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Annotated checklist of the Coccinellidae (Coleoptera, Coccinelloidea) of Switzerland

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Abstract

An updated checklist of the Swiss species belonging to the family Coccinellidae is presented and briefly discussed. This checklist includes 81 species (82 taxa including the subspecies) and is based on 33'976 occurrences obtained from the identification of specimens held in museum and private collections, as well as from records taken from the literature. *Exochomus oblongus* Weidenbach, 1859, *Hyperaspis peezi* Fürsch, 1976, *Hyperaspis pseudopustulata* Mulsant, 1853, *Nephus bisignatus* (Fürsch, 1984), *Rhyzobius forestieri* (Mulsant, 1853), *Scymniscus anomus* (Mulsant & Rey, 1852) and *Scymnus doriae* Capra, 1924 are recorded for the first time in Switzerland. In parallel, *Chilocorus similis* (P. Rossi, 1790), *Bulaea lichatschovii* (Hummel, 1827), *Ceratomegilla rufocincta rufocincta* (Mulsant, 1850), *Coccinella undecimpunctata undecimpunctata* Linnaeus, 1758, *Chnootriba elaterii* (P. Rossi, 1794), *Henosepilachna vigintioctopunctata* (Fabricius, 1775), *Hyperaspis quadrimaculata* (Redtenbacher, 1843), *Scymnus marginalis* (P. Rossi, 1794) and *Novius cardinalis* (Mulsant, 1850) were recorded from Switzerland in the past but 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.

Key Words

Insecta, beetle, ladybird, species list, new country records, faunistics, distribution

Introduction

Considered for a long time as a member of the super-family Cucujoidea, the beetle family Coccinellidae now belongs to the super-family Coccinelloidea (Robertson et al. 2015). More than 6'000 species of Coccinellidae are described worldwide (Vandenberg 2002; Kovář 2007), among them about 100 species occurring in Central Europe (Nedvěd 2015; Klausnitzer et al. 2022) and 196 in Continental Europe (Nedvěd and Đurić 2022). The majority of the European species are predators of phytophagous arthropods, particularly aphids (Aphidoidea), coccids (Coccoidea), whiteflies (Aleyrodoidea), spider mites (Acari) and larvae of chrysomelid beetles (Chrysomelidae) (Hodek and Honěk 2009; Weber and Lundgren 2009). Due to this diet, they are regularly used for biological control in agriculture

and forestry. As an unexpected consequence, certain species of exotic Coccinellidae, initially introduced as biological control agents, have become invasive species (Soares et al. 2018). Other diets exist, however, to a lesser extent within this family, with some species either phytophagous or mycophagous (Sutherland and Parrella 2009; Klausnitzer 2019a).

Despite the fact that this is a charismatic family, no overview has been published in Switzerland since the catalog of Stierlin (1900). Since this last publication, our knowledge of the systematics and distribution of the species has evolved considerably, so that an update of this list was necessary. In addition, several introduced species used in biological control have now acclimatized and are reproducing in the field in Switzerland, so that they are now part of the fauna of Switzerland.

This publication aims to present an annotated checklist of the species in Switzerland. It is based on a review of the Swiss museum and private collections, as well as of the literature and data gathered by naturalists. Thus, resident species are distinguished from species that are mistakenly mentioned for Switzerland, insufficiently documented and those introduced but not established in the country.

Materials and methods

In order to present a complete list of the Swiss fauna, based on all existing information, we performed an exhaustive examination of the relevant material present in major Swiss museum collections, as was recently done for other beetle groups (see for example Sanchez et al. 2020; Chittaro et al. 2021). The collections in the following museums were studied (the contact person is reported in parentheses after each institution):

AGRO	Agroscope-Changins, Nyon (Stève Breitenmoser)
BNM	Bündner Natur-Museum, Chur (Stephan Liersch)
ETH	Eidgenössische-Technische Hochschule, Zürich (Michael Greeff)
KMLI	Kantonsmuseum Baselland, Liestal (Marc Limat)
LEBA	Laboratoire d'écologie et biologie aquatique (UNIGE), Genève
MHNF	Musée d'histoire naturelle de Fribourg (Sophie Giriens)
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 (Sonja Gerber)
MSNL	Museo cantonale di storia naturale, Lugano (Lucia Pollini Paltrinieri)
MZL	Musée cantonal de zoologie, Lausanne (Anne Freitag)
MZA	Museum zu Allerheiligen, Schaffhausen (Urs Weibel)
NMAA	Naturama, Aarau (Janine Mazenauer)
NMB	Naturhistorisches Museum Basel (Matthias Borer)
NMBE	Naturhistorisches Museum Bern (Hannes Baur)
NMLU	Natur-Museum, Luzern (Marco Bernasconi)
NMSG	Naturmuseum St. Gallen (Karin Urfer)
NMTG	Naturmuseum Thurgau, Frauenfeld (Barbara Richner)
NMSO	Naturmuseum, Solothurn (Marc Neumann)

