une femelle, une confirmation de sa présence en Suisse par un spécimen mâle serait néanmoins souhaitable, au vu de la difficulté d'identification des femelles du genre *Stagetus* (Toskina 2015).

C75) *Dryophilus anobioides*

Matériel examiné. 2 ex., Chiasso, coll. Fontana P., MSN; 2 ex., Tessin, Generoso, B. Vista, 11.7.1960, leg. & coll. Scherler P., NMBE; 1 ex., Grono GR, 14.5.1968, leg. & coll. Allenspach V., NMB; 1 ex., Loco TI, 4.1975, leg. & coll. Anonymous, MHNG; 1 ex., Valais, Bluche, 6.1976, leg. Besuchet C., MHNG; 1 ex., Mte. Generoso, Bellavista, 6.1984, leg. Reser-Rezbanyai L., NMLU; 1 ex., s/Brè TI, 13.6.1986, leg. & coll. Scherler P., NMBE; 1 ex., Meride, San Antonio, 11.–26.6.1989, leg. Reser-Rezbanyai L., NMLU; 8 ex., Tessin, Generoso, Muggiasca, 16.6.1995, leg. Besuchet C., MHNG; 1 ex., Meride, Serpiano, 11.5.1997, leg. Reser-Rezbanyai L., NMLU; 1 ex., Meride, Serpiano, 11.6.1997, leg. Reser-Rezbanyai L., NMLU.

Données publiées. [1)]Genf par Tournier H. (Stierlin and Gautard 1867); Serpiano TI par Reser-Rezbanyai L. (Herger et al. 2015).

Commentaire. Largement répandue en Europe, cette espèce est principalement présente en Suisse au sud des Alpes. Elle a cependant également été élevée d'une «branche de genêt» en Valais, selon les indications complémentaires figurant sur l'étiquette du spécimen de Bluche.

C76) [*Dryophilus longicollis*]

Données publiées. [1)]Alp Laret, 1862 par von Heyden L. (Heyden 1863); [2)]Chiasso (Fontana 1925); [1,2)]Frauenfeld, [1,2)]Pfyn [Pfyn TG] et [1,2)]Salmsach (Hugentobler 1959); [2)] Innufer, 27.5.1953, [2)]Scuol, Clozza, 30.5.1953 et [2)]Zernez, Gondas, 1.6.1953 par Handschin E. (Handschin 1963).

Commentaire. Si l'espèce est citée de nombreux pays d'Europe et d'Afrique du Nord, nous n'avons

pas connaissance de spécimens de référence soutenant sa présence en Suisse. Les données de la littérature sont en effet invérifiables ou sont liées à des erreurs d'identification. Le spécimen mentionné par Fontana (1925) était ainsi un *D. anobioides*, alors que ceux annoncés par Handschin (1963) étaient en réalité des *D. pusillus*. Quant aux spécimens cités par Hugentobler (1959), ils ne sont pas mentionnés dans sa synthèse ultérieure (Hugentobler 1966), ce qui suggère également des erreurs d'identifications, comme cela était le cas des données d'Allemagne (Köhler and Klausnitzer 1998).

C77) *Homophthalmus rugicollis*

Matériel examiné. 1 ex., Genève, Chancy, 2.7.1974, leg. Besuchet C., MHNG; 3 ex., Genève, Frontenex, 16.7.1987, Burckhardt D., MHNG; 2 ex., Genève, Nant d'Aisy, 19.6.1988, leg. Besuchet C., MHNG; 1 ex., Genève, Carre d'Amont, 7.–8.1991, leg. Besuchet C., MHNG; 1 ex., Meride TI, 1.7.2013, leg. & coll. Chittaro Y.

Données publiées. [1)]Val Entremont par Joris C. (Stierlin 1883); [1)]Gondas, 30.6.1955, [1)]Fuldera, 16.6.1955 et [1)]Zernez, Clüs, 21.7.1921 par Handschin E. (Handschin 1963).

Commentaire. Présente dans plusieurs pays d'Europe méridionale et centrale, cette espèce est retenue pour la Suisse sur la base de cinq spécimens provenant de Genève et du sud du Tessin. Les spécimens des Grisons cités par Handschin (1963) n'ont pas été retrouvés dans les collections consultées.

C78) *Episernus angulicollis*

Matériel examiné. 1 ex., Davos GR, 16.7.1967, leg. Wittmer W., NMB; 2 ex., Samedan GR, 11.7.1970, leg. & coll. Scherler P., NMBE, 1 ex., Bürchen VS, 13.7.1974, leg. & coll. Scherler P., NMBE; 1 ex., S'charl GR, 7.1978, leg. Toumayeff G., MHNG; 1 ex., Avers GR, 14.8.2014, leg. & coll. Huber B; 1 ex., Val Müstair GR, 24.6.2017, leg. & coll. Chittaro Y.; 1 ex., Salgesch VS, 31.5.2019, leg. & coll. Chittaro Y.; 1 ex., Zermatt VS, 1.7.2019, leg. & coll. Chittaro Y.

Données publiées. [1)]Generoso par Fontana P. (Fontana 1925); 1 ex., Loëch [Loèche] par Guillebeau F. et 1 ex., Saas-Fee, 12.7.2009, par Serres E., coll. Dodelin B. (Dodelin 2016).

Commentaire. Cette espèce est connue du nord de l'Europe et de quelques localités des Alpes françaises, suisses et autrichiennes (Dodelin 2016). En Suisse, elle a été trouvées dans les Grisons et en Valais. Les spécimens collectés en 2017 et 2019 par Chittaro Y. ont été obtenus au battage de branches de pins sylvestres (*Pinus sylvestris*).

C79) *Episernus taygetanus alpestris*

Matériel examiné. 1 ex., Valais, s/Leuk, 7.6.1965, leg. & coll. Scherler P., NMBE; 1 ex., s/Saxon VS, 2.6.1971, leg. & coll. Scherler P., NMBE.

Données publiées. 1 ex., Leuk VS, 7.6.1965 et 1 ex., Saxon, 2.6.1974 [1971] par Scherler P. (Allenspach 1978).

Commentaire. Deux spécimens mâles existent dans la collection de Scherler P. conservée au NMBE pour cette espèce caractérisée par des segments antennaires 3 et 4 particulièrement courts. Ces captures valaisannes avaient été citées par Allenspach (1978) sous *E. ganglbaueri* (avec une erreur de recopie de date), mais sont à rattacher maintenant à *E. taygetanus alpestris* à la suite du travail de Dodelin and Bouyon (2017). *E. taygetanus alpestris* est connu des Alpes occidentales et centrales (Dodelin and Bouyon 2017).

C80) *Ernobius explanatus phobos*

Matériel examiné. 1 ex., Kt. Bern, Saanen, 5.1937, leg. & coll. Linder A., ETH; 2 ex., Il Fuorn, 8.1965, leg. Pfeffer A., MHNG & NMB.

Données publiées. 5 ex. (Holotype mâle, Allotype femelle, 3 Paratypes), Il Fuorn, 8.1965 par Pfeffer A. (Gottwald 1971).

Commentaire. C'est la sous-espèce *phobos*, décrite par Gottwald (1971) sur la base de cinq spécimens provenant d'Il Fuorn dans les Grisons, qui est présente dans les Alpes. Ces spécimens ont été obtenus par élevage de larves trouvées en juillet 1965 dans l'écorce épaisse d'un épicéa (*Picea abies*) fraîchement mort, à environ 1800 m d'altitude (Gottwald 1971). Le spécimen du canton de Berne étant une femelle, son identification est incertaine et la capture d'un individu mâle est souhaitée pour garantir sa présence dans l'ouest des Alpes suisses également.

C81) *Ernobius freudei*

Matériel examiné. 1 ex., Chemin VS, 5.6.1966, leg. & coll. Scherler P., det. Zahradník P., NMBE.

Commentaire. Cette espèce n'est signalée que d'Autriche, d'Italie et de Suisse. Dans ce dernier pays, elle n'est connue que d'un seul spécimen. Bien qu'identifié par P. Zahradník, il subsiste néanmoins un léger doute quant à son identification spécifique puisqu'il s'agit d'une femelle. Des spécimens mâles seraient donc les bienvenus pour confirmer définitivement la présence de cette espèce en Suisse.

C82) [*Ernobius gigas*]

Matériel examiné. [3)]1 ex., Genève, Aïre, 8.7., coll. Maerky C., det. Johnson C., MHNG; [8)]1 ex., Meilen ZH, 16.11.1992, leg. Eggenberger M., ETH.

Commentaire. Cité de nombreux pays européens, *Ernobius gigas* est principalement présent le long du bassin méditerranéen mais aussi sur la côte atlantique française (Allemand and Barnouin 2014). L'espèce n'est pas retenue pour la Suisse en fonction des éléments à disposition. Le spécimen de Genève provient en effet d'une collection problématique et ne doit pas être considéré, alors que celui de Zürich résulte vraisemblablement d'une importation isolée au vu de sa date tardive de découverte (éclosion de bois importé?) et de sa localisation (zone urbaine du Plateau suisse).

C83) *Ernobius laticollis*

Matériel examiné. 1 ex., Vaud, Fenalet, 11.9.1949, leg. Besuchet C., det. Zahradník P., MZL; 2 ex., Visperterminen, Beichji VS, 11.6.1995, leg. Reser-Rezbanyai L., NMLU; 2 ex., Leuk VS, 22.10.-16.11.2013, leg. Chittaro Y., det. Büche B., coll. Chittaro Y. & Büche B.; 1 ex., Martigny VS, 17.11.2016–15.3.2017, leg. & coll. Sanchez A.; 1 ex., Martigny VS, 16.11.2017–24.4.2018, leg. & coll. Sanchez A.

Commentaire. Seules quelques captures viennent confirmer la présence de cette espèce méridionale en Suisse. Liée aux pins (*Pinus* spp.), elle semble apparaître tardivement dans l'année, ce qui explique probablement en bonne partie la rareté de ses observations. Elle n'est connue que d'Autriche, de France, de Grèce, d'Italie, d'Espagne, de Tunisie et de Suisse.

C84) *Ernobius longicornis*

Matériel examiné. [3)]1 ex., Alpes, Lavey, 2.7., coll. Maerky C., det. Johnson C., MHNG; 1 ex., Langwies, 23.6.1881, col. Böschenstein A., NMSH; 1 ex., Anniviers VS, 12.–26.5.2015, leg. & coll. Sanchez A.; 1 ex., Anniviers VS, 20.5.–13.7.2016, leg. & coll. Sanchez A.; 1 ex., Fully VS, 6.–28.6.2018, leg. & coll. Chittaro Y.

Données publiées. [1)]Monte Generoso par Frey-Gessner E. et [1)]Neuchâtel par Coulon (Stierlin 1883); [1] Saas et [1] Siselen par Rätzer A. (Rätzer 1888); [1)]Chandolin et Ponchette par Favre E. (Favre 1890); [1)]Frauenfeld, Stadt, 1953 par Hugentobler H. (Hugentobler 1966); [1] Untervaz par Jörger J.B. (Linder 1967).

Commentaire. Bien que l'espèce soit assez largement répandue en Europe centrale et septentrionale, seuls quelques rares spécimens valides viennent confirmer sa présence dans les Alpes suisses. Le spécimen de Lavey est issu d'une collection problématique et ne peut pas être retenu.

C85) *Ernobius mulsanti mulsanti*

Matériel examiné. [3)]1 ex., Jura, Macolin, 11.5., coll. Maerky C., det. Johnson C., MHNG; 1 ex., Valais, s/Leuk, 23.4.1988, leg. & coll. Scherler P., det. Zahradník P., NMBE; 2 ex., Visperterminen, Beichji VS, 11.–12.6.1995, leg. Reser-Rezbanyai L., NMLU; 4 ex., Visperterminen, Brachland VS, 22.10.1995, leg. Reser-Rezbanyai L., MHNG; 1 ex., Stalden VS, 4.4.2009, leg. & coll. Chittaro Y., det. Büche B.; 1 ex., Vex VS, 21.3.–11.4.2014, leg. Chittaro Y., det. & coll. Büche B.; 1 ex., Zeneggen VS, 26.4.–15.5.2014, leg. & coll. Chittaro Y., det. Büche B.; 1 ex., Leuk VS, 28.4.2018, leg. & coll. Chittaro Y.

Données publiées. 1 ex., Stalden VS, 4.4.2009, 1 ex., Vex VS, 21.3.–11.4.2014 et 1 ex., Zeneggen VS, 26.4.–15.5.2014, par Chittaro Y. (Chittaro and Sanchez 2017).

Commentaire. Cette espèce n'est connue que d'Autriche, d'Allemagne, de Pologne, de France, d'Italie et de Suisse, où on ne la connaît que de quelques spécimens capturés dans des pinèdes en Valais (Chittaro and Sanchez 2017).

C86) *Ernobius parens*

Matériel examiné. 1 ex., Soloth. Jura, Metzerlen, 18.4.1948, leg. Wolf J. P., det. Zahradník P., MHNG.

Commentaire. Cette espèce, dont la présence est douteuse en Allemagne et en Hongrie, est citée de France méridionale et de Corse (Allemand and Barnouin 2014), d'Italie, du Portugal, d'Espagne, d'Ukraine et d'Afrique du Nord. Nous la retenons pour la Suisse sur la base d'un unique spécimen identifié par P. Zahradník. S'agissant d'une femelle, une confirmation de sa présence par la capture de spécimens mâles serait néanmoins bienvenue.

C87) *Ochina latreillii*

Matériel examiné. [3)]1 ex., Genève, leg. & coll. Anonymous, MHNG; [3)]1 ex., env. de Genève, Peney, leg. & coll. Anonymous, MHNG; [3)]1 ex., Kt. Genf, coll. Linder A., ex coll. Täschler M., ETH; [3)]1 ex., Peney, leg. & coll. Anonymous, MHNG; [3)]2 ex., Rouelbeau, 22.4., coll. Maerky C., MHNG; [3)]1 ex., Genève, Peney, 21.5., coll. Maerky C., MHNG; [3)]1 ex., Genève, Sionnet, 1.7., coll. Maerky C., MHNG; [3)]1 ex., Alpes, Brigue, 7.7., coll. Maerky C., MHNG; 1 ex., Genève, London [Allondon], 5.1949, leg. Toumayeff G., MHNG; 1 ex., St. Maria, Rombach, 23.5.1953, leg & coll. Handschin E., BNM; 1 ex., Meride, San Antonio, 1.–10.7.1991, leg. Reser-Rezbanyai L., NMLU; 1 ex., Meride, San Antonio, 21.–30.7.1991, leg. Reser-Rezbanyai L., NMLU; 1 ex., Genève, Avully, 15.6.1993, leg. Besuchet C., MHNG; 1 ex., Signy-Avenex VD, 7.5.2018, leg. & coll. Breitenmoser S.; 1 ex., Zwischbergen VS, 19.5.–7.6.2018, leg. & coll. Monnerat C.; 1 ex., Chéserex VD, 26.5.2018, leg. & coll. Breitenmoser S.

Données publiées. [1)]Genf par Tournier H. (Stierlin and Gautard 1867); Sta. Maria, Rombach, 23.5.1953 par Handschin E. (Handschin 1963)).

Commentaire. Cette espèce est largement répandue en Europe. Elle se développe dans des branches mortes de chênes (*Quercus* spp.), d'ormes (*Ulmus* spp.) et de tilleuls (*Tilia* spp., Dodelin B., comm. pers.). En Suisse, elle n'est connue que de quelques captures éparses réalisées dans l'ouest de la région lémanique, au sud des Alpes et dans l'extrême est des Grisons. Citée d'Alsace (Callot 2018), une présence dans le nord de la Suisse serait également possible.

C88) [*Ozognathus cornutus*]

Matériel examiné. [4,6,8)]12 ex., Weiningen ZH, 10.2016, leg. Schmidt M., NMSO.

Données publiées. [4,6,8)]30 ex., Zürich par Schmidt M. (Germann and Schmidt 2017).

Commentaire. Décrite de Californie, cette espèce néarctique a été signalée initialement dans la région paléarctique à Madère, à Malte et en Tunisie (Zahradník and Mifsud 2005), puis d'autres introductions ont été signalées en Espagne (Bercedo et al. 2005), en France (Allemand et al. 2008), en Allemagne (Bathon 2014), en Italie (Cusimano et al. 2014) et en Suisse (Germann and Schmidt 2017). Dans ce dernier cas, les spécimens

ont éclos d'une tête d'ail (*Allium sativum*) originaire de Sicile achetée en octobre 2016 sur un marché zürichois. L'espèce n'est pas établie en Suisse.

C89) *Xestobium austriacum*

Matériel examiné. 2 ex., Seewis im Prättigau GR, 27.5.2008, leg., det. & coll. Bense U.

Commentaire. *X. austriacum* est une espèce d'Europe centrale connue d'Autriche, d'Allemagne, de République tchèque, de Pologne, de Slovakie, d'Ukraine et, depuis 2008 seulement, de l'est de la Suisse, où elle atteint la limite occidentale de sa répartition. Deux exemplaires ont été trouvés sous l'écorce d'une souche sèche de sapin blanc (*Abies alba*) située sur un versant exposé au nord-ouest (Bense U., comm. pers.).

C90) [*Hedobia pubescens*]

Données publiées. [1)][Suisse] ? (Bremi-Wolf 1856).

Commentaire. Cette espèce n'a été citée qu'une seule fois de Suisse par Bremi-Wolf (1856), et déjà avec une indication de doute («?»). Aucun élément concret ne permet de la retenir pour la Suisse, bien qu'elle soit largement distribuée en Europe, principalement dans le centre et dans le sud.

C91) *Dignomus irroratus*

Matériel examiné. [3)]2 ex., Alpes, Tessin, coll. Maerky C., ex coll. Ghidini A., MHNG; 1 ex., Chamoson VS, 16.7.–11.8.2015, leg. & coll. Sanchez A.

Données publiées. 1 ex., Chamoson VS, 16.7.–11.8.2015 par Sanchez A. (Sanchez and Chittaro 2019).