We also cited data gathered from three museums outside Switzerland:

MAMU	Manchester Museum, Great Britain
TLMF	Tiroler Landesmuseen, Innsbruck, Austria
SMNS	Staatlichen Museum für Naturkunde Stuttgart, Germany

Moreover, we included data from the private collections of the authors, as well as those of the following individuals. They are classified in alphabetical order. The municipality and the abbreviated canton of residence are indicated in brackets: Bastien Guibert (Gy GE), Berndt Eismann (Kreuzlingen TG), Hansjörg Brägger (Amriswil TG), Kevin Gurcel (France, Annecy), Stève Breitenmoser (Givrins VD) and Werner Marggi (Thun BE).

All available data from the literature relevant for Switzerland were also considered. The references from these publications are included in the bibliography if they are specifically cited in the text. Publications consulted but not cited in the text are not mentioned.

The subfamily and tribal classifications adopted here follow Bouchard et al. (2011), Seago et al. (2011) and Robertson et al. (2015). Nomenclature and systematics followed are those of the “Catalogue of Palaearctic Coleoptera” (Kovář 2007), with the following exceptions:

- *Exochomus flavipes* (Thunberg, 1781) does not belong to the Palaearctic fauna and is therefore absent from this catalogue (Kovář 2007). For this species, we followed Fürsch (1961).
- Like Tomaszewska (2010), we preferred the combinations *Rhyzobius forestieri* (Mulsant, 1853) and *Rhyzobius lophanthae* (Blaisdell, 1892) instead of *Lindorus forestieri* (Mulsant, 1853) and *Lindorus lophanthae* (Blaisdell, 1892).
- Based on morphological and molecular examination, we considered the combination *Chnootriba elaterii* (P. Rossi, 1794) instead of *Henosepilachna elaterii* (P. Rossi, 1794), as proposed by Tomaszewska and Szawaryn (2016).
- As proposed by Pang et al. (2020), we use here the combination *Novius cardinalis* instead of *Rodolia cardinalis* (Mulsant, 1850).

The specimens were identified using the following publications: Fürsch (1961, 1965, 1984), Canepari (1983), Canepari et al. (1985), Nedvěd (2015), Biranvand et al. (2017, 2020).

When not otherwise specified, general information on species' distributions is taken from Kovář (2007), Coutanceau (2014) and Nedvěd (2015).

The list of the main synonyms of each taxon is provided in “Catalogue of Palaearctic Coleoptera” (Kovář 2007) and is therefore not reported here.

Once an exhaustive list of species was compiled, we followed the procedure proposed by Monnerat et al. (2015) in order to assess which of these species should be considered as belonging to the Swiss fauna. We only retained species whose relative data were deemed sufficient (unambiguous labeling, reliable collections, etc.) for inclusion on the national checklist.

Those species whose presence in Switzerland is substantiated by less than 30 valid observations are subject to an additional comment (the majority of these species are illustrated in Fig. 1). In these cases, species names in the

table are followed by a letter and a number in bold (“C1” for example) and all the examined specimens and published observations are mentioned in order to document and justify the presence or absence of these species on the checklist. When not otherwise specified, all examined material was identified or reviewed by the first author.

There are various genera and species groups in Coccinellidae (mainly among the genera *Nephus*, *Scymnus* and *Hyperaspis*) for which the only known reliable characters are the male genitalia. For those species, only dissected males are counted as “verified” records, while records based exclusively upon female specimens were omitted as unverifiable.

The specimens and literature-based records presented here are listed in chronological order of discovery (or publication date) and then in alphabetical order by locality, depending on available information. All occurrences are cited according to the following scheme: number of specimens, locality (pre-2000 data) or municipality and abbreviated canton (post-2000 data), date, collector, determinator (in the case that the determinator was not one of the authors), collection and official acronym of the institution where the insect is deposited.

Information about localities and dates are reported as found on the labels. Interpretations of alphabetical abbreviations are placed within square brackets “[]”. In old collections, the collector (leg.) is not always explicitly labelled. In such cases, we favored the « coll. » tag. In some cases, the original collection holder was not labelled but we were nonetheless able to identify the source of the collection based on type labels and/or handwriting.

The Charles Maerky collection, held by the Natural History Museum of Geneva, has long been considered problematic (Monnerat et al. 2015). In addition to specimens coming from his personal collection (“coll. Maerky C.”), it also contains insects from other sources (labelled, for instance, as “ex coll. Melly A.”) but lacking any original labels. In such cases, we maintained the “coll. Maerky C.” mention for his whole collection to ensure the association of these samples with the Maerky C. collection.

For literature-based data, detailed under “Published data”, we retained the locality as it appeared in the original citation. We consider the “source” of the records to be the author of the publication, for example: “Ormontsthal by Venetz I. (Stierlin and Gautard 1867)”. If the same records have been published more than once, then only the oldest publication is retained, given that localities in later publications are often altered and sometimes truncated.

Among the data cited in this paper under “Examined material” or “Published data”, we inserted a superscript number code before those entries we considered insufficiently documented to be retained, using the following code to describe error type (following Monnerat et al. 2015). Thus if one of the following eight criteria is fulfilled, a record is considered as doubtful:

1. data source cannot be verified
2. incorrect identification
3. specimen from problematic collection

4. specimen of unknown origin but attributed to a Swiss locality
5. double labeling, original locality misinterpreted or incorrectly copied
6. confusion between localities: original finding, breeding or hatching place and collection storage site
7. non-Swiss localities or potentially Swiss localities that share their names with foreign place names (and thus of dubious Swiss origin)
8. chorological or ecological inconsistencies

Abbreviations used: coll. = collection, det. = determinator, ex. = specimen, leg. = collector. Abbreviated Swiss cantons (only cantons cited in the text): AG = Aargau, BE = Bern, FR = Fribourg, GE = Geneva, GR = Grisons, JU = Jura, LU = Lucerne, TI = Ticino, VD = Vaud, VS = Valais.

Results

Swiss fauna Coccinellidae list

We consider that the 81 species (82 taxa) listed in bold and without square brackets “[]” either currently do or formerly did form populations in Switzerland, even if only scant information is available for many of them. We also consider here several allochthonous species, originating from other regions of the world (sometimes introduced), which maintain (or have maintained) continuous populations in Switzerland during several years.

On the other hand, the 14 species (15 taxa including the subspecies) listed in square brackets “[]” should not be considered as belonging to the Swiss fauna, until new data show otherwise. In this category, we placed species whose individuals come from problematic collections, such as Charles Maerky’s or Max Täschler’s (Monnerat et al. 2015), those that were erroneously mentioned for Switzerland due to incorrect identifications and those cited in old publications, like Stierlin and Gautard (1867), without reference to specific individuals and consequently considered as doubtful. Other species may eventually be found in the Swiss territory, but currently available data are not sufficient to confirm their establishment in Switzerland. We also consider here allochthonous species (but not established) certainly found in Switzerland but whose observation results each time from either new or attested or probable imports.

To facilitate the species’ search in this document, taxa appear in alphabetical order for subfamilies, tribes, genera, subgenera, species and subspecies.

All collected information represents 33’976 occurrences within the concerned family.

Updated distribution maps of these species are available on the info fauna – CSCF cartographic server (<http://lepus.unine.ch/carto/>). All the valid data are also available in <http://www.GBIF.org> (<https://doi.org/10.15468/dl.w7yjn>).



Figure 1. A. *Exochomus oblongus*; B. *Parexochomus nigromaculatus*; C. *Rhyzobius lophanthae*; D. *Calvia quindecimguttata*; E. *Ceratomegilla alpina redtenbacheri*; F. *Coccinella venusta adalioides*; G. *Coccinella trifasciata trifasciata*; H. *Oenopia impustulata*; I. *Hyperaspis concolor*, habitus; J. aedeagus ventral view; K. *Hyperaspis peezi*, habitus; L. aedeagus ventral view; M. *Hyperaspis pseudopustulata*, habitus; N. aedeagus ventral view; O. *Hyperaspis reppensis*, habitus; P. aedeagus ventral view; Q. *Clitostethus arcuatus*; R. *Nephus bisignatus*, habitus; S. aedeagus ventral view; T. aedeagus lateral view; U. *Scymniscus anomus*, habitus; V. aedeagus ventral view; W. *Scymnus doriae*, habitus; X. aedeagus ventral view. When no scale is specified, the scale bar is equal to 1 mm.