Commentaire. Cette espèce a été découverte très récemment dans notre pays au moyen d'un piège d'interception placé dans une chênaie pubescente, en bordure de pelouse steppique (Sanchez and Chittaro 2019). La donnée historique ne doit pas être considérée puisqu'elle est liée à une collection problématique. *D. irroratus* colonise le sud-est de la France (Calmont 2016) et le sud de l'Europe.

C92) [*Eurostodes quisquiliarum*]

Données publiées. [1,7)]M. Moro (Rätzer 1888).

Commentaire. Signalée dans une liste suisse par Rätzer (1888), nous n'avons toutefois pas connaissance de spécimens soutenant la présence de cette espèce dans notre pays. *E. quisquiliarum* est considéré comme endémique d'Italie selon Borowski and Zahradník (2007). Etant donné que le Monte Moro se trouve à cheval entre la Suisse et l'Italie, la mention de Rätzer (1888) se réfère probablement plutôt à ce dernier pays.

C93) [*Mezium affine*]

Matériel examiné. [3,4,8)]3 ex., Zürich, leg. & coll. Anonymous, MHNG; [4,6,8)]1 ex., Porrentruy, BE, Umgeb., 1948, leg. Wyniger R., MHNG; [4,6,8)]9 ex., Kt. Basel, Basel, 7.1955, leg. & coll. Linder A., ETH; [4,6,8)]7 ex., Pruntrut [Porrentruy], 3.1963, leg. Ziegler, coll. Wolf J. P., ETH; [4,6,8)]1 ex., Bâle, entrepôts, 6.1973, leg. Besuchet C., MHNG; [4,6,8)]1 ex., Kradolf TG, 5.8.1999, leg. & coll. Anonymous, SPZH.

Commentaire. D'origine néarctique, cette espèce est maintenant presque cosmopolite (Bélles 1990). Elle a été importée dans plusieurs pays européens parmi lesquels l'Autriche, l'Allemagne (Zahradník 2013) et la Suisse, où elle a été signalée à plusieurs reprises dans le nord du pays, que ce soit dans des entrepôts (Bâle) ou dans des fermes aux alentours de Porrentruy. Ces observations sont vraisemblablement toujours le fruit de nouvelles importations et l'espèce ne semble pas s'être établie en Suisse.

C94) [*Pseudeurostus anemophilus*]

Données publiées. [1,8)]SZ [Suisse] (Borowski and Zahradník 2007).

Commentaire. Citée de France, d'Italie et de Suisse (Borowski and Zahradník 2007), nous n'avons toutefois pas connaissance de spécimens suisses relatifs à cette espèce, tous les spécimens du genre *Pseudeurostus* examinés se référant à *P. frigidus*. *P. anemophilus* est localisé en France uniquement au Mont-Ventoux et aux Alpes-de-Haute-Provence (Calmont 2016). L'espèce n'est donc pas retenue pour la Suisse.

C95) [*Ptinus* (*Bruchoptinus*) *italicus*]

Données publiées. [1)]Generoso (Fontana 1947); [2)]Grono par Linder A. (Linder 1967).

Commentaire. L'espèce est citée d'Autriche, d'Italie et du quart sud-est de la France (Allemand and Barnouin 2014, Calmont 2016). Si sa présence en Suisse est possible, notamment au sud des Alpes, aucun spécimen n'existe à notre connaissance. Tous les spécimens en collections annoncés sous *P. italicus* (correspondant à ceux cités par Linder (1967) mais aussi à des spécimens dont les données n'ont jamais été diffusées) étaient en réalité, après dissection, des mâles de *P. rufipes* à fascie élytrale noirâtre prononcée. L'espèce n'est donc pas retenue pour la Suisse.

C96) [*Ptinus* (*Bruchoptinus*) *palliatus*]

Matériel examiné. [3)]1 ex., Genève, Jussy, 1.7., coll. Maerky C., det. Bellés X., MHNG.

Commentaire. Cette espèce d'Europe occidentale est connue de la Péninsule ibérique, de France, d'Italie, d'Angleterre, de l'ouest de l'Autriche et d'Allemagne, alors que sa présence est douteuse en Serbie et au Monténégro (Zahradník 2013). Probablement présente sur tout le territoire français (Calmont 2016), elle est potentielle en Suisse également. Elle n'est cependant pas retenue à l'heure actuelle faute d'exemplaire de référence valide, le seul spécimen suisse examiné provenant d'une collection problématique.

C97) *Ptinus* (*Cyphoderes*) *catalonicus*

Matériel examiné. Nombreux spécimens du Valais.

Commentaire. La dissection de nombreux spécimens du sous-genre *Cyphoderes* atteste de la présence de *P. catalonicus* en Valais. Cette espèce semble par contre absente du Tessin et du bassin lémanique, où elle est remplacée par l'espèce voisine *P. bidens*, alors que *P. raptor* se rencontre principalement en montagne, mais aussi parfois sur le Plateau suisse en tant qu'individus importés (Fig. 2). *P. catalonicus* est connu également de la moitié sud de la France, d'Italie et d'Espagne (Allemand and Barnouin 2014, Calmont 2016).

C98) [*Ptinus* (*Cyphoderes*) *schlerethi*]

Données publiées. [2)]Chiasso (Fontana 1925); [2)]Generoso (Fontana 1947).

Commentaire. Cette espèce colonise le sud-est de l'Europe et l'Europe centrale (Zahradník 2013). Bien que citée de Suisse (Fontana 1947), elle ne fait pas partie de notre faune. Tous les spécimens du sous-genre *Cyphoderes* qui ont pu être vérifiés par l'examen des pièces génitales mâles appartenaient en réalité à *P. bidens* ou à *P. catalonicus*.

C99) *Ptinus* (*Gynopterus*) *aubei*

Matériel examiné. [3)]2 ex., Genève, Veyrier, 10.4., coll. Maerky C., MHNG; [3)]1 ex., Jura, Tramelan, 2.6., coll. Maerky C., MHNG; [3)]2 ex., Alpes, Alliaz, 20.7., coll. Maerky C., MHNG; 3 ex., Commugny VD, 23.3.1964, leg. Steffen J., MHNG; 1 ex., Genève, Vandoeuvres, 5.–6.1990, leg. Besuchet C., MHNG; 1 ex., Genève, Corsier, 6.–7.1990, leg. Besuchet C., MHNG; 2 ex., Genève, Chougny, 5.–6.1991, leg. Besuchet C., MHNG; 1 ex., Genève, Collonge, 5.–6.1991, leg. Besuchet C., MHNG; 1 ex., Genève, Corsier, 5.–6.1991, leg. Besuchet C., MHNG; 1 ex., Genève, Presinge-Des., 5.–6.1991, leg. Besuchet C., MHNG; 2 ex., Genève, Presinge, 6.–7.1993, leg. Besuchet C., MHNG.

Commentaire. Cette espèce est annoncée de Croatie, d'Italie, de France, de Slovénie et d'Espagne, ainsi que d'Algérie et de Tunisie. Elle est confirmée en Suisse par plusieurs captures effectuées dans l'ouest du pays. La larve vit dans les galles de chêne (*Quercus* spp.) en décomposition tombées au sol (Calmont 2016).

C100) *Ptinus* (*Gynopterus*) *variegatus*

Matériel examiné. [3)]1 ex., Carouge, coll. Poncy E., MHNG; 3 ex., Chiasso, coll. Fontana P., MSNL; 1 ex., Fusio, coll. Fontana P., MSNL; 2 ex., Generoso, coll. Fontana P., MSNL; [3)]2 ex., Kt. Genf, coll. Linder A., ex coll. Täschler M., ETH; [3)]2 ex., Onex, coll. Maerky C., MHNG; [3)]2 ex., Peney, coll. Maerky C., MHNG; [3)]1 ex., Suisse, coll. Maerky C., ex coll. Melly A., MHNG; [3)]1 ex., Jura, St. Ursanne, 7.1., coll. Maerky C., MHNG; [3)]1 ex., Alpes, Aigle, 2.6., coll. Maerky C., MHNG; 1 ex., Generoso, 20.6., coll. Fontana

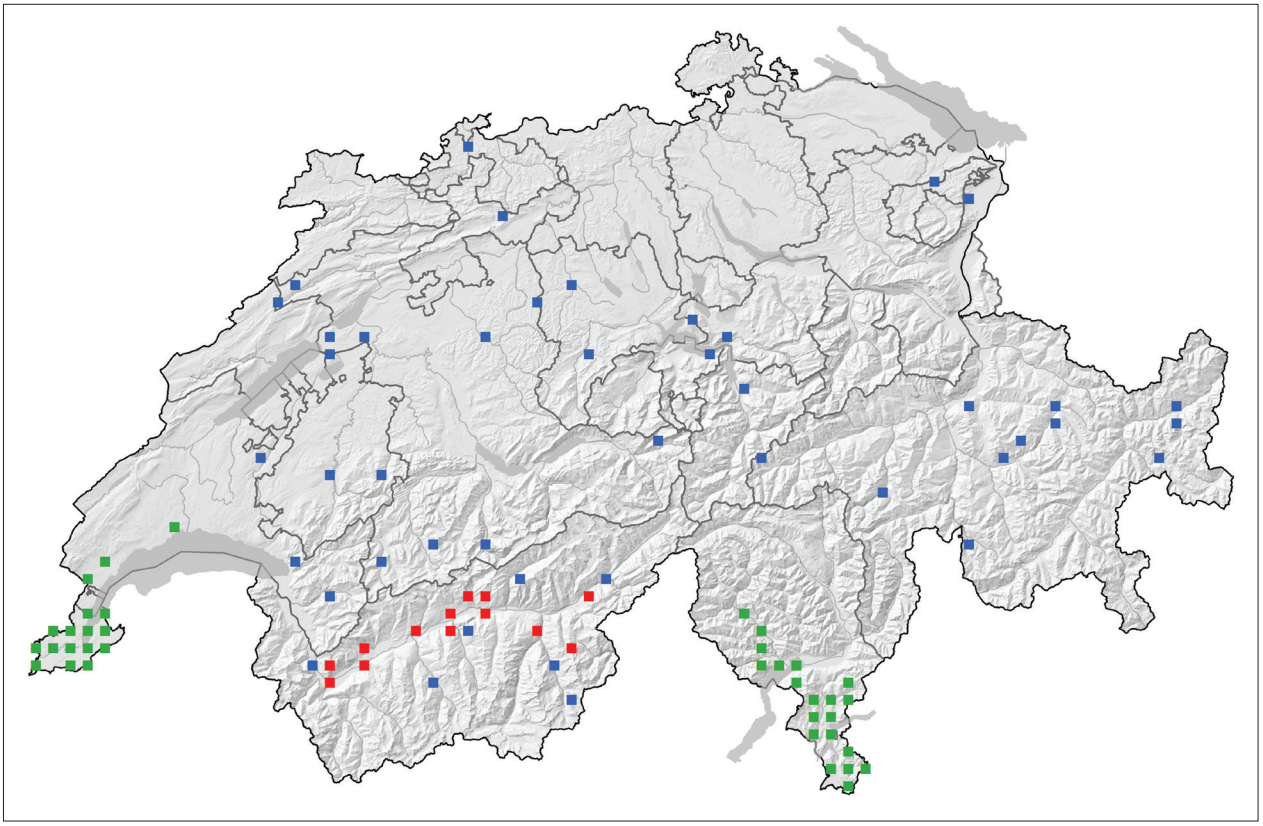


Figure 2. Répartition des espèces de *Ptinus* du sous-genre *Cyphoderes* en Suisse: *Ptinus bidens* (en vert), *P. catalonicus* (en rouge) et *P. raptor* (en bleu). Les limites cantonales suisses sont indiquées.

P., MSNL; [3)]1 ex., Genève, 30.6.1910, coll. Gaud A., MZL; 1 ex., Generoso, 9.6.1927, coll. Fontana P., MSNL; 1 ex., Chiasso, 10.4.1938, coll. Fontana P., MSNL.

Données publiées. [1)]Genf par Tournier H. (Stierlin and Gautard 1867); Chiasso, Generoso et Fusio par Fontana P. (Fontana 1925); [1)]Airolo (Fontana 1947).

Commentaire. Largement répandue à l'échelle paléarctique, cette espèce principalement méridionale n'est retenue pour la Suisse que sur la base de quelques spécimens anciens provenant du Tessin. La dernière capture sur notre territoire date de 1938 à Chiasso.

C101) [*Ptinus* (*Pseudoptinus*) *auberti*]

Matériel examiné. [3,8)]1 ex., Genève, Versoix, 10.6., coll. Maerky C., det. Bellés X., MHNG.

Commentaire. Cette espèce méridionale est citée de Slovénie, de Croatie, de France, d'Italie, d'Espagne et du Portugal. Le seul spécimen «suisse» examiné provient d'une collection problématique qui ne doit pas être considérée. *P. auberti* n'est pas retenu pour la Suisse, et sa présence y est peu probable.

C102) *Ptinus* (*Pseudoptinus*) *capellae*

Matériel examiné. 1 ex., Generoso TI, 22.6.1982, leg. & coll. Scherler P., det. Bellés X., NMBE; 1 ex., Samedan GR, 21.7.1987, leg. & coll. Sauter W., det. Calmont B., ETH; 1 ex., Centovalli TI, 18.10.–20.11.2017, leg. Pollini L. & Abderhalden M., det. Calmont B., coll. Chittaro Y.; 1 ex., Centovalli TI, 22.12.2017–24.01.2018, leg. Pollini L. & Abderhalden M., MSNL.

Commentaire. Cette espèce montagnarde colonise principalement l'est de l'Europe mais atteint à l'ouest l'Italie (notamment le sud-Tyrol italien (Kahlen and Hellrigl 1996)), l'Autriche et la Suisse. En limite d'aire de répartition dans notre pays, elle n'est connue que de deux localités tessinoises (dans la continuité de ses populations du nord de l'Italie) et d'une localité de l'est des Grisons.

C103) *Ptinus* (*Pseudoptinus*) *coarticollis*

Matériel examiné. 1 ex., Il Fuorn, 16.6.1952, leg. & coll. Handschin E., MHNG; 1 ex., Il Fuorn, 20.5.1953, leg. & coll. Handschin E., det. Bellés X., BNM.

Commentaire. Largement répandue dans l'ouest de la région paléarctique, la présence en Suisse de cette espèce rare n'est toutefois attestée que par deux spécimens de l'est des Grisons, capturés à environ 1800 m d'altitude.

C104) *Ptinus* (*Ptinus*) *bicinctus*

Matériel examiné. 1 ex., Il Fuorn, 16.6.1952, leg. & coll. Handschin E., det. Bellés X., MHNG.

Données publiées. [1)]Genf par Tournier H. et [1)] Schaffhausen par Stierlin G. (Stierlin and Gautard 1867); [1)]Büren par Rätzer A. (Rätzer 1888).

Commentaire. En Suisse, seul un spécimen capturé dans l'extrême est des Grisons permet de retenir cette espèce d'Europe centrale et de l'est dans la liste faunistique nationale.

C105) *Ptinus* (*Ptinus*) *calcaratus*

Matériel examiné. 1 ex., Grisons, Sta Maria-Umbrail, 5.8.1974, leg. Besuchet C., det. Zahradník P., MHNG.

Commentaire. Cette espèce colonise le centre et l'est de l'Europe à partir de l'Autriche, de l'Italie et de l'extrême est de la Suisse, d'où provient l'unique exemplaire suisse connu.

C106) [*Ptinus* (*Ptinus*) *perplexus*]

Matériel examiné. [3,8)]2 ex., Genève, coll. Odier J., det. Calmont B., MHNG.

Commentaire. Un mâle et une femelle de *P. perplexus*, étiquetés de Genève, existent au MHNG dans la collection Odier, une collection qui s'est révélée plusieurs fois problématique. Cette espèce méridionale n'est connue que d'Espagne, d'Italie et de France, où elle n'est attestée que des Pyrénéees-Orientales, du Var, du Gard et des Bouches-du-Rhône (Calmont 2016), à plusieurs centaines de kilomètres de la Suisse. Au vu de la grande distance qui sépare la localité suisse des localités les plus proches connues et en fonction de la collection à laquelle appartiennent les spécimens examinés, nous ne retenons pas *P. perplexus* pour la Suisse.

C107) [*Ptinus* (*Ptinus*) *pilosus*]

Données publiées. [1)]Genf par Tournier H. (Stierlin and Gautard 1867).

Commentaire. Bien que l'espèce soit largement répandue en Europe, nous n'avons pas connaissance de spécimens suisses venant confirmer l'unique donnée de littérature. Citée récemment d'Alsace (Callot 2018) et connue du sud de l'Allemagne (Köhler and Klausnitzer 1998), elle reste néanmoins potentielle dans le nord du pays.

C108) [*Ptinus* (*Ptinus*) *podolicus*]

Données publiées. [1)]SZ [Switzerland] (Borowski and Zahradník 2007).

Commentaire. Cette espèce est citée dans le «Catalogue of Palaearctic Coleoptera» de nombreux pays européens, dont la Suisse (Borowski and Zahradník 2007). Nous n'avons cependant pas connaissance de spécimens se référant à cette espèce, si bien que nous ne la retenons pas à l'heure actuelle.

C109) *Ptinus (Ptinus) pusillus*

Matériel examiné. [3)]1 ex., Genève, Vessy, 6.6., coll. Maerky C., det. Bellés X., MHNG; 1 ex., Genève, Jussy, nid de frelons, 18.12.1961, leg. Besuchet C., det. Bellés X., MHNG; 2 ex., Genève, env. Sézegnin, 5.6.1964, leg. Besuchet C., det. Bellés X., MHNG.

Données publiées. [1)]Genf par Tournier H., [1)]Handeck [Handegg] par Bonvouloir H. A. et [1)]Schaffhausen par

Stierlin G. (Stierlin and Gautard 1867); [1)]Bern, [1)]Büren, [1)] Gadmen et [1)]Seeland par Rätzer A. (Rätzer 1888); [1)] Saint-Cergue, 7.6.1953 par Rehfous M. (Rehfous 1955).

Commentaire. Cette espèce ouest-paléarctique anthropophile est largement répandue en France (Allemand and Barnouin 2014) et se trouve dans les greniers, les endroits sombres des habitations et les poulaillers notamment (Calmont 2016). En Suisse, deux données de Genève permettent de la retenir dans la liste faunistique nationale. Citée d'Alsace (Callot 2018) et du sud de l'Allemagne (Köhler and Klausnitzer 1998), elle pourrait également être observée dans le nord du pays.