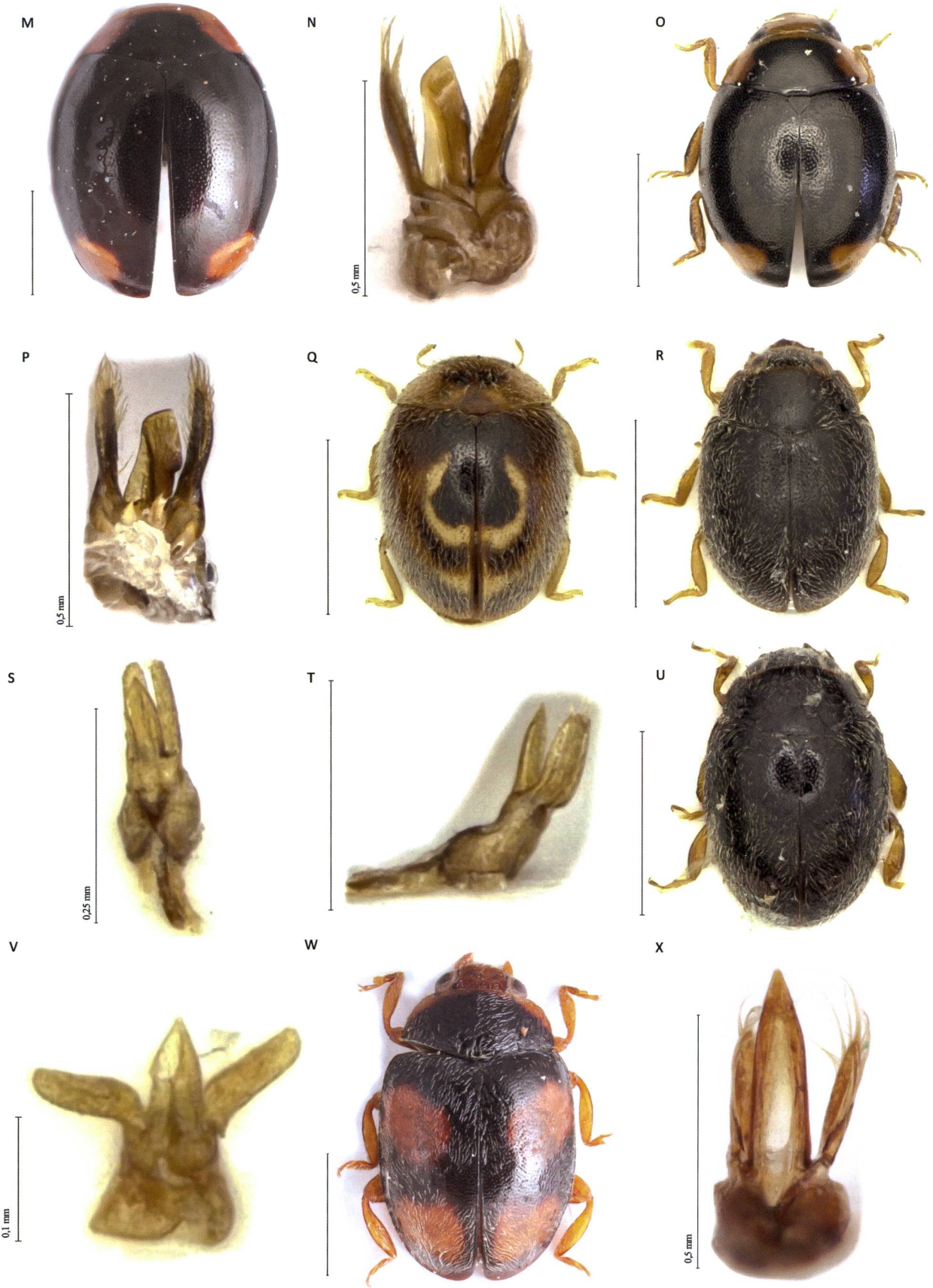


Figure 1. Continued.