C110) [*Ptinus* (*Ptinus*) *spitzyi*]

Matériel examiné. [3,8)]2 ex., Kt. Genf, coll. Linder A., ex coll. Täschler M., det. Calmont B., ETH;

Données publiées. [1)]Genf par Tournier H. (Stierlin and Gautard 1867).

Commentaire. Cette espèce méditerranéenne n'est pas retenue pour la Suisse. Les seuls spécimens examinés proviennent d'une collection problématique alors que la citation de la littérature n'est pas vérifiable. En France, elle n'est connue que des Pyrénées-Orientales, de Corse, de l'Ardèche, de la Drôme, du Var et des Alpes-Maritimes (Calmont 2016).

C111) [*Ptinus* (*Ptinus*) *villiger*]

Données publiées. [1)]Ostermundingen, am Fenster meines Hauses, 9.11.1988 par Gfeller W. (Gfeller 1992).

Commentaire. Largement répandue en Europe et en Asie, cette espèce a été citée une fois de Suisse, mais son annonce est invérifiable. *P. villiger* reste donc à confirmer dans notre pays, tout comme en France (Allemand and Barnouin 2014).

C112) [*Ptinus* (*Tectoptinus*) *tectus*]

Matériel examiné. [4,6,8)]1 ex., Basel, Museum, leg. & coll. Handschin E., KMLI; [4,8)]3 ex., Lausanne, VD, dans semoule, 12., leg. Toumayeff G., MHNG; [4,6,8)]3 ex., Bern, 11.1924, leg. Linder A., NMB; [4,6,8)]13 ex., Zürich, Univers., 2.9.1931, 12.3.1932 & 6.4.1932, leg. & coll. Allenspach V., MHNG & NMB; [4,8)]10 ex., Basel, Hopf, in Seide, 10.1933, leg. Handschin E., NMB; [4,6,8)]9 ex., Davos, 28.10.1938 & 15.4.1939, leg. Wolf J. P., ETH; [4,6,8)]23 ex., Genève, Villette, 11.9.1940 & 21.6.1941, leg. & coll. Julliard C., MHNG; [4,6,8)]2 ex., Bern, 1.1944, leg. von Peez A., Museo Civico di Bolzano; [4,6,8)]16 ex., Kt. Bern, Bern, 1.1944, leg. & coll. Linder A., ETH; [4,6,8)]4 ex., Lenz GR, 8.1944, leg. Lautner J., NMB & MHNG; [4,6,8)]1 ex., Lenz GR, 8.1944, leg. Linder A., MHNG; [4,6,8)]8 ex., Basel, 12.1.1949, leg. Wolf J. P., ETH; [4,6,8)]1 ex., Zurich, 10.1951, leg. Toumayeff G., MHNG; [4,6,8)]6 ex., Lausanne, VD, 10.1970, leg. Toumayeff G., MHNG; [4,6,8)]1 ex., St. Gallen, 28.4.1971, leg. & coll. Spälti A., MHNG; [4,6,8)]1 ex., Bertschikon ZH, 27.10.1992, leg. & coll. Anonymous, SPZH; [4,6,8)]4 ex., Basel, Nat. Hist. Museum, 17.11.2008, leg. & coll. Geiser M., NMB & NMBE.

Données publiées. [4,8)]Bern (mit einer Sendung Fischfutter eingeschleppt), 8.1928 (Linder 1937); [6,8)]Villette [GE], dans biscuits pour chiens importés d'Angleterre, 1940 par Julliard C. (Anonyme 1943); [4,6,8)]St. Gallen, Heimatmuseum, 8.1957 par Hugentobler H. (Hugentobler 1966).

Commentaire. Cette espèce cosmopolite, d'origine australienne, a été importée sporadiquement plusieurs fois en Europe, et notamment en Suisse où elle ne semble pas s'être établie.

C113) [*Sphaericus* (*Sphaericus*) *pinguis*]

Matériel examiné. [4,6,8)]80 ex., Genève, camomille, 7.4.1970, leg. Meuwly S., det. Bellés X., MHNG.

Commentaire. Cette espèce, répandue sur le pourtour méditerranéen (Calmont 2016), a été importée occasionellement dans de nombreux pays européens avec des denrées végétales (Zahradník 2013). En Suisse, de nombreux spécimens ont été importés en 1970 avec de la camomille (*Chamaemelum nobile*), mais l'espèce ne s'est pas établie.

C114) [*Trigonogenius globosus*]

Matériel examiné. [4,6,8)]59 ex., Genève, Chêne-Bourg, droguerie (tisanes), 11.1985, 5.2.1986, 18.2.1986, 27.1.1987, 10.2.1987, 9.3.1987, 8.1987, 31.10.1987, 13.1.1988, 25.3.1988, 26.4.1988, 28.5.1988, 9.9.1988, 21.9.1988, 1.1989, 7.2.1989 & 9.10.1989, leg. Standhammer M., det. Besuchet C., MHNG.

Commentaire. Originaire d'Amérique du sud, cette espèce synanthrope a été importée plusieurs fois en Europe. En Suisse, tous les spécimens connus ont été collectés dans une droguerie de Genève entre 1985 et 1989, dans des tisanes notamment. L'espèce n'est pas résidente en Suisse.

C115) [*Lasioderma haemorrhoidale*]

Matériel examiné. [3)]1 ex., Peney, Genève, 21.5., coll. Maerky C., det. Zahradník P., MHNG.

Données publiées. [1)]Schaffhausen par Vogler (Stierlin 1883).

Commentaire. S'il existe bien un spécimen de cette espèce étiqueté de Suisse, celui-ci provient d'une collection problématique et ne doit pas être considéré. Quant à la citation de la littérature, elle est invérifiable. Cette espèce ne fait pas partie de la faune suisse en fonction des éléments à disposition. Présente en Europe centrale et méridionale, elle reste néanmoins potentielle.

C116) [*Lasioderma laeve*]

Données publiées. [1)]SZ [Switzerland] (Borowski and Zahradník 2007).

Commentaire. Bien qu'annoncée de Suisse par Borowski and Zahradník (2007), aucun spécimen se

rapportant à cette espèce n'a été trouvé dans les collections consultées. Ses anciennes citations d'Autriche et de Hongrie se rapportent vraisemblablement à *L. redtenbacheri* (Zahradník 2013), et cela pourrait également être le cas en Suisse. *L. laeve* colonise les régions méditerrannéennes de France, d'Italie, du Portugal et d'Espagne.

C117) [*Metholcus phoenicis*]

Données publiées. [1,7,8]Mt. Rosa (Stierlin 1898).

Commentaire. Seule une citation de littérature, très ancienne et imprécise (le Monte Rosa étant une montagne à cheval entre la Suisse et l'Italie), annonce cette espèce pour la Suisse. Principalement méridionale, elle semble peu probable en Suisse et n'est donc pas retenue.

C118) *Xyletinus* (*Xyletinus*) *fibyensis*

Matériel examiné. [3)]1 ex., Jura, Bienne, 29.6.1907, coll. Maerky C., [ex coll. Mathey A.], det. Zahradník P., MHNG; 1 ex., Genève, 5.1948, leg. Toumayeff G., det. Zahradník P., MHNG.

Commentaire. Cette espèce d'Europe centrale et septentrionale n'est retenue pour la faune suisse que sur la base d'un spécimen mâle provenant de Genève. Le second spécimen examiné provient d'une collection problématique et ne peut pas être considéré.

C119) *Xyletinus (Xyletinus) longitarsis longitarsis*

Matériel examiné. [3)]1 ex., Mte Brè, 14.5., leg. & coll. Anonymous, det. Zahradník P., MHNG; [3)]1 ex., Genève, Cointrin, 7.6., coll. Maerky C., det. Zahradník P., MHNG; [3)]1 ex., Alpes, Sion, 4.7., coll. Maerky C., det. Zahradník P., MHNG; 1 ex., Domleschg, Ro. [Rothenbrunnen], 13.7.1938, leg. Wolf J. P., MHNG; 1 ex., Visperterminen VS, Beichji, 19.5.1996, leg. Reser-Rezbanyai L., NMLU; 1 ex., Fully VS, 1.–14.5.2012, leg. & coll. Chittaro Y., det. Büche B.; 1 ex., Breil/Brigels GR, 1.–27.5.2014, leg. & coll. Chittaro Y., det. Büche B.; 1 ex., Fully VS 11.5.2015, leg. & coll. Chittaro Y., det. Büche B.; 1 ex., Binn VS, 9.6.2015, leg. Germann C., NMSO.

Commentaire. Cette espèce colonise largement l'Europe centrale et septentrionale. Quelques individus mâles provenant de localités valaisannes et grisonnes permettent de retenir *X. longitarsis* pour la Suisse.

C120) [*Xyletinus* (*Xyletinus*) *pectinatus pectinatus*]

Matériel examiné. [3)]1 ex., Bern, coll. Benteli R., det. Zahradník P., NMBE; [3)]1 ex., St. Gallen, coll. Täschler M., det. Zahradník P., MHNG.

Données publiées. [1)]1 ex., Mt. Bré par Meyer-Dür R. (Stierlin 1863–1864); [1)]Basel par Imhof L., [1)]Schaffhausen par Stierlin G. et [1)]Yverdon par Heer O. (Stierlin and Gautard 1867); [1)]Bazenheid (unbelegt) par Rietmann O. (Hugentobler 1966).

Commentaire. La distribution de cette espèce reste à préciser au vu des nombreuses confusions passées avec *X. longitarsis* (Zahradník 2013). Deux spécimens «suisses» existent bien dans les collections consultées, mais ils sont liés à des collections problématiques et ne doivent pas être considérés. Quant aux données de littérature, elles sont invérifiables. Cité d'Alsace (Callot 2018), *X. pectinatus* demeure néanmoins potentiel dans notre pays.

C121) *Xyletinus* (*Xyletinus*) *planicollis*

Matériel examiné. 2 ex., Filisur, 10.5.1934, leg. Wolf J. P., det. Zahradník P., MHNG; 2 ex., Anniviers VS, 7.7.–13.8.2014, leg. & coll. Sanchez A., det. Büche B.

Données publiées. 2 ex., Anniviers VS, 7.7.–13.8.2014 par Sanchez A. (Chittaro and Sanchez 2017).

Commentaire. Quatre exemplaires seulement, de deux localités alpines, sont connus de Suisse pour cette espèce qui colonise principalement l'Europe centrale et septentrionale.

C122) *Xyletinus* (*Xyletinus*) *vaederoeensis*

Matériel examiné. 4 ex., Gudo, Demanio TI, 1.–10.6.1981, leg. Reser-Rezbanyai L., 1 ex., Gudo, Demanio TI, 1.–10.6.1982, leg. Reser-Rezbanyai L., NMLU; 1 ex., Tessin, Gudo, 6.1988, leg. Brunetti R., MHNG.

Commentaire. Quelques spécimens mâles, capturés à l'aide de pièges lumineux au Tessin, permettent de retenir cette espèce pour la Suisse. *X. vaederoeensis* n'était cité que de Bulgarie, de République Tchèque, d'Allemagne, de Slovaquie, de Suède et de Chypre.

C123) *Derodontus macularis*

Matériel examiné. 1 ex., Rossinière, 18.10.1964, leg. Besuchet C., coll. Scherler P., NMBE.

Données publiées. 1 ex., Saint-Gingolphe VS, 4.2007 par Blanc M. (Blanc 2009).

Commentaire. Seulement deux données sont connues en Suisse pour cette espèce rare et discrète qui se rencontre essentiellement en automne et en hiver sur les carpophores *d'Ischnoderma* spp., et plus particulièrement d'*I. benzoinum* (Dodelin 2004). *D. macularis* colonise presqu'exclusivement des parcelles forestières quasi-inexploitées (Dodelin B., comm. pers.).

Discussion

Cette liste commentée s'inscrit dans la continuité des synthèses réalisées au cours des dernières années sur diverses familles de Coléoptères (Marggi and Luka 2001, Carron 2005, Carron 2008, Luka et al. 2009, Germann 2010, Chittaro and Blanc 2012, Reibnitz et al. 2013, Monnerat et al. 2015b, Breitenmoser et al. 2016, Chittaro and Sanchez 2016b, Cosandey et al. 2017, Sanchez and Chittaro 2018, Chittaro and Sanchez 2019) et contribue à améliorer nos connaissances sur la faune de Suisse. Elle fournit, avec les cartes de distribution basées sur les données récoltées

(disponibles sur le serveur cartographique d'info fauna – CSCF, www.cscf.ch), une synthèse des connaissances actuelles disponibles sur les espèces appartenant aux superfamilles des Bostrichoidea et des Derodontoidea.

Nos connaissances sur leur distribution et leur écologie reposent sur des bases solides et peuvent être considérées comme bonnes. Certaines espèces sont cependant nettement moins bien documentées. C'est particulièrement le cas des espèces de plusieurs genres de Ptinidae (*Dorcatoma* spp., *Stagetus* spp., *Xyletinus* spp., *Ernobius* spp. notamment) qui sont à la fois discrètes (petite taille, activité nocturne, parfois phénologie décalée dans l'année, sporadique …) et dont l'identification est complexe et passe généralement par l'examen des pièces génitales mâles. Des recherches ciblées au cours des prochaines années et la dissection systématique des individus capturés permettront peut-être de confirmer l'indigénat de certaines espèces considérées actuellement comme douteuses, voire de découvrir quelques espèces supplémentaires pour notre pays.

Plusieurs espèces indigènes n'ont ainsi été découvertes que très récemment en Suisse (*Dorcatoma androgyna*, voir Chittaro and Sanchez (2016a); *Anitys rubens*, voir Chittaro and Sanchez (2018)) et une a même été décrite sur la base d'un individu de Suisse (*Globicornis luckowi*, voir Herrmann et al. (2011)). La Suisse porte une responsabilité élevée pour la conservation de ces espèces rares à l'échelle européenne, ainsi que pour de nombreux taxa strictement alpins ou boréoalpins, à l'instar de *Cacotemnus thomsoni*, d'*Episernus angulicollis*, d'*Episernus taygetanus alpestris*, d'*Ernobius explanatus phobos* et de *Stagetus borealis*.

D'autres espèces, résultant d'importations à partir d'autres régions du monde à la suite d'échanges commerciaux, viendront peut-être aussi rallonger à l'avenir la liste des espèces résidentes en Suisse. Les Bostrichidae et les Dermestidae notamment possèdent un fort potentiel invasif et comptent déjà un grand nombre d'espèces cosmopolites (Denux and Zagatti 2010, Geis 2014). S'il est souvent difficile de retracer l'historique de la colonisation et de la provenance de telles espèces, quelques-unes d'aspect caractéristique sont toutefois bien documentées. C'est le cas du Ptinidae *Niptus hololeucus* décrit d'Asie-Mineure et devenu presque cosmopolite avec des premières observations documentées en 1837 en Angleterre, en 1840 en Allemagne, en 1855 en France (synthèse dans Calmont 2016) et en 1862 en Suisse (Dietrich 1865). D'autres acquisitions pour notre faune sont plus récentes et datent du siècle dernier, à savoir *Anthrenocerus australis*, *Attagenus smirnovi*, *Attagenus unicolor*, *Dermestes haemorrhoidalis*, *Lasioderma serricorne*, *Lyctus brunneus*, *L. cavicollis*, *Nicobium castaneum*, *Reesa vespulae* et *Trogoderma angustum*. La plupart d'entre elles sont préférentiellement voire exclusivement synanthropes et occasionnent parfois des dégâts aux denrées alimentaires stockées, aux bois ouvrés, ainsi qu'à divers matériaux d'origine végétale ou animale entreposés dans des locaux (Lepesme 1944, Delobel and Tran 1993, Hagstrum et al. 2013). Mais quelques-unes sont également capables de s'établir en nature et peuvent menacer nos espèces indigènes. Geis (2014) constate ainsi le recul simultané des observations de *Lyctus linearis*, autochtone en Europe, et l'expansion de *L. cavicollis*, originaire d'Amérique du Nord. Concurrencé dans ses habitats naturels par *L. cavicollis*, *L. linearis* est aussi remplacé en milieu urbain par *L. brunneus* (Lan-Yu and Geis 2019) d'origine asiatique. Cela semble également être le cas en Suisse et *L. linearis*, pourtant largement répandu par le passé, n'a pratiquement plus été signalé au cours des cinquante dernières années. Ces changements faunistiques doivent être suivis avec attention.

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Références

Aistleitner E, Kapp A (2008) Fragmenta entomofaunistica IX. Coleopterologische Miscellen. Käferdaten aus Vorarlberg, Austria occ., und Liechtenstein sowie Streudaten aus dem grenznahen Graubünden (CH) (Insecta, Coleoptera). Entomofauna, Zeitschrift für Entomologie 29(8): 125–144.*

Allemand R (2011a) Présence en France de *Ptinus* (*Cyphoderes*) *schlerethi* Reitter, et commentaires sur les espèces voisines (Coleoptera, Ptinidae). Bulletin de la Société Entomologique de France 116(2): 185–190.

Allemand R (2011b) Rectificatif sur la présence en France de *Ptinus* (*Cyphoderes*) *schlerethi* Reitter (Coleoptera, Ptinidae). Bulletin de la Société Entomologique de France 116(4): 509–510.

Allemand R, Barnouin T (2014) Ptinidae. In: Tronquet M (Ed.) Catalogue des Coléoptères de France. Perpignan, Association Roussillonnaise d'Entomologie, 453–463.

Allemand R, Laclos de E, Büche B, Ponel P (2008) Anobiidae nouveaux ou méconnus de la faune de France (3e note) (Coleoptera). Bulletin de la Société Entomologique de France 113(3): 397–402.

Allenspach V (1948) Käferfang mit der Quecksilberdampflampe. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 21: 210–212.*

Allenspach V (1968) Käferfang am Schmetterlingsschirm in Minusio/TI. Mitteilungen der Entomologischen Gesellschaft Basel 18: 125–133.*

Allenspach V (1971) Käferfang am Schmetterlingschirm in Minusio/Tessin (Erster Nachtrag). Mitteilungen der Entomologischen Gesellschaft Basel 21: 110–114.*

Allenspach V (1978) Fünfter Beitrag zur Coleopteren-Fauna der Schweiz von Arthur Linder. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 51: 407–410.

Alonso C (2014) Dermestidae. In: Tronquet M (Ed.) Catalogue des Coléoptères de France. Perpignan, Association Roussillonnaise d'Entomologie, 446–451.

Anonyme (1943) Société Lépidoptérologique de Genève. Captures intéressantes faites en 1940. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 19: 233–234.

Basset Y (1985) Les peuplements d'Arthropodes sur *Pinus mugo* Turra dans les tourbières du Haut-Jura neuchâtelois. Bulletin de la Société Neuchâteloise des Sciences Naturelles 108: 63–76.*

Bathon H (2014) *Ozognathus cornutus* (LeConte, 1859), ein für Mitteleuropa neue Pochkäfer. Mitteilungen des Internationalen Entomologischen Vereins Frankfurt a. M. 39(1): 31–34.

Bellés X (1990) Coleoptera Ptinidae, Gibbinae. Fauna Ibérica, vol. 0. Museo Nacional de Ciencias Naturales, CSIC. Madrid, 43 pp.

Bercedo P, Coello P, Arnáiz L, Baena M (2005) *Ozognathus cornutus* (LeConte, 1859) nuevo anóbido para la fauna ibérica (Coleoptera: Anobiidae). Boletín de la Sociedad Entomológica Aragonesa 37: 213–214.

Bell KL, Philips TK (2012). Molecular systematics and evolution of the Ptinidae (Coleoptera: Bostrichoidea) and related families. Zoological Journal of the Linnean Society 165(1): 88–108. https://doi.org/10.1111/j.1096-3642.2011.00792.x

Besuchet C, Reuteler C, Merz B (2012) Superfamille Bostrichoidea. In: Merz B (Ed.) Liste Annotée des Insectes (Insecta) du Canton de Genève. Instrumenta Biodiversitatis, Muséum d'histoire naturelle, Genève, 142–145.

Bischoff-Ehinger A (1870) Reise in die italienischen Hochgebirge des Piemonts. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 3(4): 159–175.*

Blanc M (2009) *Derodontus macularis* (Fuss, 1850) – Coléoptère mycétophage nouveau pour la faune de Suisse (Coleoptera, Derodontidae). Entomo Helvetica 2: 282–283.

Borowski J (2007) Bostrichidae. In: Löbl I, Smetana A (Eds) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea – Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 320–328.

Borowski J, Węgrzynowicz P (2007) World Catalogue of Bostrichidae (Coleoptera). Wydawnictwo Mantis, Olsztyn, 248 pp.

Borowski J, Zahradník P (2007) Ptinidae. In: Löbl I, Smetana A (Eds) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea – Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 328–362.

Bouchard P, Bousquet Y, Davies A, Alonso-Zarazaga M, Lawrence J, Lyal C, Newton A, Reid C, Schmitt M, Slipinski A, Smith A (2011) Family-group names in Coleoptera (Insecta). ZooKeys 88: 1–972. https://doi.org/10.3897/zookeys.88.807

Brandstetter CM, Kapp A (1998) Käferinventar von Vorarlberg und Liechtenstein. Insecta: Coleoptera. Eigenverlag des Ersten Vorarlberger Coleopterologischen Vereins, Bürs, 92 pp.

Breitenmoser S (2017) Les chênes séculaires de Duillier (VD): un sanctuaire pour des Coléoptères saproxyliques exceptionnels. Bulletin de la Société Vaudoise des Sciences Naturelles 96: 49–76.*

Breitenmoser S, Chittaro Y, Sanchez A (2016) Liste commentée des Oedemeridae (Coleoptera) de Suisse. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 89: 73–92.

Bremi-Wolf JJ (1856) Catalog der Schweizerischen Coleopteren, als Vorläufer der Beiträge für Schweizerische Entomologie. Druck und Commission von Friedrich Schulthess, Zürich, 78 pp.

Brustel H (2014) Bostrichidae. In: Tronquet M (Ed.) Catalogue des Coléoptères de France. Perpignan, Association Roussillonnaise d'Entomologie, 451–453.

Brustel H, Gouix N, Bouyon H, Rogé J (2013) Les *Stephanopachys* de la faune ouest-paléarctique (Coleoptera Bostrichidae): distribution et reconnaissance des trois espèces françaises au service de l'application de la directive Habitats, Faune, Flore. L'Entomologiste 69(1): 41–50.

Büche B (2001) A new fungivorous Deathwatch-beetle from Europa (Coleoptera, Anobiidae). Entomologische Blätter 96(3): 229–234.

Büche B, Möller G (2005) Rote Liste und Gesamtartenliste der holzbewohnenden Käfer (Coleoptera) von Berlin mit Angaben zu weiteren Arten. In: Der Landesbeauftragte für Naturschutz und Landschaftpflege / Senatsverwaltung für Stadtentwicklung (Eds). Rote Liste der gefährdeten Pflanzen und Tiere von Berlin, CD-ROM.

Caflisch JL (1894) Beiträge zu einem Verzeichnisse der Insecten-Fauna Graubündens von Dr. E. Killias. IV: Coleopteren. Supplement/Beilage zu Jahresbericht der Naturforschenden Gesellschaft Graubündens, 275 pp.

Callot H (2018) Liste de référence des Coléoptères d'Alsace. Société Alsacienne d'Entomologie, version du 30-IX-2018, 107 pp.

Calmont B (2016) Coléoptères Gibbinae et Ptininae de France. Arvensis, hors-série 2, 202 pp.

Carron G (2005) Kommentierte Checkliste der Dytiscidae und Noteridae (Coleoptera) der Schweiz. Mitteilungen der Entomologischen Gesellschaft Basel 55(3): 93–114.

Carron G (2008) Checklist des coléoptères aquatiques de Suisse. Deuxième partie: Gyrinidae, Haliplidae, Paelobiidae, Sphaeriusidae. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 81: 53–60.

Chittaro Y, Blanc M (2012) Liste commentée des Cerophytidae, Elateridae, Eucnemidae et Throscidae (Coleoptera) de Suisse. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 85: 91–114.

Chittaro Y, Sanchez A (2016a) Inventaire des Coléoptères saproxyliques d'un site exceptionnel: la Châtaigneraie de Fully (VS). Bulletin de la Murithienne 133: 13–27.

Chittaro Y, Sanchez A (2016b) Liste commentée des Tenebrionoidea (Coleoptera) de Suisse. Partie 1: Aderidae, Anthicidae, (Boridae), Melandryidae, Meloidae, Mycetophagidae, Mycteridae, Prostomidae, Pyrochroidae, Pythidae, Ripiphoridae, Salpingidae, Tenebrio-

nidae, Tetratomidae, Zopheridae. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 89: 183–235.

Chittaro Y, Sanchez A (2017) A propos de quelques Coléoptères rares ou nouveaux pour la Suisse. Entomo Helvetica 10: 45–53.

Chittaro Y, Sanchez A (2018) *Limoniscus violaceus* (P. W. J. Müller, 1821), *Anitys rubens* (J. J. Hoffmann, 1803) et *Philothermus evanescens* (Reitter, 1876), trois Coléoptères «reliques de forêts primaires» nouveaux pour la Suisse. Entomo Helvetica 11: 9–15.

Chittaro Y, Sanchez A (2019) Liste commentée des Cleroidea (Coleoptera) de Suisse. Alpine Entomology 3: 141–167. https://doi.org/10.3897/alpento.3.35994

Chittaro Y, Sanchez A, Blanc M, Monnerat C (2013) Coléoptères capturés en Suisse par pièges attractifs aériens: bilan après trois années et discussion de la méthode. Entomo Helvetica 6: 101–113.*

Cosandey V, Chittaro Y, Sanchez A (2017) Liste commentée des Scarabaeoidea (Coleoptera) de Suisse. Alpine Entomology 1: 57–90. https://doi.org/10.3897/alpento.1.21179

Cusimano C, Cerasa G, Lo Verde G, Massa B (2014) *Ozognathus cornutus* (LeConte, 1859) (Coleoptera, Anobiidae) new record for Italy. Naturalista siciliano Serie 4, 38(1): 131–132.

Cymorek S (1969) Lyctidae & Bostrychidae, In: Freude H, Harde KW, Lohse GA (Eds) Die Käfer Mitteleuropas. Band 8. Teredilia, Heteromera, Lammelicornia. Goecke, Evers, Krefeld, 7–27.

Dietrich K (1865) Beitrag zur Kenntnis der Insekten-Fauna des Kantons Zürich. Käfer. Neue Denkschriften der allgemeinen schweizerischen Gesellschaft für die gesammten Naturwissenschaften 21: 1–240.

Delobel A, Tran M (1993) Les Coléoptères des denrées alimentaires entreposées dans les régions chaudes. Faune tropicale XXXII. Orstom / CTA Editions, Paris, 425 pp.

Denux O, Zagatti P (2010) Coleoptera families other than Cerambycidae, Curculionidae sensu lato, Chrysomelidae sensu lato and Coccinelidae. Chapter 8.5. BioRisk 4: 315–406. https://doi.org/10.3897/biorisk.4.61

Dodelin B (2004) *Derodontus macularis* Fuss: un Coléoptère mycétophage nouveau pour la faune de France (Derodontidae). Bulletin de la Société entomologique de France 109(5): 499–505.

Dodelin B (2016) Sur les *Episernus* Paléarctiques (Col., Ptinidae, Ernobiinae). Bulletin mensuel de la Société linnéenne de Lyon 85(9–10): 278–302.

Dodelin B, Bouyon H (2017) Un nouvel *Episernus* des Alpes françaises (Col., Ptinidae, Ernobiinae). Bulletin mensuel de la Société linnéenne de Lyon 86(7–8): 251–254.

Español F (1992) Coleoptera, Anobiidae. Fauna Ibérica, vol. 2. Museo Nacional de Ciencias Naturales, CSIC, Madrid, 195 pp.

Favre E (1890) Faune des Coléoptères du Valais et des régions limitrophes. Zurcher, Furrer, 448 pp.

Focarile A (1984) Nuove ricerche sui popolamenti di coleotteri nel Ticino settentrionale – Campagne 1979–1982. Bolletino della Società Ticinese di Scienza Naturali 72: 7–55.*

Focarile A (1988) Ricerche sui Coleotteri del Parco alpino della Val Piora (Ticino, Svizzera). Bolletino della Società Ticinese di Scienza Naturali 76: 61–89.*

Focarile A (2003) Ecologia e faunistica degli insetti (particolarmente Coleotteri) nell'ecosistema alluviale della Val Bavona (Ticino, Svizzera). Rapporto Fondazione Valle Bavona, Cavergno, 85 pp.*

Fontana P (1925) Contribuzione alla Fauna coleotterologica ticinese III. Bolletino della Società Ticinese di Scienza Naturali 19: 32–56.

Fontana P (1929) Note di Entomologia crepuscolare. Bolletino della Società Ticinese di Scienza Naturali 24: 121–127.*

Fontana P (1947) Contribuzione alla fauna coleotterologica ticinese. Bolletino della Società Ticinese di Scienza Naturali 42: 16–94.

Foster CW, Holloway GJ (2015) *Anthrenus* (*Anthrenus*) *angustefasciatus* (Coleoptera: Dermestidae), a species new to Britain. British Journal of Entomology and Natural History 28: 47–51.

Freude A (1969) Ptinidae. In: Freude H, Harde KW, Lohse GA (Eds) Die Käfer Mitteleuropas. Band 8. Teredilia, Heteromera, Lammelicornia. Goecke, Evers, Krefeld, 60–74.

Frey-Gessner E (1900a) Liste des Coléoptères et des lépidoptères intéressants notés par M. le chanoine E. Favre. Bulletin de la Murithienne 29–30: 73–77.*

Frey-Gessner E (1900b) Souvenirs d'excursions d'un entomologiste dans le Val d'Anniviers. 1865–1900. Bulletin de la Murithienne 29–30: 66–72.*

Fuessly JC (1775) Verzeichnis der ihm bekannten schweizerischen Insekten mit einer ausgemahlten Kupfertafel, nebst der Ankündigung eines neuen Insekten Werks. Zürich und Wintherthur, Heinrich Steiner und Companie, 62 pp.* https://doi.org/10.5962/bhl.title.65772

Gaud A (1904) Binn. Course du 27 juillet au 1er août 1903. Bulletin de la Murithienne 33: 55–59.*

Gehrig J (1965) Neue Käferfunde im Allschwilerwald. Mitteilungen der Entomologischen Gesellschaft Basel 15(3): 41–43.*

Geis K-U (2002) Gebietsfremde Splintholz- und Bohrkäfer, nach Mitteleuropa mit Importholz und anderen Gütern eingeschleppt. Eine Bestandsaufnahme (Coleoptera: Lyctidae, Bostrichidae). Mitteilungen des internationalen Entomologischen Verein e. V. (Frankfurt a. M.) Supplement 10, 100 pp.

Geis K-U (2014) Invasive faunenfremde Arten der Bostrichidae (Coleoptera) in Europa – mit Richtigstellungen und Anmerkungen zu den Ergebnissen des DAISIE-Projekts. Mitteilungen des internationalen Entomologischen Verein e. V. (Frankfurt a. M.) 39: 209–232.

Germann C (2010) Die Rüsselkäfer (Coleoptera, Curculionoidea) der Schweiz – Checkliste mit Verbreitungsangaben nach biogeografischen Regionen. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 83: 41–118.

Germann C, Schmidt M (2017) Erstes Auftreten von *Ozognathus cornutus* (LeConte, 1859) in der Schweiz (Coleoptera, Ptinidae). Entomologische Nachrichten und Berichte 61(2): 151–153.

Germann C, Schneppat U, Herger P (2014) *Trogoderma angustum* (Solier, 1849) (Coleoptera, Dermestidae) – Nachweise aus der Schweiz. Entomo Helvetica 7: 93–97.*

Gfeller W (1992) Bemerkenswerte Käferfunde in der Schweiz, insbesondere in den Jahren 1988 bis 1992. 3. Beitrag zur Faunistik und Ökologie der Käfer in der Schweiz. Mitteilungen der Entomologischen Gesellschaft Basel 42(4): 163–168.

Gollkowski V (2011) *Attagenus punctatus* (Scopoli, 1772) (Coleoptera, Dermestidae) in der Schweiz. Entomologische Nachrichten und Berichte 55: 267.*

Gottwald J (1971) Die mitteleuropäischen Arten aus der Verwandtschaft von *Ernobius explanatus* Mannerheim (Coleoptera, Anobiidae). Ergebnisse der wissenschaftlichen Untersuchungen im Schweizerischen Nationalpark 11: 168–173.

Graf E (1981) Splintholzkäfer in der Schweiz. Schweizerische Schreinerzeitung 51: 1212–1218.

Graf R (2016) *Dorcatoma* (*Dorcatoma*) *lomnickii* Reitter, 1903 (Coleoptera, Ptinidae, Anobiinae) neu für die Fauna der Schweiz. Entomo Helvetica 9: 139–142.

Hagstrum DW, Klejdysz T, Subramanyam B, Nawrot J (2013) Atlas of stored-product insectes and mites. AACC International Press, USA, 589 pp. https://doi.org/10.1016/B978-1-891127-75-5.50009-5

Handschin E (1963) Die Coleopteren des schweizerischen Nationalparkes und seiner Umgebung. Ergebnisse der wissenschaftlichen Untersuchungen im schweizerischen Nationalpark. Band VIII. Lüdin, Liestal, 302 pp.

Hartmann K, Sprecher E (1990) Ein Beitrag zur Insektenfauna des Arlesheimer Waldes, unter besonderer Berücksichtigung der holzbewohnenden Käfer. Tätigkeitsberichte Naturforschende Gesellschaft Baselland 36: 75–124.*

Háva J (2003a) Notes on Dermestidae (Coleoptera) with description of eight new species. Annales Historico-Naturales Musei Nationalis Hungarici 95: 19–35.

Háva J (2003b) World Catalogue of the Dermestidae (Coleoptera). Studie a zprávy oblastního muzea Praha-východ v Brandýse nad Labem a Staré Boleslavi, Supplementum 1, 196 pp.

Háva J (2007a) Dermestidae. In: Löbl I, Smetana A (Eds) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea – Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 299–320.

Háva J (2007b) Derodontidae. In: Löbl I, Smetana A (Eds) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea –Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 298–299.

Háva J (2015) World Catalogue of Insects.Volume 13. Dermestidae (Coleoptera). Leiden/Boston: Brill, 419 pp. https://doi.org/10.1163/9789004286610

Háva J (2018) World Catalogue of the Dermestidae (Coleoptera). http://dermestidae.wz.cz/world-dermestidae/

Háva J (2019) *Dermestes* (*Dermestinus*) *szekessyi kazakh* ssp. nov., a new subspecies from East Kazakhstan (Coleoptera: Dermestidae: Dermestinae). Boletín de la Real Sociedad Española de Historia Natural 113: 1–3.

Háva J, Bornand P (2013) *Attagenus incognitus* Háva 2003 new species for Switzerland (Coleoptera: Dermestidae). Arquivos Entomolóxicos 9: 51–52.

Háva J, Herrmann A (2014) New Faunistic Records of Dermestidae (Coleoptera) – Part 10. Mitteilungen des Internationalen Entomologischen Vereins 39: 1–10.

Háva J, Herrmann A (2018) New faunistic records and remarks on Dermestidae (Coleoptera) – Part 17. Folia Heyrovskyana, series A, 26(1): 13–18.

Háva J, Herrmann A, Kadej M (2013) New faunistic record of Dermestidae (Coleoptera) – Part 7. Arquivos Entomoloxicos 8: 135–140.

Heer O (1841a) Die Kaefer der Schweiz, mit besonderer Berücksichtigung ihrer geographischen Verbreitung. Erster Theil, Dritte Lieferung. Petitpierre, Neuchatel, 79 pp.