Checklist of the Swiss species

Coccinellinae Latreille, 1807

Chilocorini Mulsant, 1846

- Chilocorus bipustulatus* (Linnaeus, 1758)
Chilocorus renipustulatus (L. G. Scriba, 1791)
 [Chilocorus similis (P. Rossi, 1790)] C1
Exochomus oblongus Weidenbach, 1859 C2
Exochomus quadripustulatus (Linnaeus, 1758)
Parexochomus nigromaculatus (Goeze, 1777) C3

Coccidulini Mulsant, 1846

- Coccidula rufa* (Herbst, 1783)
Coccidula scutellata (Herbst, 1783)
 [Cryptolaemus montrouzieri montrouzieri Mulsant, 1853] C4
Rhyzobius chrysomeloides (Herbst, 1792)
Rhyzobius forestieri (Mulsant, 1853) C5
Rhyzobius litura (Fabricius, 1787)
Rhyzobius lophanthae (Blaisdell, 1892) C6

Coccinellini Latreille, 1807

- Adalia (Adalia) bipunctata* (Linnaeus, 1758)
Adalia (Adalia) decempunctata (Linnaeus, 1758)
Adalia (Adaliomorpha) conglomerata (Linnaeus, 1758)
Anatis ocellata (Linnaeus, 1758)
Anisosticta novemdecimpunctata (Linnaeus, 1758)
Aphidecta oblitterata (Linnaeus, 1758)
 [Bulaea lichatschovii (Hummel, 1827)] C7
Calvia decemguttata (Linnaeus, 1767)
Calvia quatuordecimguttata (Linnaeus, 1758)
Calvia quindecimguttata (Fabricius, 1777) C8
Ceratomegilla (Adaliopsis) alpina alpina (A. Villa & G. B. Villa, 1835)
Ceratomegilla (Adaliopsis) alpina redtenbacheri (Capra, 1928) C9
Ceratomegilla (Ceratomegilla) notata (Laicharting, 1781)
Ceratomegilla (Ceratomegilla) rufocincta doderoi (Capra, 1944)
 [Ceratomegilla (Ceratomegilla) rufocincta rufocincta (Mulsant, 1850)] C10
Ceratomegilla (Ceratomegilla) undecimnotata (D. H. Schneider, 1792)
Coccinella (Chelonitis) venusta adalioides (Capra, 1944) C11
Coccinella (Coccinella) hieroglyphica hieroglyphica Linnaeus, 1758
Coccinella (Coccinella) magnifica L. Redtenbacher, 1843
Coccinella (Coccinella) quinquepunctata Linnaeus, 1758
Coccinella (Coccinella) septempunctata Linnaeus, 1758
Coccinella (Coccinella) trifasciata trifasciata Linnaeus, 1758 C12
 [Coccinella (Spilota) undecimpunctata undecimpunctata Linnaeus, 1758] C13
Coccinula quatuordecimpustulata (Linnaeus, 1758)
Halyzia sedecimguttata (Linnaeus, 1758)
Harmonia axyridis (Pallas, 1773)
Harmonia quadripunctata (Pontoppidan, 1763)
Hippodamia (Hemisphaerica) septemmaculata (DeGeer, 1775)
Hippodamia (Hemisphaerica) tredecimpunctata (Linnaeus, 1758)
Hippodamia (Hippodamia) variegata (Goeze, 1777)
Myrrha (Myrrha) octodecimguttata (Linnaeus, 1758)

- Myzia oblongoguttata oblongoguttata* (Linnaeus, 1758)
Oenopia conglobata conglobata (Linnaeus, 1758)
Oenopia impustulata (Linnaeus, 1767) C14
Oenopia lyncea agnatha (Rosenhauer, 1847)
Propylea quatuordecimpunctata (Linnaeus, 1758)
Psyllobora (Thea) vigintiduopunctata (Linnaeus, 1758)
Sospita vigintiguttata (Linnaeus, 1758)
Tytthaspis sedecimpunctata (Linnaeus, 1761)
Vibidia duodecimguttata (Poda von Neuhaus, 1761)

Epilachnini Mulsant, 1850

- [Chnootriba elaterii (P. Rossi, 1794)] C15
Cynegetis impunctata (Linnaeus, 1767)
Henosepilachna argus (Geoffroy, 1785)
 [Henosepilachna vigintioctopunctata (Fabricius, 1775)] C16
Subcoccinella vigintiquatuorpunctata (Linnaeus, 1758)