Heer O (1841b) Fauna coleopterorum helvetica. Pars 1. Turici: Impensis Orelii, Fuesslini et Sociorum, 652 pp.*

Herger P (1981) Zur Insektenfauna des Siedereiteiches bei Hochdorf, Kanton Luzern. VI. Coleoptera (Käfer) – 1. Teil. Entomologische Berichte Luzern 5: 74–82.*

Herger P (1982) Zur Insektenfauna vom Pilatus-Kulm, 2060 m, Kanton Nidwalden. III. Coleoptera (Käfer) – 1. Teil. Entomologische Berichte Luzern 8: 48–56.*

Herger P (1983a) Zur Insektenfauna der Umgebung von Baldegg, Kanton Luzern. Baldegg-Institut. III. Coleoptera 1 (ohne Staphylinidae und Curculionidae) (Käfer). Entomologische Berichte Luzern 10: 69–74 u. Anhang, 81–88.*

Herger P (1983b) Zur Insektenfauna der Umgebung von Ettiswil, Kanton Luzern. III. Coleoptera 1 (ohne Staphylinidae und Curculionidae) (Käfer). Entomologische Berichte Luzern 10: 75–80 u. Anhang, 81–88.*

Herger P (1986) Zur Insektenfauna von Rigi-Kulm, 1600–1797 m, Kanton Schwyz. IV. Coleoptera 1: Carabidae – Scolytidae (ohne Staphylinidae). Entomologische Berichte Luzern 15: 1–11.*

Herger P (1987) Zur Insektenfauna von Gersau-Oberholz, Kanton Schwyz. IV. Coleoptera 1: Carabidae – Scolytidae (ohne Staphylinidae und Chrysomelidae). Entomologische Berichte Luzern 17: 1–19.*

Herger P (1991) Zur Insektenfauna von Obergütsch (500–600 m), Stadt Luzern. V. Coleoptera 3 (ohne Staphylinidae, Elateridae und Curculionidae). Entomologische Berichte Luzern 25: 27–40.*

Herger P (1992) Zur Insektenfauna vom Vogelmoos (775 m) bei Neudorf, Kanton Luzern. VI. Coleoptera 1 (ohne Staphylinidae, Elateridae, Chrysomelidae u. Curculionidae). Entomologische Berichte Luzern 28: 45–60.*

Herger P (1993) Zur Insektenfauna vom Airolo, Lüvina, 1200 m, Kanton Tessin. IV. Coleoptera 1: (ohne Nitidulidae, Cryptophagidae, Chrysomelidae). Entomologische Berichte Luzern 30: 13–30.*

Herger P (1994) Die Käfersammlung von Josef Roos (1908–1992) – Ein Beitrag zur Käferfauna der Talschaft Entlebuch, Kanton Luzern (Coleoptera). Entomologische Berichte Luzern 32: 1–12.*

Herger P (1995) Käfer aus einer Lichtfalle bei Wädenswil, Sandhof, 518 m, Kanton Zürich (Coleoptera). Entomologische Berichte Luzern 34: 13–18.*

Herger P (1998) Zur Insektenfauna des Kantons Schaffhausen (Hallau-Egg und Löhningen). III. Coleoptera (Käfer). Entomologische Berichte Luzern 39: 113–126.*

Herger P (1999a) Zur Insektenfauna vom Hochmoor Forenmoos, 970 m, Eigental, Kanton Luzern. IV. Coleoptera (Käfer). Entomologische Berichte Luzern 41: 1–16.*

Herger P (1999b) Zur Käferfauna im Entlebuch, Kanton Luzern: Käferfänge in Doppelschwand, Aebnetgüetli 850 m (Coleoptera). Entomologische Berichte Luzern 41:17–22.*

Herger P (2000) Heimliche Untermieter. Rückblick auf 25 Jahre Ungeziferbestimmungsdienst im Natur-Museum Luzern. Entomologische Berichte Luzern 43: 1–10.*

Herger P (2002) Zur Insektenfauna vom Rüss-Spitz (Kanton Zug), 388 m, bei Maschwanden ZH. V. Coleoptera 1 (Käfer). Entomologische Berichte Luzern 47: 1–24.

Herger P (2004) Zur Insektenfauna vom Hanenriet bei Giswil, 470 m, Kanton Obwalden. III. Coleoptera 1 (Käfer). Entomologische Berichte Luzern 51: 1–18.*

Herger P (2005) Zur Insektenfauna des Flachmoores Wauwilermoos, 498 m, Kanton Luzern. III. Coleoptera 1 (Käfer). Entomologische Berichte Luzern 53: 1–20.*

Herger P (2006) Zur Insektenfauna von Altdorf und Umgebung, Kanton Uri. 2. Reussdelta bei Seedorf, 435 m. IV. Coleoptera 2: Allgemeiner Überblick und Artenliste 2. Teil (ohne Staphylinidae und Curculionidae). Entomologische Berichte Luzern 55: 1–20.*

Herger P (2007a) Zur Insektenfauna der Umgebung von Lauerz, Kanton Schwyz. 1. Sägel (455 m) und Schuttwald (480 m). VII. Coleoptera 2: Allgemeiner Überblick und Artenliste 2. Teil (ohne Staphylinidae und Curculionidae). Entomologische Berichte Luzern 57: 47–70.*

Herger P (2007b) Zur Insektenfauna der Umgebung von Lauerz, Kanton Schwyz. 2. Schwändi (650m). V. Coleoptera 2: Allgemeiner Überblick und Artenliste 2. Teil (ohne Staphylinidae und Curculionidae). Entomologische Berichte Luzern 57: 71–78.*

Herger P, Germann C (2014) Käfer aus Lichtfallenfängen in Ufhusen und Luthern, Kanton Luzern (Coleoptera). Entomo Helvetica 7: 147–150.*

Herger P, Germann C (2015) Käfer (Coleoptera) vom östlichen Napfgebiet (Romoos und Umgebung), Kanton Luzern. Entomo Helvetica 8: 59–64.*

Herger P, Uhlig M (1990) Zur Insektenfauna von Hospental, Kanton Uri. III. Coleoptera (Käfer). Entomologische Berichte Luzern 23: 15–22.*

Herger P, Germann C, Uhlig M., Vogel J, Geiser M, Kirejtshuk A (2015) Käfer aus Lichtfängen am Monte San Giorgio bei Serpiano, Kanton Tessin (Coleoptera). Entomo Helvetica 8: 89–96.

Herrmann A, Háva J (2006) Die Einwanderer *Anthrenocerus australis* (Hope, 1843) und *Attagenus smirnovi* Zhantiev, 1973 (Coleoptera: Dermestidae) nun auch aus der Schweiz gemeldet. Entomologische Berichte Luzern 55: 43–44.

Herrmann A, Háva J, Kadej M (2011) A new species of *Globicornis* Latreille in Cuvier (Coleoptera: Dermestidae: Megatominae) from Switzerland. Studies and Reports, Taxonomical Series 7(1–2): 141–145.

Heyden von L (1863) Beitrag zur Coleopterenfauna des Ober-Engadins, insbesondere der Umgegend von St. Moritz. Jahresberichte der naturforschenden Gesellschaft Graubündens 8: 1–52.

Heyden von L (1864) Nachtrag zum Beitrag der Coleopterenfauna des Ober-Engadins, insbesondere der Umgegend von St. Moritz. Jahresberichte der naturforschenden Gesellschaft Graubündens 9: 1–16.*

Heyden von L (1871) Supplement zum Beitrag der Coleopterenfauna des Ober-Engadins, insbesondere der Umgegend von St. Moritz. Jahresberichte der naturforschenden Gesellschaft Graubündens 16: 27–49.*

Huber B, Büche B (2014) Vielfalt der Totholzkäferfauna im Urwald Scatlè, Breil/Brigels (Schweiz, Graubünden) (Coleoptera). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 87: 311–326.*

Hugentobler H (1954) Ein eingenartiger Biotop einiger seltener Käfer. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 27: 161–162.*

Hugentobler H (1959) Beitrag zur Kenntnis der Käferfauna des Thurgaus. Mitteilungen der Thurgauischen Naturforschenden Gesellschaft 38: 5–116.

Hugentobler H (1966) Beitrag zur Kenntnis der Käfer der Nordostschweiz. Naturwissenschaftlichen Gesellschaft St. Gallen, 248 pp.

Ivie MA (2010) Additions and corrections to Borowski and Wegrzynowicz's world catalogue of Bostrichidae (Coleoptera). Zootaxa 2498: 28–46. https://doi.org/10.11646/zootaxa.2498.1.2

Jaccard H (1890) Catalogue des Coléoptères récoltés à Aigle et environs. Bulletin de la Murithienne 19–20: 21–60.

Jörger JB (1914) Ein Beitrag zur Coleopteren-Fauna des Rigi. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 12: 190–193.*

Juillerat P, Bäumler B, Bornand C, Gygax A, Jutzi M, Möhl A, Nyffeler R, Sager L, Santiago H, Eggenberg S (2017) Checklist 2017 der Gefässpflanzenflora der Schweiz / de la flore vasculaire de la Suisse / della flora vascolare della Svizzera. Info Flora, 380 pp.

Kadej M, Háva J, Kalík V (2007) Review of the *Anthrenus pimpinellae* species group from Palaearctic region (Coleoptera: Dermestidae: Anthrenini). Genus 18(4): 721–750.

Kahlen M, Hellrigl K (1996) Ordnung Coleoptera-Käfer. In: Hellrigl K (Ed.) Die Tierwelt Südtirols. Naturmuseum Südtirol, Bozen, 393–511.

Kiesenwetter von H (1861) Eine entomologische Excursion in das Wallis und nach dem Monte Rosa im Sommer 1861. Berliner Entomologische Zeitschrift 5: 360–395.*

Kiener S (1995) Bemerkenswerte Käfernachweise aus der Schweiz (Coleoptera). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 68: 55–68.*

Killias E (1860) Zoologische Mittheilungen. 2. Insectenverzeichniss aus Puschlav. Jahresbericht der Naturforschenden Gesellschaft Graubündens 7: 102–108.*

Köhler F (2000) Erster Nachtrag zum „Verzeichnis der Käfer Deutschlands". Entomologische Nachrichten und Berichte, Dresden 44(1): 60–84.

Köhler F (2011) 2. Nachtrag zum „Verzeichnis der Käfer Deutschlands" (Köhler, Klausnitzer 1998) (Coleoptera). Entomologische Nachrichten und Berichte (Dresden) 55: 109–174, 247–254.

Köhler F, Klausnitzer B (1998) Entomofauna Germanica. Verzeichnis der Käfer Deutschlands. Entomologische Nachrichten und Berichte, Dresden, Beiheft 4: 1–185.

Labram JD, Imhoff L (1842) Die Insekten der Schweiz, die vorzüglichsten Gattungen je durch eine Art bildich dargestellt. Basel, 192 pp.*

Laclos de E, Büche B (2008a) La Vrillette sans peine: deuxième note (Coleoptera Anobiidae). L'Entomologiste 64(4): 217–220.

Laclos de E, Büche B (2008b) La Vrillette sans peine: première note (Coleoptera Anobiidae). L'Entomologiste 64(1): 3–10.

Laclos de E, Büche B (2009a) La Vrillette sans peine: quatrième note (Coleoptera Anobiidae). L'Entomologiste 65(4): 207–213.

Laclos de E, Büche B (2009b) La Vrillette sans peine: troisième note (Coleoptera Anobiidae). L'Entomologiste 65(4): 13–20.

Lan-Yu L, Geis KU (2019) A synopsis of the Lyctine beetles of Eurasia with a key to the species (Insecta: Coleoptera: Bostrichidae: Lyctinae). Journal of Insect Biodiversity 9(2): 34–56. https://doi.org/10.12976/jib/2019.09.2.1

Lepesme P (1944) Les coléoptères des denrées alimentaires et des produits industriels entreposés. Encyclopédie entomologique. Paul Lechevalier Editeur, Paris, 335 pp.

Linder A (1937) Beitrag zur Coleopteren-Fauna der Schweiz. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 17: 172–175.

Linder A (1941) La collection de coléoptères du Chanoine Cerutti. Bulletin de la Murithienne 59: 129–134.

Linder A (1946) 2. Beitrag zur Coleopteren-Fauna der Schweiz. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 20: 197–207.

Linder A (1953) 3. Beitrag zur Coleopteren-Fauna der Schweiz. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 26(1): 63–71.

Linder A (1967) Nachtrag zum Verzeichnis der Bündner Coleopteren von Dr. E. Killias. Jahresbericht der Naturforschenden Gesellschaft Graubünden 93: 78–109.

Linder A (1968) 4. Beitrag zur Coleopteren-Fauna der Schweiz. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 41: 211–232.*

Liniger E (1886) Ein Aufenthalt im Wallis. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 7: 286–294.*

Liu LY, Schönitzer K (2011) Phylogenetic analysis of the family Bostrichidae auct. at suprageneric levels (Coleoptera: Bostrichidae). Mitteilungen der Münchner Entomologischen Gesellschaft 101: 99–132.

Löbl I (2007) Endecatomidae. In: Löbl I, Smetana A (Eds) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea – Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 320.

Löbl I, Smetana A (2007) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea – Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 935 pp. https://doi.org/10.1163/9789004260894

Lohse GA (1969) Anobiidae. In: Freude H, Harde KW, Lohse GA (Eds) Die Käfer Mitteleuropas. Band 8. Teredilia, Heteromera, Lamellicornia. Goecke, Evers, Krefeld, 27–59.

Lohse GA (1979) Dermestidae. In: Freude H, Harde KW, Lohse GA (Eds) Die Käfer Mitteleuropas. Band 6. Diversicornia. Goecke, Evers, Krefeld, 304–327.

Lohse GA, Lucht WH (1992) Die Käfer Mitteleuropas. 2. Supplementband mit Katalogteil. Goecke, Evers, Krefeld, 375 pp.

Luka H, Nagel P, Feldmann B, Luka A, Gonseth Y (2009) Checkliste der Kurzflügelkäfer der Schweiz (Coleoptera: Staphylinidae ohne Pselaphinae). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 82: 61–100.

Marggi W, Germann C (2018) Nachweis von *Dinoderus minutus* (Fabricius, 1775) in der Schweiz (Coleoptera: Bostrichidae). Entomo Helvetica 11: 157–160.

Marggi W, Luka H (2001) Laufkäfer der Schweiz – Gesamtliste 2001 (Coleoptera: Carabidae). Checklist 2001, Carabidae of Switzerland. Opuscula Biogeographica Basileensia 1, 37 pp.

Mathey-Dupraz A (1922) Les allées de Colombier et leurs destructeurs. Le Rameau de Sapin 6(3): 17–19.*

Meier C, Sauter W (1989) Zur Kenntnis der Insektenfauna eines Auwaldreservates an der Aare bei Villnachern AG. Mitteilungen der Aargauischen Naturforschenden Gesellschaft 32: 217–258.*

Meier F, Engesser R, Forster B, Odermatt O, Angst A (2012) Forstschutz-Überblick 2011. Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft WSL, Birmensdorf, 28 pp.

Meier F, Engesser R, Forster B, Odermatt O, Angst A (2014) Forstschutz-Überblick 2013. WSL Berichte 11, 28 pp.

Meier F, Queloz V, Forster B, Odermatt O, Angst, A, Hölling D (2016) Waldschutz-Überblick 2015. WSL Berichte 45, 32 pp.

Meier F, Forster B, Odermatt O, Hölling D, Meyer J, Dubach V, Schneider S, Wasem U, Queloz V (2017) Waldschutz-Überblick 2016. WSL Berichte 55, 36 pp.

Michaud A (1937) Observations sur la Faune entomologique du Val d'Orvin. Bulletin de la Société Neuchâteloise des Sciences Naturelles 62: 84–98.*

Monnerat C, Chittaro Y, Sanchez A, Gonseth Y (2015a) Critères et procédure d'élaboration de listes taxonomiques nationales: le cas des Buprestidae, Cerambycidae, Lucanidae et Cetoniidae (Coleoptera) de Suisse. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 88: 155–172.

Monnerat C, Chittaro Y, Sanchez A, Gonseth Y (2015b) Liste commentée des Lucanidae, Cetoniidae, Buprestidae et Cerambycidae (Coleoptera) de Suisse. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 88: 173–228.

Nardi G, Háva J (2013) Italian Dermestidae: notes on some species and an updated checklist (Coleoptera). Zookeys 360: 45–81. https://doi.org/10.3897/zookeys.360.6023

Rätzer A (1888) Nachträge zur Fauna coleopterorum Helvetiae besonderes aus dem Gebiete des berner Seelandes, des Jura und der Walliseralpen. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 8: 20–42.

Rehfous M (1955) Contribution à l'étude des Insectes des Champignons. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 28: 1–106.

Reibnitz J, Graf R, Coray A (2013) Verzeichnis der Ciidae (Coleoptera) der Schweiz mit Angaben zur Nomenklatur und Ökologie. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 86: 63–88.

Rosset FC (1879) Contributions à la faune entomologique du Valais. I. Insectes rares capturés sur le Simplon. Bulletin de la Murithienne 9: 36–38.*

Sanchez A, Chittaro Y (2017) Inventaire des Coléoptères saproxyliques des pinèdes du Val d'Anniviers (VS). Bulletin de La Murithienne 134: 21–34.*

Sanchez A, Chittaro Y (2018) Liste commentée des Histeridae et Sphaeritidae de Suisse (Coleoptera, Histeroidea). Entomologische Blätter und Coleoptera 114: 335–352.

Sanchez A, Chittaro Y (2019) *Dignomus irroratus* (Ptinidae) et *Isomira testacea* (Tenebrionidae), deux Coléoptères nouveaux pour la faune de Suisse. Entomo Helvetica 12: 161–163.

Sanchez A, Chittaro Y, Monnerat C (2015) Coléoptères nouveaux ou redécouverts pour la Suisse ou l'une de ses régions biogéographiques. Entomo Helvetica 8: 119–132.

Schacht W (1879) Contributions à la faune entomologique du Valais. III. Contribution à la faune des coléoptères du Valais. Bulletin de la Murithienne 9: 43–54.*

Scherler P (1992) JORLOG, études entomologique des parcelles 06, 38, 39, 40, 41 et 42. Echantillonnage des Coléoptères. Bulletin Romand d'Entomogie 10: 59–80.*

Scherler P (1995) Les Coléoptères de la Grande Cariçaie (rive sud-est du lac de Neuchâtel). Bulletin Romand d'Entomologie 13: 31–54.*

Sprecher E, Luka H, Germann C, Luka A, Klausnitzer B, Graff P (2008) Käfer. In: Baur B, Billen W, Burckhardt D (Eds) Vielfalt zwischen den Gehegen: wildlebende Tiere und Pflanzen im Zoo Basel. Monographien der Entomologischen Gesellschaft Basel 3, 308–331.*

Steinhammer F (2007) Nosodendridae. In: Löbl I, Smetana A (Eds) Catalogue of Palaearctic Coleoptera, Vol. 4. Elateroidea – Derodontoidea – Bostrichoidea – Lymexyloidea – Cleroidea – Cucujoidea. Apollo Books, Stenstrup, 299.

Stierlin G (1863) Verzeichniss der während einer entomologischen Exkursion nach dem Engadin im Juni 1862 gesammelten Käfer. Mittheilungen der Schweizerischen Entomologischen Gesellschaft 1: 57–66.*

Stierlin G (1863–1864) Zusammenstellung der durch Herrn Meyer-Dür in Tessin und Oberengadin beobachteten und eingesammelten Coleopteren. Mittheilungen der Schweizerischen Entomologischen Gesellschaft 1: 155–172.*

Stierlin G (1875) Verzeichniss der gesammelten Käfer. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 4: 465–468.*

Stierlin G (1880) Beiträge zur Kenntnis der Käferfauna des Kant. Wallis und der *Dichotrachelus*-Arten. Mittheilungen der Schweizerischen Entomologischen Gesellschaft 5: 541–551.*

Stierlin G (1883) Zweiter Nachtrag zur Fauna coleopterorum helvetica. Neue Denkschriften der schweizerischen Gesellschaft für die gesammten Naturwissenschaften 8(3): 1–98.

Stierlin G (1898) Fauna coleopterorum helvetica. Die Käfer-Fauna der Schweiz nach der analytischen Methode. II. Theil. Bolli, Böcherer, Schaffhausen, 662 pp.

Stierlin G (1900) Fauna coleopterorum helvetica. Die Käfer-Fauna der Schweiz nach der analytischen Methode. I. Theil. Bolli, Böcherer, Schaffhausen, 667 pp.

Stierlin G (1906) Coleopteren-Fauna der Gegend von Schaffhausen. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 11: 167–220.*

Stierlin G, Gautard VV (1867) Fauna coleopterorum helvetica. Die Käfer-Fauna der Schweiz. Schaffhausen und Vevey, 372 pp.

Täschler M (1872) Beitrag zur Coleopteren-Fauna der Kantone St. Gallen und Appenzell. Berichte der Tätigkeiten der St. Galler Naturwissenschaftlichen Gesellschaft, 39–249.*

Toskina IN (2015) Key to Palaearctic species of the genus *Stagetus* (Coleoptera, Ptinidae, Dorcatominae). Vestnik Zoologii 49(1): 13–34. https://doi.org/10.1515/vzoo-2015-0002

Tronquet M (2014) Catalogue des Coléoptères de France. Perpignan, Association Roussillonnaise d'Entomologie, 1056 pp.

Uhlig M, Uhlig B (2006) Zur Käferfauna der Schweiz (Coleoptera ohne Staphylinidae). Entomologische Berichte Luzern 56: 1–20.*

Viñolas A, Recalde Irurzun JI (2018) Los Ernobiinae de la Península Ibérica e Islas Baleares. 1ª Nota. El género *Episernus* C. G. Thomson 1863 (Coleoptera: Ptininae). Butlletí de la Institució Catalana d'Història Natural 82: 97–107.

Walter T, Wolf M, Plattner M (2003) Holzbewohnende Käfer im Naturschutzgebiet Wildenstein. Mitteilungen der Naturforschenden Gesellschaften beider Basel 7: 263–285.*

Welti S (1998) Totholzabhängige Käfer (Coleoptera) und Totholzangebot im Sihlwald (Kt. Zürich). Diplomarbeit, Universität Zürich, 61 pp.*

Wittenberg R, Kenis M, Blick T, Hänggi A, Gassmann A, Weber E (2006) An inventory of alien species and their threat to biodiversity and economy in Switzerland. CABI Bioscience Switzerland Centre report to the Swiss Agency for Environment, Forests and Landscape. The environment in practice 0629, 155 pp.

Wyniger R (1957) Ein Kaffeeschädling als Zigarren-Zerstörer. Mitteilungen der Entomologischen Gesellschaft Basel 7: 79–82.

Zahradník P (2000) *Ernobius besucheti* sp. n. (Coleoptera: Anobiidae) from Switzerland. Folia Heyrovskyana 8(2): 133–136.

Zahradník P (2013) Beetles of the family Ptinidae of Central Europe. Academia, Praha, 352 pp.

Zahradník P, Háva J (2014) Catalogue of the world genera and subgenera of the superfamilies Derodontoidea and Bostrichoidea (Coleoptera: Derodontiformia, Bostrichiformia). Zootaxa 3754(4): 301–352. https://doi.org/10.11646/zootaxa.3754.4.1

Zahradník P, Mifsud D (2005) *Ozognathus cornutus* (LeConte) – new record for the Palearctic Region (Coleoptera: Anobiidae). Studies and reports of District Museum Prague-East Taxonomical Series 1 (1–2): 141–143.

Zhang SQ, Che LH, Li Y, Liang D, Pang H, Ślipiński A, Zhang P (2018) Evolutionary history of Coleoptera revealed by extensive sampling of genes and species. Nature Communications 9(1): 205. https://doi.org/10.1038/s41467-017-02644-4

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PENSOFT

Alpine Entomology

Dritter Nachtrag zur Rüsselkäfer-Fauna der Schweiz (Coleoptera, Curculionoidea)

Third addition to the checklist of Swiss weevils (Coleoptera, Curculionoidea)

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Zusammenfassung

Die Anzahl verlässlich gemeldeter Taxa (Arten und Unterarten) der Curculionoidea aus der Schweiz beträgt momentan 1081. Funde von *Orchestes calceatus* (Germar, 1821) werden hier erstmals bestätigt. Zusätzliche Verbreitungsdaten von zehn Arten werden gegeben. Der auf subalpine und alpine Lebensräume beschränkte *Phyllobius alpinus* Stierlin, 1859 ist eine valide Art **stat. rev.**, und kein Synonym zu *Ph. xanthocnemus* Kiesenwetter, 1852 und wird daher aus der Synonymie herausgenommen. Die Arten werden verglichen und typische Unterscheidungsmerkmale werden aufgeführt.

Abstract

The number of reliably recorded taxa (species and subspecies) of Curculionoidea from Switzerland counts at present 1081. Records of *Orchestes calceatus* (Germar, 1821) are confirmed here for the first time. Additional data on distribution is given for ten species. *Phyllobius alpinus* Stierlin, 1859, restricted to subalpine and alpine habitats, is a valid species **stat. rev.**, and not a synonym of *Ph. xanthocnemus* Kiesenwetter, 1852 and thus resurrected from synonymy. Both species are compared and characters for differentiation are provided.

Einleitung

Die im 2010 vorgestellte Checkliste der schweizerischen Rüsselkäfer (Germann 2010) und deren Supplement im Folgejahr (Germann 2011), wurden durch zwei Nachträge ergänzt (Germann 2013, 2017). Seither erfolgten weitere Entdeckungen. Das Vorkommen von *Polydrusus sparsus* Gyllenhal, 1834 konnte erfreulicherweise durch einen aktuellen Nachweis bestätigt werden (Germann and Chittaro 2019). Germann and Graf (2018) meldeten *Mecinus pascuorum* (Gyllenhal, 1813) erstmals aus der Zentralschweiz und Borer et al. (2018) berichteten über Käfer aus den Merian-Gärten in Basel, darunter Nachweise von *Eusomus ovulum* Germar, 1824, einer in der Schweiz wenig gefundenen, sehr lokal vorkommenden und wenig mobilen Art xerothermer Lebensräume. Während zweier Biodiversitäts-Veranstaltungen im 2018 in der Zentralschweiz, im Gebiet von Fryberg Kärpf (GL) und auf dem Urnerboden (UR) wurden zudem grössere Aufsammlungen unternommen, und im Val Müstair wurden während eines GEO-Tages der Artenvielfalt im Juni 2019 weitere Funde zusammengetragen. Die Resultate – darunter einige Erstnachweise – sollen auch innerhalb nützlicher Frist publiziert werden. Um den erneuten Anpassungen in Nomenklatur, Taxonomie und Faunistik gerecht zu werden, wird hier ein dritter Nachtrag zur Checkliste gegeben. Zudem werden Funddaten von wenig gemeldeten und bemerkenswerten Arten aufgeführt und der Status einer Art wird revidiert.

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Material und Methoden

Folgende Abkürzungen werden verwendet:

cCG	Sammlung Christoph Germann (Rubigen)
cGF	Sammlung Georg Frey (im NMB)
cHB	Sammlung Hermann Blöchlinger (Erschmatt)
cSB	Sammlung Stève Breitenmoser (Changins)
ETHZ	Eidgenössisch-Technische Hochschule Zürich
HJB	Sammlung Hansjörg Brägger (Amriswil)
NMB	Naturhistorisches Museum Basel
NMSO	Naturmuseum Solothurn

Es werden Schweizer Koordinaten angegeben und zusätzlich die internationalen Koordinaten (lat./long.) in eckigen Klammern.

Folgende Vergleichsexemplare wurden zwecks Illustration des revidierten Status von *Phyllobius alpinus* fotografiert: *Ph. alpinus* ♂ Italy, Piemonte, Valle Formazza, Vannino, ob. Valdo, Sagersboden, 674790N/136683E, [46°22'38"N, 8°24'38"E] 1770 m, 4.7.2010, leg. C. Germann; ♀ Austria, Steiermark, Rottenmanner Tauern, Hengst, 47°06'36"N, 13°09'07"E, 1500 m, 29.7.2007, leg. C. Germann (cCG). *Ph. xanthocnemus* ♂ Canterets, Hautes Pyrenées, coll. J. Breit (cGF); ♀ France, Hautes Pyrenées, Gavarnie, E-side, 42°43'20"N, 0°00'01"W, 1650 m, 9.8.2007, leg. C. Germann (cCG). Die Nomenklatur folgt dem neusten Katalog von Alonso-Zarazaga et al. (2017).

Resultate

Neue Funddaten
Ceutorhynchinae

***Drupenatus nasturtii* (Germar, 1824)**

Untersuchte Exemplare. 3 Ex., BE, Rubigen, Hechteloch, Schwarzbach, 608245N/193083E [46°53'20"N, 7°32'48"E], 520 m, 10.6.2019, leg. C. Germann (cCG).

Bemerkung. Die letzten Funde lagen aus den 70 er Jahren vor (Aarwangen BE, leg. & coll. A. Linder ETHZ), hier erstmals aktuelle Funde der auf Feuchtgebiete beschränkten Art.

***Neophytobius granatus* (Gyllenhal, 1836)**

Untersuchte Exemplare. 2 ♀, BE, Spiez, Einigen, Kanderdelta, 31.5.2017, leg. A. Jaun via W. Marggi (cCG, NMSO).

Bemerkung. Bisher lagen nur wenige und überwiegend ältere Nachweise der Art vor. Erste Nachweise aus der biogeographischen Region Alpennordflanke (Germann 2010).

***Phrydiuchus topiarius* (Germar, 1824)**

Untersuchte Exemplare. 1 ♀, VS, Turtmanntal, Unterems, Äbnet, 620000N/126200E, [46°17'13"N, 7°41'53"E], 1150 m, 4.11.2012, leg. H. Blöchlinger (cHB).

Bemerkung. Selten und schwierig nachzuweisende Art, an südexponierte Trockenstandorte gebunden und meist nur unter den Blättern von *Salvia pratensis* L. zu finden. Die Tiere sind durch ihre Färbung bestens getarnt.

***Stenocarus ruficornis* (Stephens, 1831)**

Untersuchte Exemplare. 1 ♂, BE, Rubigen, in Garten, 10.6.2018, leg. C. Germann (cCG).

Bemerkung. Bisher keine aktuellen Funde aus dem Mittelland.

Cossoninae

***Cossonus cylindricus* C. R. Sahlberg, 1834**

Untersuchte Exemplare. 1 Ex., VD, Trélex, La Coque, Le Molard, 6.5.2018, leg. S. Breitenmoser (cSB).

Bemerkung. Bisher nur wenige und ältere Nachweise.

Cryptorhynchinae

***Gasterocercus depressirostris* (Fabricius, 1792)**

Untersuchte Exemplare. 1 Ex., TG, Amriswil, Oberfeld, 740050N/267225E [47°32′27″N, 9°17′55″E], 460m, 5.6.2018, leg. H. Brägger (cHB). 2 Ex., dito 18.8.2018. 1 Ex., Bern, Elfenau, 12.6.2018, leg. TeilnehmerInnen der Uni-Käferexkursion (cCG).

Bemerkung. Wie bereits von Germann (2017) erwähnt, wurden nun seit dem Erstnachweis dieser Art im 2013 stetig weitere Exemplare gefunden, vorliegend in der Nähe altständiger Eichen am Rand einer Flussaue, beim Abkeschern der Vegetation.

Curculioninae

***Curculio vicetinus* Cussigh, 1989**

Untersuchte Exemplare. 1 Ex., BE, Rubigen, Hechteloch, 520 m, an Gallen von *Pediaspis aceris* Gmelin, 1790 (Hymenoptera: Cynipidae) auf *Acer pseudoplatanus* L., 10.6.2019, leg. C. Germann (cCG).

Bemerkung. Erstmals im Basler Zoo im 2005 für die Schweiz nachgewiesen (Germann 2014), hier der zweite Nachweis weit ab vom Rheintal (dort eine Häufung von Funden) oder von Italien, wo die Art aus den Monti Berici bei Vicenza beschrieben wurde.

***Orchestes calceatus* (Germar, 1821)**

Untersuchtes Exemplar. 1 ♀, BE, Wimmis, 613970N/168800E, [46°40'13"N, 7°37'16"E], 630 m, 23.6.2006, Auenwald, leg. C. Germann (cCG).

Bemerkungen. Bestätigung für die Schweiz. Bereits Kraatz (1874: 280) erwähnte Funde der auf Birke (*Betula pendula* und *B. pubescens*) lebenden, selten gefundenen Art. So erwähnt er mehrere Exemplare aus der Schweiz: "Vom *semirufus* [*semirufus* Gyllenhal, 1827 = synonym zu *calceatus*] besitze ich nur ein Stück von Barmen [SG] mit fast ganz abgeriebener Behaarung, welches vollkommen mit dem grössern meiner beiden Schweizer 5-*mac-*

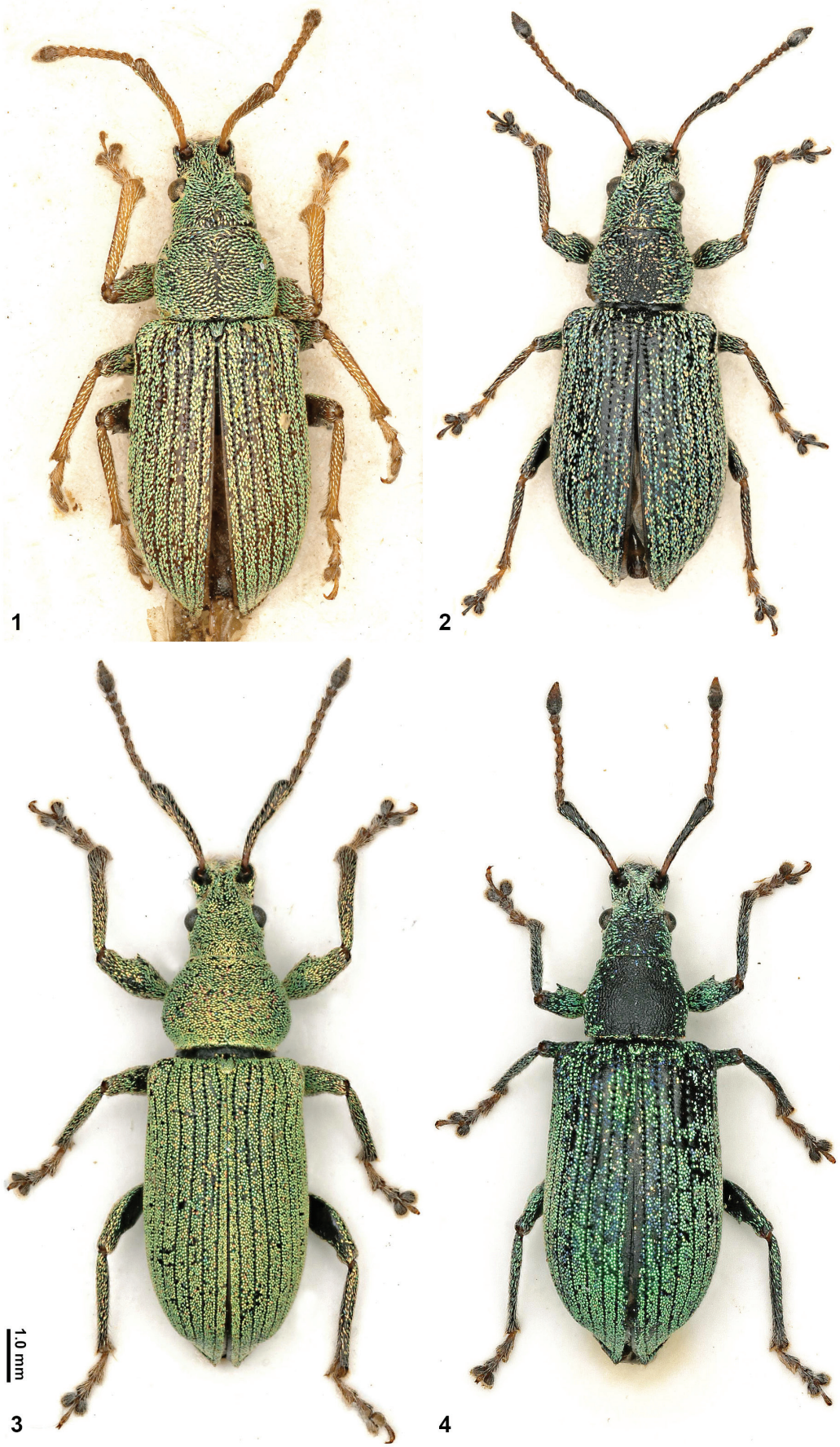


Abb. 1–4. 1–2 Männchen (Frankreich, Hautes Pyrenées, Canterets) und Weibchen (Frankreich, Hautes Pyrenées, Gavarnie) von *Phyllobius xanthocnemus*. **3–4** Männchen (Italia, Valle Formazza) und Weibchen (Österreich, Tauern) von *Phyllobius alpinus* (Fotos: C. Germann).

ulatus [*quinquemaculatus* Chevrolat, 1867 = synonym zu *calceatus*] übereinstimmt...". Stierlin (1883) meldete *O. calceatus* (unter dem Synonym *pubescens* Gyllenhal, 1835 und als *semirufus*) von Bünzen und dem Bünzenmoos, später (Stierlin 1898) auch aus dem Wallis und unter *quinquemaculatus* zusätzlich von Aarau, Laufenburg und Schaffhausen. In der Checkliste (Germann 2010) wurde *O. calceatus* noch als Fehlmeldung eingestuft, da keine Belegtiere vorlagen, dies kann hier nun revidiert werden.