Hyperaspini Mulsant, 1846

- Hyperaspis (Hyperaspis) campestris* (Herbst, 1783)
Hyperaspis (Hyperaspis) concolor (Suffrian, 1843) C17
 [Hyperaspis (Hyperaspis) erythrocephala (Fabricius, 1787)] C18
Hyperaspis (Hyperaspis) peezi Fürsch, 1976 C19
Hyperaspis (Hyperaspis) pseudopustulata Mulsant, 1853 C20
 [Hyperaspis (Hyperaspis) quadrimaculata (Redtenbacher, 1843)] C21
Hyperaspis (Hyperaspis) reppensis (Herbst, 1783)

Noviini Mulsant, 1850

- [Novius cardinalis] (Mulsant, 1850) C22

Platynaspidini Mulsant, 1846

- Platynaspis luteorubra* (Goeze, 1777)

Scymnini Mulsant, 1846

- Clitostethus arcuatus* (P. Rossi, 1794) C23
Nephus (Bipunctatus) bipunctatus (Kugelann, 1794)
Nephus (Bipunctatus) bisignatus (Fürsch, 1984) C24
 [Nephus (Bipunctatus) kieserwetteri (Mulsant, 1850)] C25
 [Nephus (Nephus) binotatus (C. N. F. Brisout de Barneville, 1863)] C26
Nephus (Nephus) quadrimaculatus (Herbst, 1783)
Nephus (Nephus) redtenbacheri (Mulsant, 1846)
Scymniscus anomus (Mulsant & Rey, 1852) C27
 [Scymniscus horioni (Fürsch, 1965)] C28
Scymnus (Neopullus) ater Kugelann, 1794
Scymnus (Neopullus) haemorrhoidalis Herbst, 1797
Scymnus (Neopullus) limbatus Stephens, 1832
Scymnus (Parapullus) abietis (Paykull, 1798)
Scymnus (Pullus) auritus Thunberg, 1795
Scymnus (Pullus) ferrugatus (Moll, 1785)
 [Scymnus (Pullus) fraxini Mulsant, 1850] C29
Scymnus (Pullus) impexus Mulsant, 1850
Scymnus (Pullus) subvillosus (Goeze, 1777)
Scymnus (Pullus) suturalis Thunberg, 1795
Scymnus (Scymnus) apetzi Mulsant, 1846

Scymnus (Scymnus) doriae Capra, 1924 C30
Scymnus (Scymnus) femoralis (Gyllenhal, 1827)
Scymnus (Scymnus) frontalis (Fabricius, 1787)
Scymnus (Scymnus) interruptus (Goeze, 1777)
 [Scymnus (Scymnus) marginalis (P. Rossi, 1794)] C31
Scymnus (Scymnus) nigrinus Kugelann, 1794
Scymnus (Scymnus) rubromaculatus (Goeze, 1777)
Scymnus (Scymnus) schmidti Fürsch, 1958
Scymnus (Scymnus) suffrianioides apetzoides (Capra & Fürsch, 1967)

Stethorini Dobrzanskiy, 1924

Stethorus (Stethorus) pusillus (Herbst, 1797)

Commented species

C1) [*Chilocorus similis* (P. Rossi, 1790)]

Published data. ^{1,8)}Aigle by Jaccard H. (Jaccard 1890); ^{1,8)}Puschlav [Poschiavo] by Killias E., ^{1,8)}Chur in der Au, 1848, by Kriechbaumer J. and ^{1,8)}Chur, 1887, by Killias E. (Caflich 1894); ^{1,8)}[Schweiz] (Stierlin 1898).

Comment. None of the numerous citations in the older literature are reliable, as none of them are supported by specimens in the examined collections. In the Palearctic region, *C. similis* is only known from Italy, but absent from Sardinia (Canepari 2011).

C2) *Exochomus oblongus* Weidenbach, 1859

Fig. 1A

Examined material. 1 ex., GR, Eng. [Engadin], V. d'Uina, VII.1972, leg. Toumayeff G., MHNG.

Comment. This very rare species which develops on pines (probably *Pinus mugo* Turra in Switzerland) and perhaps also on spruce (*Picea* spp.) and juniper (*Juniperus* spp.) in peat bogs, is only present in Germany (Bavarian region and Baden-Württemberg), in Austria and Italy (Tyrol), and very sporadically in Czech Republic, and Bosnia and Herzegovina. Only one specimen was found in Switzerland in the canton of Grisons at 1800 meters above the sea level, close to the Tyrol region. Considered as belonging to the Swiss fauna, the species has not been found in Switzerland for 50 years, and further research is necessary to identify a real native population.

C3) *Parexochomus nigromaculatus* (Goeze, 1777)

Fig. 1B

Examined material. 7 ex., Bern, leg. Benteli F., det. Kreissl E., NMBE; 1 ex., Genève, Gr. Saconnex, leg. Anonymous, coll. Zehr S., MHNG; 1 ex., Genf, leg. Lasserre, ETH; ^{3,4,6)}1 ex., Wallis, leg. Anonymous, det. Kreissl E., NMBE; ^{3,4,6)}1 ex., Helvet. [Helvetia], leg. Anonymous, ETH; ³⁾2 ♂, Kt. Genf, leg. Täschler M., coll. Linder A., ETH; 3 ex., Pomy, leg. & coll. Mellet L., MZL; ^{3,4,6)}1 ex., Wallis, leg. Anonymous, NMBE; 1 ex.,

Peney, VII.1908, leg. Tournier H., MHNG; 1 ex., Genève, Jussy, 2.VII.1918, leg. Zehr S., MHNG; 1 ex., Châtelaine, 27.V.1921, leg. & coll. Simonet J., MHNG; 1 ex., London [Allondon], 15.VI.1943, leg. & coll. Simonet J., MHNG.

Published data. ¹⁾Genf by Chevrier F. (Stierlin and Gautard 1867); ¹⁾Seeland b. Kerzers by Rätzer A. (Rätzer 1888); Switzerland, uncertain data (Nedvěd 2015).

Comment. *Parexochomus nigromaculatus* is widely distributed in Europe. It is known from all France and Corsica (Nicolas and Pique 2008; Callot 2009; Nicolas 2009; Coutanceau 2014) but its presence was considered uncertain in Switzerland by Nedvěd (2015). However, several Swiss specimens exist in the examined collections, especially in the Geneva area, but the species has not been found for almost 80 years. Further research is needed to confirm if this species is still present in Switzerland. It is found on different species of deciduous and coniferous trees and plants, including pine trees (*Pinus* spp.), European blueberry (*Vaccinium myrtillus* L.), willows (*Salix* spp.), heathers (*Calluna* spp., *Erica* spp.), gorses (*Ulex* spp.), brooms (*Cytisus* spp.), junipers (*Juniperus* spp.) and oaks (*Quercus* spp.) (Nicolas and Pique 2008; Nedvěd 2015; Classen et al. 2016; Klausnitzer 2019b, 2020), especially in the moorlands, where it feeds on coccids (and aphids (Coutanceau 2014)), especially *Peliococcus calluneti* (Lindinger, 1912), *Phyllostroma myrtilli* (Kaltenbach, 1874) and *Rhizococcus devoniensis* (Green, 1896) (Klausnitzer 2019b).

C4) [*Cryptolaemus montrouzieri montrouzieri* Mulsant, 1853]

Examined material. ⁸⁾11 ex., Suisse, Lucerne, Grossdietwil, IV.1993, leg. & det. Andermatt Biocontrol Suisse AG, MHNG.

Comment. This Australian species is now established in the Palearctic region after several introductions on the continent for biological control of mealybugs (Hemiptera, Pseudococcidae) (Franco et al. 1994; Roy and Migeon 2010; Klausnitzer 2020). It was first recorded in Europe in Italy in 1908 (Canepari 2007; Roy and Migeon 2010) and in 1918 in France (Coutanceau 2014) where it is now principally known from the Mediterranean coast (Midi and Corsica), even if a case of urban reproduction (specimens escaped from a green house) was also reported in the north of the country (Cloupeau et al. 2012; Coutanceau 2014). In Switzerland, 11 specimens were found in 1993 in the canton of Luzern by a company commercializing this species as a biological control agent. They are therefore certainly the result of introductions. Nevertheless, it seems that this species has not become established and therefore is not considered as belonging to the Swiss fauna. *Cryptolaemus montrouzieri* is sensitive to cold and it seems that it cannot overwinter in the field in Central Europe at the moment (Klausnitzer 2020). Nevertheless, the species is still commercialized for biological control in Switzerland and may therefore be found again in the future.

C5) *Rhyzobius forestieri* (Mulsant, 1853)

Examined material. 1 ex., Brissago TI, 3.VII.2022, leg. & coll. Chittaro Y.; 1 ♂, Mendrisio TI, 5.VII.2022, leg. & coll. Chittaro Y.