***Tychius cuprifer* (Panzer, 1799)**

Untersuchte Exemplare. 1 Ex., VD, Prangins, Changins, 507855N/138920E, [46°23'43"N, 6°14'25"E], 422 m, 3–4 (Fallenfänge). 2018, leg. S. Breitenmoser (cSB). 1 Ex,. dito, 8.5.2018. 1 ex. dito, 25.5.2018.

Bemerkung. Xerothermophile Art, überwiegend an *Trifolium arvense*, wurde in Deutschland als verletzlich eingestuft (Rheinheimer and Hassler 2010). Auch bei uns liegen nur punktuell und vorwiegend aus Wärmegebieten Funde vor.

Entiminae

***Otiorhynchus indefinitus* Reitter, 1912**

Untersuchte Exemplare. 10 Ex. BA, Basel-Stadt, Gundeli-Quartier, 610843N/266174E, [47°32'46"N, 7°34'57"E], bei Nacht an Hecken, 19.9.2019, leg. C. Germann (cCG, NMB).

Bemerkung. Seit 2006 (Germann 2006) sind Funde dieser früher als *O. dieckmanni* Magnano, 1979 bekannten Art aus der Schweiz bekannt. Nach den Erstnachweisen aus Bern hier ein weiterer individuenreicher Nachweis aus dem urbanen Basel.

Hyperinae

***Donus intermedius* (Boheman, 1842)**

Untersuchte Exemplare. 2 Ex., BE, Vauffelin, Les Tayés, 589791N/226754E, [47°11'30"N, 7°18'13"E], 770 m, 2.4.2014, leg. R. Bryner (cCG).

Bemerkung. Nur wenige neue Funde von dieser allgemein selten gefundenen Art sind bekannt.

Taxonomie

***Phyllobius alpinus* Stierlin, 1859 bona species, status revidiert**

Alonso-Zarazaga et al. (2017) führen im neusten Katalog der paläarktischen Rüsselkäfer *Phyllobius alpinus* Stierlin, 1859, als Synonym von *Phyllobius xanthocnemus* Kiesenwetter, 1852 auf. Diese Synonymie wurde von Stüben et al. (2015) vorgeschlagen und durch Alonso-Zarazaga et al. (2017) schliesslich festgelegt. Nach eingehender Prüfung von Vergleichstieren konnten jedoch die bisher bekannten und auch verlässlichen Merkmale zur Unterscheidung beider Arten nach Pesarini (1981) bestätigt werden. Untersuchte Exemplare von *Ph. xanthocnemus* sind durchwegs kleiner [N=6, 4.2–4.6 mm (Pesarini 1981: 4.5–5.5 mm), bei *Ph. alpinus* N=7, 5.2–7.5 mm (Pesarini 1981: 4.5–7.0 mm)], vom Augenvorderrand bis Apex der Elytren dorsal gemessen), die Dornen der Femora sind schwächer ausgeprägt, der Kopf ist weniger markant eckig geformt, die Augen weniger prominent hervorstehend, die Pterygien schwächer vorgezogen, das Pronotum ist, vorallem beim Männchen, weniger ausgeprägt glockenförmig (markant glockenförmig beim Männchen von *Ph. alpinus*), die Schuppen sind tropfenförmig (rund bei *Ph. alpinus*) und die Elytren schmaler (Abb. 1–4). Somit muss *Phyllobius alpinus* als valide Art gelten und die Synonymie wird hiermit rückgängig gemacht (stat. rev.). *Ph. alpinus* ist weit verbreitet, von den Karpathen und Sudeten bis zum Alpenbogen. *Ph. xanthocnemus* ist hingegen auf die Pyrenäen beschränkt. Beide Taxa sind als typische Gebirgstiere auf die (hoch-)montane bis alpine Stufe beschränkt, so dass die Verbreitung nicht über das gesamte angegebene Gebiet verstanden werden kann, sondern als Teilfläche auf erhöhter Lage innerhalb dieses. Auf Grund dieser stärker eingeschränkten Verbreitung erhalten Populationen in den Pyrenäen für *Ph. xanthocnemus* oder für *Ph. alpinus* im Alpenbogen natürlich eine höhere Bedeutung.

Neben der oben gegebenen Revalidierung von *Phyllobius alpinus* Stierlin, 1859 muss nach Alonso-Zarazaga et al. (2017) *Protapion ruficroides* (Dieckmann, 1973) nun *P. nigricrus* (Desbrochers des Loges, 1895) heissen.

Diskussion

Allgemein

Eine Checkliste einer beliebigen Artengruppe ist stets kurz nach ihrem Erscheinen bereits wieder überholt; neue Funde werden gemacht, zusätzliche (auch alte Nachweise und Belege) werden entdeckt und die Nomenklatur ändert sich wie vorliegend aufgezeigt. Somit sind Nachträge zwecks einer ständigen Aktualisierung unverzichtbar, auch und besonders bei artenreichen Überfamilien wie den Curculionoidea. Die hier vorgestellten Funddaten betreffen folgende besonders erwähnenswerte Funde: Zwei Feuchtland-Arten (*Drupenatus nasturtii* und *Neophytobius granatus*) welche beide auf Grund fehlender und/oder stark im Rückgang begriffener Auenhabitate nur noch selten gefunden werden. *D. nasturtii* dürfte dabei von der Renaturierung im Gebiet beim Hechteloch (Kleinhochstettenau) profitiert haben, *N. granatus* wurde auf Überschwemmungsflächen im Naturschutzgebiet Kanderdelta als Beifang gefunden, eine schwer zugängliche Fläche. Zwei weitere Arten (*Cossonus cylindricus* und *Gasterocercus depressirostris*) leben xylobiont und die letztere Art, welche auch als Urwaldrelikt angesehen wird (Rheinheimer and Hassler 2010) – und von welcher neuerdings auch Belege aus dem Tessin bekannt geworden sind (teste L. Pollini) – scheint nun definitiv bei uns auch weiter

verbreitet zu sein. Dieselbe Einschätzung von einem häufigeren Auftreten dürfte auch für *Tychius cuprifer* gelten, welcher im Gebiet beim Flughafen Mulhouse bei Basel (auf der französischen Seite) erst kürzlich im Mai 2019 in Dutzenden Exemplaren gefunden werden konnte. Bei *Orchestes calceatus* bleibt abzuwarten ob weitere Nachweise gelingen werden, die eher aus kühlen und feuchten Lebensräumen bekannte Art wird generell wenig gefunden. *Curculio vicetinus* ist ein Neobiont in Ausbreitung. *Stenocarus ruficornis*, welcher an *Papaver*-Arten lebt, dürfte davon profitieren, dass seine Wirtspflanze wieder in Getreideäckern toleriert wird. Die parthenogenetische und invasie Art *Otiorhynchus indefinitus* dürfte sich mit vorliegenden Funden definitiv bei uns etabliert haben und auch bereits weiter verbreitet sein.

Die letzten beiden vorgestellten Arten (*Phrydiuchus topiarius* und *Donus intermedius*) werden generell nur selten gefunden und sind bisher nur von kleinräumigen und isoliert liegenden Populationen bekannt geworden. Besonders im Hinblick auf die schwindende Biodiversität und das Insektensterben sind solche Fundmeldungen insbesondere von gefährdeten und wenig mobilen Arten von grosser Bedeutung und müssen publik werden.

Nachträge zu historischen Literaturangaben und Änderungen der Nomenklatur

Ein Beitrag zur Fauna des Kantons Glarus von Blösch (1875) wurde bisher übersehen, darin werden auch von Sackberg [bei Braunwald] und aus dem Klöntal acht Curculionoidea aufgelistet, die zum Teil bisher nicht in die Verbreitungsangaben der Checkliste Eingang fanden. Die faunistischen Beiträge von Rosset (1879) und Schacht (1879) zur Käferfauna des Wallis wurden bisher ebenfalls übersehen. Rosset (1879) führt 15 Curculionidae vom Simplon(pass) auf. Schacht (1879) gibt spannende Funde von 87 Curculionoidea überwiegend aus Sierre und Umgebung an, dabei einige Erstnachweise, zeitlich vor den bisherigen Meldungen von Favre (1890) wie der (noch immer unbestätigt gebliebene) walliser Fund von *Protapion ruficrus* (Germar, 1817) und die faunistisch interessanten Nachweise von *Curculio elephas* (Gyllenhal, 1836) und *Trichosirocalus horridus* (Panzer, 1801). Miot (1874) schliesslich führte einzelne Curculionidae, ohne besonders erwähnenswerte Nachweise, aus der Umgebung des Tarasper Bads (Graubünden) auf.

Danksagung

Hermann Blöchlinger (Erschmatt), Hansjörg Brägger (Amriswil), Stève Breitenmoser (Changins), Ruedi Bryner (Biel) und Werner Marggi (Allmendingen b. Thun) danke ich herzlich für die Möglichkeit der Überprüfung ihrer Belege und für die Verwendung der Funddaten. Ein herzliches Dankeschön gebührt den Reviewern für Ihre gründliche Durchsicht des Manuskripts.

Literatur

Alonso-Zarazaga MA, Barrios H, Borovec R, Bouchard P, Caldara R, Colonnelli E, Gültekin L, Hlaváč P, Korotyaev B, Lyal CHC, Machado A, Meregalli M, Pierotti H, Ren L, Sánchez-Ruiz M, Sforzi A, Silfverberg H, Skuhrovec J, Trýzna M, Velázquez de Castro AJ, Yunakov NN (2017) Cooperative Catalogue of Palaearctic Coleoptera Curculionoidea. Monografías electrónicas de la Sociedad Entomológica Aragonesa 8: 1–729.

Blösch C (1875) Deux excursions dans le canton de Glaris. Petites Nouvelles Entomologiques 1(126): 1–503.

Borer M, Germann C, Coray A, Luka H (2018) Kommentierte Artenliste der Käfer (Coleoptera) am GEO-Tag der Natur in den Merian Gärten 2017. Mitteilungen der Naturforschenden Gesellschaften beider Basel 18: 39–52.

Favre E (1890) Faune des Coléoptères du Valais et des Régions Limitrophes. Nouvelles Mémoires de la Société Helvétique des Sciences Naturelles 31, Imprimerie Zurcher & Furrer, Zürich, 448 pp.

Germann C (2006) Beitrag zur Rüsselkäfer-Fauna der Schweiz – mit der Meldung von 17 weiteren Arten (Coleoptera, Curculionoidea). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 79: 299–309.

Germann C (2010) Die Rüsselkäfer der Schweiz – Checkliste (Coleoptera, Curculionoidea) mit Verbreitungsangaben nach biogeografischen Regionen. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 83: 41–118.

Germann C (2011) Supplement zur Checkliste der Rüsselkäfer der Schweiz (Coleoptera, Curculionoidea). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 84: 155–169.

Germann C (2013) Erster Nachtrag zur Checkliste der Rüsselkäfer der Schweiz (Coleoptera, Curculionoidea). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 86: 151–164.

Germann C (2014) *Curculio vicetinus* Cussigh, 1989 seit 2005 auch in der Schweiz (Coleoptera, Curculionidae). Mitteilungen der Schweizerischen Entomologischen Gesellschaft 87: 309–310.

Germann C (2017) Zweiter Nachtrag zur Rüsselkäfer-Fauna der Schweiz (Coleoptera, Curculionoidea). Alpine Entomology 1: 43–49 https://doi.org/10.3897/alpento.1.17788

Germann C, Chittaro Y (2019) Wiederfund und Bestätigung von *Polydrusus sparsus* Gyllenhal, 1834 für die Schweiz (Coleoptera, Curculionidae). Entomo Helvetica 12: 169–171.

Germann C, Graf R (2018) Massenfund und Beobachtungen zur Phänologie von *Mecinus pascuorum* (Gyllenhal, 1813) an der Alpennordflanke der Zentralschweiz (Coleoptera, Curculionidae). Entomologische Nachrichten und Berichte 62(3): 205–207.

Kraatz G (1874) Ueber *Orchestes pubescens* Steph. und *semirufus* Gylh. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 4: 279–280.

Miot M (1874) Nouvelles. Petites Nouvelles Entomologiques 106: 1–423.

Pesarini C (1981) Le specie paleartiche occidentali della tribù Phyllobiini (Coleoptera Curculionidae). Bollettino di Zoologia Agraria e di Bachicoltura (ser. n.) 15: 49–230.

Rheinheimer J, Hassler M (2010) Die Rüsselkäfer Baden-Württembergs. Verlag Regionalkultur, Heidelberg, 944 pp.

Rosset C (1879) Contributions à la faune entomologique du Valais. Insectes rares capturés sur le Simplon. Bulletin des Travaux de la Société murithienne du Valais 9: 36–38.

Schacht [?] (1879) III Contribution à la faune des Coléoptères du Valais. Bulletin des Travaux de la Société murithienne du Valais 9: 43–54.

Stierlin G (1898) Fauna Coleopterorum Helvetica. Teil II. Bolli und Boecherer, Schaffhausen, 662 pp.

Stierlin G (1883) Zweiter Nachtrag zur Fauna coleopterorum helvetica. Denkschriften der schweizerischen Gesellschaft für die gesammten Naturwissenschaften 28(3): 60–81.

Stüben PE, Bayer C, Bahr F, Sprick P, Behne L (2015) Digital-Weevil-Determination der westpaläarktischen Curculionoidea: Transalpina: Phyllobiini. Snudebiller: Studies on taxonomy, biology and ecology of Curculionoidea 16 (240): 1–14.

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PENSOFT

Alpine Entomology

Protokoll der Jahresversammlung der Schweizerischen Entomologischen Gesellschaft vom 1. und 2. März 2019 am Naturmuseum St. Gallen

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Die Jahresversammlung der SEG wurde auf Einladung des Naturmuseums St. Gallen am 1. und 2. März 2019 in St. Gallen durchgeführt. Der Freitagnachmittag war, neben einem Einblick in die spannenden und noch immer nicht vollständig verstandenen Zyklen der Lärchenwickler, vor allem Themen der angewandten Entomologie in der Forst- und Landwirtschaft sowie in urbanen Gebieten gewidmet. David Frey (Eidg. Forschungsanstalt WSL, Birmensdorf) eröffnete die Tagung mit einem interessanten Hauptvortrag zum Thema Biodiversität und Ökosystemleistungen in Stadtgärten. Im Rahmen des interdisziplinären Nationalfonds-Projekts „BetterGardens“ wurde der Einfluss von 80 privat bewirtschafteten stadtzürcher Gärten auf die Ökosystemleistungen untersucht. Zusätzlich wurde auch die spannende Wechselwirkung zwischen der sozialen Funktion und Ökologie der Gärten erforscht. Die erhobenen Daten zeigen, dass sich extensiv gepflegte und strukturreiche Gärten sowohl positiv auf verschiedene Ökosystemleistungen auswirken als auch dem Stressabbau der Gärtnerinnen und Gärtner dienen. Fazit: Selbst kleine Grünflächen im urbanen Raum können die Biodiversität und diverse Ökosystemprozesse positiv beeinflussen.

Folgende sieben Vorträge wurden am Freitagnachmittag gehalten:

- Biodiversität und Ökosystemleistungen in Stadtgärten
  David Frey, Eidg. Forschungsanstalt WSL, Birmensdorf

- Do cities homogenize biodiversity?
  Dr. Marco Moretti, Swiss Federal Research Institute WSL, Birmensdorf

- Effets de l’augmentation de la pollution lumineuse sur les pollinisateurs et la qualité de leur pollinisation
  Simone Giavi, Institut d’Écologie et Évolution, Université de Berne

- An overview on bee health: are neonicotinoid pesticides to blame?
  Dr. Lars Straub, Institut für Bienengesundheit, Bern

- Crab spiders impact floral-signal evolution indirectly through removal of florivores
  Anina Knauer, Agroscope, Zürich

- Entomologische Bewertung von Waldrändern
  Jürg Schlegel, ZHAW, Wädenswil

- Revival der berühmten Lärchenwickler-Zyklen (*Zeiraphera griseana*)?
  Dr. Beat Wermelinger, Eidg. Forschungsanstalt WSL, Birmensdorf

Im Anschluss an die Vorträge wurde zu einer Besichtigung des didaktischen Bienenzentrums beim Gymnasium Untere Waid eingeladen. Den Teilnehmenden wurden die sehr informativ und äusserst ansprechend gestalteten Stationen im Aussenbereich vorgestellt sowie ein Einblick in den sehr divers ausgestatteten Experimentier- und Schulungsraum gewährt. An dieser Stelle ein herzliches Dankeschön an den Präsidenten und die Mitglieder des Bienenzüchtervereins St. Gallen und Umgebung.

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Der Samstag war freien Themen aus der Faunistik, Taxonomie, Systematik, sowie der Datenerhebung mittels Einbezug der Bevölkerung (Citizen Science) gewidmet.

Prof. Dr. Michael Boppré (Albert-Ludwigs-Universität, Freiburg i. Br.) eröffnete den zweiten Tag mit einem facettenreichen und spannenden Vortrag – einem Einblick in seine jahrzehntelange Erforschung der Bärenspinner in der Neotropis. Die attraktiven Farbmuster sind auch für Nicht-Spezialisten dieser Gruppe sehr überzeugend. Herr Boppré zeigte, dass diese Bärenspinner in verschiedenster Weise, sei es durch ihre Morphologie, Physiologie / Biochemie, Ökologie oder auch ihr Verhalten sehr spannend, divers und daher auch anspruchsvoll zum Erforschen sind. Diese Variabilität ist dann auch für das taxonomische Bearbeiten und die Systematik dieser Gruppe eine grosse Herausforderung. Zu den biologischen Herausforderungen der untersuchten Organismen kommen leider immer wie mehr komplizierte und aufwändige bürokratische Hindernisse dazu, die das Erforschen von Organismen ganz allgemein extrem erschweren oder sogar verunmöglichen. Der Referent hielt einen äusserst gelungenen und überzeugenden Vortrag – ein Plädoyer für die Grundlagenforschung in der Entomologie.

Folgende zehn Vorträge wurden am Samstag gehalten:

- Bären in der Neotropis: Lust und Frust mit Spinnern (Lep.: Erebidae: Arctiinae)
  Prof. Dr. Michael Boppré, Albert-Ludwigs-Universität, Freiburg i.Br.

- *Tapinoma magnum*, une nouvelle espèce de fourmi en Suisse, invasive et redoutable!
  Dr. Anne Freitag, Musée de Zoologie Lausanne & Dr. Daniel Cherix, Université de Lausanne

- Kontaktzonen und zwischenartlicher Genfluss zwischen drei nahverwandten Arten des Erebia tyndarus Komplexes
  Dr. Kay Lucek, Universität Basel

- Regeln für das Züchten von Schmetterlingen
  Marc de Roche, Swiss Butterfly Breeders, Bern

- Neotropical jumping plant-lice (Hemiptera, Psylloidea) associated with Copaifera and Hymenaea (Leguminosae, Detarioideae, Detarieae)
  Dr. Daniel Burckhardt, Naturhistorisches Museum Basel

- Untersuchungen zur Totholzkäferfauna im Kanton St. Gallen
  Barbara Huber, Abenis AG, Chur

- Käferendemiten in Österreich – Übersicht und Updates
  Mag. Gregor Degasperi, Innsbruck, Österreich

- Bürgerbeteiligung und die Dokumentation der Artenvielfalt – Fallstricke und Chancen
  Dr. Georg Friebe, Inatura GmbH, Dornbirn

- Klimawandel fördert Ausbreitung von *Scutigera coleoptrata*
  Mag. Dr. Klaus Zimmermann, Inatura GmbH, Dornbirn

- Aedes albopictus in its native range:NGS-based analysis of the population structure of the Asian tiger mosquito
  Dr. Ann-Christin Honnen, Swiss TPH (Schweizerisches Tropen- und Public Health-Institut), Basel

Die Vortragsreihe am Samstag wurde mit einer Führung in die Sammlung des Naturmuseums St. Gallen abgerundet.

An der Generalversammlung vom Samstagmorgen nahmen 22 Mitglieder teil. Dem Naturmuseum St. Gallen, im speziellen Andreas Kopp und Priska Seri-Jud, sei für die hervorragende Organisation der Jahresversammlung und für das Offerieren der Pausenverpflegungen herzlich gedankt.

Generalversammlung

Begrüssung

Der Präsident Hannes Baur eröffnet die Generalversammlung um 10:00 und begrüsst die 22 anwesenden Mitglieder und 8 Gäste.

Protokoll der Generalversammlung 2018 in Bern

Das Protokoll wird kommentarlos genehmigt.

Bericht des Präsidenten (Hannes Baur)

Administratives

Im administrativen Bereich wurden wir 2018 wiederum durch das Centre Suisse de Cartographie de la Faune (CSCF) in Neuchâtel unterstützt. Die SEG ist Mitglied der Plattform Biologie der Akademie der Naturwissenschaften Schweiz (SCNAT) in Bern und wird dort von der Geschäftsleiterin Pia Stieger betreut.

Finanzielle Unterstützung

Die Gesuche des Präsidenten um finanzielle Unterstützung wurden von den angefragten Institutionen in vollem Umfang bewilligt. Es handelt sich dabei um folgende Beträge: Akademie der Naturwissenschaften Schweiz (SCNAT) in Bern: CHF 7‘500.–, Biedermann-Mantel-Stiftung in Zürich: CHF 6‘000.– und Syngenta AG in Basel: CHF 6‘000.–. Wir danken allen drei Geldgebern für ihre wichtigen Beiträge.

Jahresversammlung, Generalversammlung und Vorstandssitzungen

Die entomo.ch, die traditionell zweitägige Jahresversammlung der SEG, wurde am Freitag, 2. und Samstag, 3. März 2018 am Naturhistorischen Museum Bern durchgeführt. Dem Museumsteam, insbesondere der Cafeteria, danken wir für die Organisation des

Anlasses ganz herzlich. Die Generalversammlung fand am Samstag, 3. März 2018 von 10 bis 11 Uhr am gleichen Ort statt. Der Präsident leitete die beiden regulären, halbjährlichen Vorstandssitzungen, welche am Freitag, 2. März und am Mittwoch, 7. November 2018 jeweils am Naturhistorischen Museum in Bern stattfanden.

Website

Die Website unserer Gesellschaft, u.a. mit Information zur Jahrestagung entomo.ch, war auch dieses Jahr wieder im Portal Naturwissenschaften Schweiz der Akademie der Naturwissenschaften Schweiz (SCNAT) abrufbar. Für die Betreuung danke ich Pascal Blanc (Chefredaktor) sowie Stefan Schmidlin und Mariella Hobi (Support). https://www.naturwissenschaften.ch/organisations/seg

Digitalisierung von Sammlungen

Die SCNAT hat eine Initiative zur Digitalisierung aller naturwissenschaftlichen Sammlungen der Schweiz gestartet. Grundlage dazu ist ein Bericht, welcher unter der Federführung des neuen Präsidenten der Plattform Biologie, Prof. Dr. Christoph Scheidegger von der WSL Birmensdorf, ausgearbeitet wurde (Swiss Academies of Arts and Sciences 2019). Im Bericht wurde aufgezeigt, wo die Defizite beim Zugang zu den zahlreichen Sammlungen liegen. Ein grosser Teil der über 60 Millionen Objekten ist demnach nur ungenügend erschlossen. Dies gilt insbesondere für die Insekten. Der Präsident hatte im Berichtsjahr als Vertreter der SEG an einem Symposium und einem Workshop zu diesem Thema teilgenommen. Viel Raum hatte es auch an der Sitzung der Plattform Biologie, wo der Präsident ebenfalls teilnahm.

Insektensterben

Seit der Publikation der sogenannten Krefelder Studie (Hallmann et al. 2017) hat der Rückgang der Insekten unter dem Titel „Insektensterben“ weltweit grosse Beachtung in den Medien gefunden. Der Präsident wurde während der Berichtsperiode verschiedentlich um Stellungnahme aus Sicht unserer Gesellschaft gebeten. Er nahm diesbezüglich auch an einem Podiumsgespräch in Luzern teil. Der SEG-Vorstand wird an einer der kommenden Sitzungen das Thema aufgreifen.

Insekt des Jahres

In Zusammenarbeit mit Entomologen aus Deutschland und Österreich wurde für das Jahr 2019 die Rostrote Mauerbiene (*Osmia bicornis*) zum Insekt des Jahres bestimmt. Dazu wurde wiederum ein Flyer publiziert, welcher über die SEG bezogen werden kann.

Im Namen des Vorstandes und der Mitglieder der Schweizerischen Entomologischen Gesellschaft danke ich allen genannten Institutionen, Gremien und Personen nochmals ausdrücklich für ihre Unterstützung und ihren Einsatz!

Bericht des Bibliothekars und der Redaktoren (Alpine Entomology und Fauna Helvetica)

Bericht des Bibliothekars (Dr. P. Jeanneret)

En 2018, quelques demandes d’articles ont été enregistrées. J’ai alors fait référence à la version électronique d’Alpine Entomology. Quelques demandes concernant les échanges de l’ex-bulletin avec des publications étrangères ont été formulées. J’ai alors à nouveau référé à la version électronique d’Alpine Entomology et j'ai annoncé que la bibliothèque de l’ETH ne reprenait plus de version papier de publications pour la société.

Bericht des Redaktors der Fauna Helvetica (PD Dr. D. Burckhardt)

Im Berichtsjahr wurden die Bände 29 und 30 publiziert. Beide sind überarbeitete Neuauflagen von Werken, die seit einiger Zeit vergriffen sind. Bei Band 29 handelt es sich um den ersten Teil der Apidae, der 1996 als letzter Band der Insecta Helvetica publiziert wurde. Neben der Einführung in die Apidae werden vor allem die *Bombus*-Arten abgehandelt. Band 30 ist eine Neubearbeitung der Fische. Im Weiteren ist Band 32 über die Amphipoda im Druck. Der Band über die Vespidae befindet sich im Stadium der Drucklegung und sollte ebenfalls bald publiziert sein. An weiteren Bänden wird gearbeitet.

Wie immer klappte die Zusammenarbeit mit dem CSCF ausgezeichnet. Dafür möchte ich dem Leiter Dr. Y. Gonseth und seinen Mitarbeiterinnen und Mitarbeitern ganz herzlich danken.

Bericht des Chefredaktors von Alpine Entomology (Dr. T. Lachat)

The second issue of Alpine Entomology arrived in time for Christmas 2018. This issue includes 14 articles on 160 pages: eleven research articles, one book review, one editorial and one meeting report of the Swiss Entomological Society. Nine of eleven research articles have been published in English. This shows that our journal is gaining in popularity among entomologists worldwide.

The editorial board is now composed of twenty specialists from all fields of Entomology and from a variety of different countries. Summing up the review process for the second issue, six manuscripts have been rejected, however resubmission was encouraged for half of them.

We think that the transition from the former “Mitteilungen der Schweizerischen Entomologischen Gesellschaft” has been achieved and we can consider the last two years as a success. The excellent support of Pensoft plays a major role in this endeavor, together with the very active support of our editorial board and reviewers. Our next aim in the coming years is to gain recognition for our journal by the Science Citation Index Expanded (SCIE) in order to be considered as a journal with impact factor.

Bericht der Quästorin und der Rechnungsrevisoren

Bericht der Quästorin (E. Leonetti)

Frau Emanuela Leonetti legt den Anwesenden die Jahresrechnung 2018 vor. Daraus sind folgende Zahlen entnommen:

Positionen/Objets	Ausgaben/ Dépenses	Einnahmen/ Revenus
Publikationskosten / Charges de publications:		
Publications AE – impression, rédaction	7'059.89	
Pensoft: Website, Open access	17'376.75	
Verwaltung / Administration	5'287.25	
Beitrag sc|nat / Cotisation sc|nat	1'645.00	
Arbeitsgruppenförderung / Soutien groupes de travail	2'187.75	
Verkauf Mitteilungen / Ventes bulletins		1'307.05
Mitgliederbeiträge / Cotisations		15'401.57
Beiträge / Subventions		
sc|nat		12'187.75
Syngenta		6'000.00
Biedermann – Mante I– Stiftung		6'000.00
Spenden und sonstige Einnahmen / Dons et autres produits		90.00
Zinsen / Intérêts	135.60	
Total / Totaux	**33'692.24**	**40'986.37**
Jahresgewinn / Bénéfice annuel 2018	**7'294.13**	
	40'986.37	40'986.37

Die Erfolgsrechnung für das Jahr 2018 schloss mit einem Gewinn von CHF 7'294.13 (Vermögen CHF 102'834.66).

Bericht der Rechnungsrevisoren (Dr. M. Sartori und Andreas Sanchez)

En tant qu'organe de contrôle de la société Entomologique Suisse, nous avons vérifié les comptes de l'exercice 2018. Nous avons pu constater que:

- le bilan d'ouverture, le bilan de clôture et le compte d'exploitation correspondent à la comptabilité
- les justificatifs sont conformes, exacts et correspondent à l'activité habituelle de la SES
- la fortune de la société correspond aux comptes à l'actif du bilan (liquidité + transitoires).

Pour sa part, la caissière assure que la tenue de la comptabilité a été faite, dans les limites de ses compétences, avec exactitude et selon les principes formulés dans le Code des Obligations (CO 959 t 662a/2).

C'est pourquoi nous prions l'assemblée d'accepter les comptes de l'exercice 2017 et de donner décharge à la caissière.

Der Quästorin wird einstimmig Decharge erteilt.

Budget und Mitgliederbeitrag

Budget 2019

Der Präsident stellt das Budget für 2019 vor, das einen Gewinn von CHF 1'400.- vorsieht.

Mitgliederbeitrag 2019

Die Beiträge bleiben gleich: Mitglieder in der Schweiz CHF 60.-, Studierende oder sich anderweitig in Ausbildung befindende Mitglieder zahlen während drei Jahren nur die Hälfte (CHF 30.-) des ordentlichen Beitrages. Mitgliedern im Ausland, die die gedruckte Version von Alpine Entomology wünschen, werden zusätzlich CHF 15.- Versandkosten verrechnet.

Das Budget und der Mitgliederbeitrag werden einstimmig und ohne Enthaltung genehmigt.

Prix Moulines 2019

Der Präsident gibt den Gewinner, Dr. Beat Wermelinger, bekannt. Herr Wermelinger, ein enthusiastischer Makrofotograf, wird für sein Buch «Insekten im Wald. Vielfalt, Funktion und Bedeutung», das an ein breites Publikum gerichtet, aber dennoch ein Fachbuch ist, ausgezeichnet.

Wermelinger B., 2017: *Insekten im Wald. Vielfalt, Funktionen und Bedeutung*. Birmensdorf, Eidg. Forschungsanstalt WSL; Bern, Stuttgart, Wien, Haupt Verlag. 367 S.

Varia

Der Präsident gratuliert dem Mitglied Dr. h.c. Armin Coray im Namen der SEG zu seinem Ehrendoktortitel, der ihm im November 2018 von der Universität Basel verliehen wurde.

Jahresversammlung 2020

Die nächste Jahresversammlung, entomo.ch 2020, findet am 6. und 7. März 2020 am Naturhistorischen Museum in Basel statt.

Ende der Generalversammlung um 10:50 Uhr.

Basel, im November 2019, der Sekretär Matthias Borer

Referenzen

Hallmann CA, Sorg M, Jongejans E, Siepel H, Hofland N, Schwan H, Stenmans W, Müller A, Sumser H, Hörren T, Goulson D, Kroon H de (2017) More than 75 percent decline over 27 years in total flying insect biomass in protected areas. PLOS ONE 12: e0185809. https://doi.org/10.1371/journal.pone.0185809

Swiss Academies of Arts and Sciences (2019) National significance of natural history collections in Switzerland. Swiss Academies Reports 14(2): 36 p. https://naturwissenschaften.ch/service/publications/109910-nationale-bedeutung-naturwissenschaftlicher-sammlungen-der-schweiz

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PENSOFT

Alpine Entomology

Thomas Walter – entomologiste et naturaliste (1957–2019)

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http://zoobank.org/C8037C80-A3C1-4F4D-8EEB-287BD94751D2

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C'est au matin du 26 septembre 2019 que Thomas Walter nous a quitté précocement à l'âge de 62 ans, à la maison, des suites d'un infarctus.

Thomas Walter, né en 1957, travaillait sur le site d'Agroscope à Reckenholz depuis le 1er août 1999.

Thomas était un zoologue chevronné, expert de groupes d'espèces liées de près ou de loin à l'agriculture en général comme les orthoptères et les papillons. Dans le cadre d'un projet consacré aux zones alluviales, il s'était intéressé ces dernières années de plus près aux carabes et aux coléoptères saproxyliques dont il a rapidement maitrisé l'identification.

Diplômé en zoologie, il participe d'abord à l'étude de la gestion de l'eau dans les agglomérations et la protection des eaux. Thomas a toujours gardé un intérêt particulier pour les milieux aquatiques. Il aimait notamment aller à la pêche, tout en gardant son regard et un comportement de naturaliste convaincu. Il s'est rapidement intéressé particulièrement à la comparaison entre la présence potentielle et effective des espèces dans une région, et l'inclusion de la faune dans les planifications territoriales, ce qui l'amena à participer au développement de l'antenne du Centre de Cartographie de la Faune (CSCF) en Suisse allemande et de la banque de données écofaunistiques.

Thomas a participé comme un des rédacteurs principaux d'un ouvrage majeur sur l'état des connaissances concernant la biodiversité en Suisse: «Evolution de la biodiversité en Suisse depuis 1900», paru en 2010. Dans la lignée de cette publication, Thomas a coordonné la rédaction d'un autre ouvrage éminemment important touchant à la protection de la nature dans l'environnement agricole: «Opérationnalisation des objectifs environnementaux pour l'agriculture», paru en 2013.

Ces derniers mois, il est souvent apparu dans les médias suite au lancement de son projet de riziculture. Il explique dans un interview donné à la SRF et diffusé le jour de sa mort, les premiers résultats de l'implantation de rizières au nord des Alpes dans des endroits adaptés à ce type de culture, temporairement inondés et donc peu adaptés aux grandes cultures classiques telle que le blé.



https://www.srf.ch/news/regional/aargau-solothurn/versuch-fast-erfolgreich-bald-gibt-es-reis-aus-brugg

Thomas était particulièrement enthousiaste à l'observation dans ces essais pilotes de rizières de rainettes vertes, de crapauds calamites, de nombreuses espèces de libellules, de bécassines et de chevaliers guignette. Des espèces que l'on retrouve normalement dans les zones alluviales.

Les autres projets de Thomas visaient tous à soutenir les espèces cibles et caractéristiques dans l'agriculture suisse pour lesquelles il promouvait des formes de production adaptées au site et laissant une place suffisante aux espaces naturels. Se faisait, il était un ardent défenseur de la qualité des surfaces de promotion de la biodiversité sur les exploitations agricoles. Il était membre du Forum Biodiversité de l'Académie des sciences naturelles de Suisse.

Thomas laisse derrière lui un grand vide en tant que collègue et ami et en tant que scientifique.

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