Comment. *Rhyzobius forestieri* is a species of Australian origin imported in Europe in the 1980s for the biological control of the Olive Scale *Saissetia oleae* (Olivier, 1791) (Hemiptera, Coccidae) (Katsoyannos 1984). In Switzerland's neighboring countries, it is acclimatized since 1987 in France (Cloupeau and Durand 2010) and in Italy (Canovai and Raspi 1999), but never seems to have been reported in Germany or in Austria. In 2022, two specimens were found in the canton of Ticino in Switzerland, in two localities several tens of kilometers apart, in good natural environments. Since to our knowledge the species has never been introduced in Switzerland, we suspect a natural colonization of Ticino from Italy.

C6) *Rhyzobius lophanthae* (Blaisdell, 1892)

Fig. 1C

Examined material. 1 ex., CH, TI, Lugano, Mt. Brè-Vetta, 11.–20.VII.1983, leg. Rezbanyai-Reser L., NMLU; 1 ex., CH, TI, Meride, San Antonio, 1.–10.-VIII.1991, leg. Rezbanyai-Reser L., NMLU; 1 ex., TI, S. Pietro, Mte Albano, VIII.1991, leg. Station fédérale de recherches agronomiques Changins, MHNG; 1 ex., CH, TI, Mezzana, Balerna, 11.–20.VI.1997, leg. Rezbanyai-Reser L., NMLU; 1 ex., Meinier GE, 30.V.–5.VI.2015, leg. Faye J. D., LEBA; 5 ex., Meinier GE, 30.VI.–15.VII.2015, 15.–31.VII.2015, 31.VII.–15-VIII.2015, leg. Faye J. D., LEBA; 2 ex., Meyrin GE, 28.VI.–11.VII.2016, 11.–25.VII.2016, leg. Monod V., LEBA; 1 ex., Gy GE, 26.VI.–10.VII.2017, leg. Bessat M., LEBA; 1 ♂, Jaun FR, 4.–24.VI.2019, leg. Hauser G., MHNF; 1 ♂, Jaun FR, 15.VII.–11.VIII.2019, leg. Giriens S., coll. Chittaro Y.; 1 ex., Morges VD, 22.II.2020, leg. & coll. Chittaro Y.; 1 ex., Signy-Avenex VD, 8.VII.–1.VIII.2020, leg., det. & coll. Breitenmoser S.; 1 ex., Fully VS, 20.VII.2022, leg. Sierro A., coll. Chittaro Y.

Published data. Most of the data above in Sanchez et al. (2021).

Comment. The situation of this exotic species, now established in Switzerland, was extensively detailed in Sanchez et al. (2021). Since this publication, several new specimens have been found in the country, which seems to show that *R. lophanthae* continues its expansion in the country.

C7) [*Bulaea lichatschovii* (Hummel, 1827)]

Examined material. ^{3,4,6,8}3 ex., Genève, leg. Poncy E., coll. Maerky C., MHNG; ^{3,4,6,8}3 ex., Genève, Lancy, leg. Fries A., coll. Maerky C., MHNG; ^{3,8}4 ex., Genf, leg. Lasserre H., ETH; ^{3,4,6,8}2 ex., Suisse, Nyon, leg. Poncy E., coll. Maerky C., MHNG.

Published data. ^{1,8}[Schweiz] by Heer O. (Bremi-Wolf 1856); ^{1,8}Genf by Chevrier F. (Stierlin and Gautard 1867); ^{1,8}Visp by Rätzer (Rätzer 1888).

Comment. This species is present in Africa and in the eastern Palearctic region and has been occasionally introduced in Central Europe (Ali et al. 2014; Nedvěd 2015; Biranvand et al. 2017). All the examined specimens belong to problematic collections (see Monnerat et al. 2015) and therefore this species is not considered as belonging to the Swiss fauna. *Bulaea lichatschovii* feeds on plants (mostly pollen) of Chenopodiaceae.

C8) *Calvia quindecimguttata* (Fabricius, 1777)

Fig. 1D

Examined material. ³1 ex., Tessin, leg. Ghidini A., coll. Maerky C., MHNG; 1 ex., Mendrisio, 21.VII., leg. Frey-Gessner E., MHNG; ³1 ex., Suisse, Mendrisio, 24.VII., leg. & coll. Maerky C., MHNG; ³3 ex., Suisse, Agno, 29.VII., leg. & coll. Maerky C., MHNG; 1 ex., TI, Locarno, V.1934, leg. & coll. Toumayeff G., MHNG; 1 ex., Bioggio, 24.V.1955, leg. & coll. Simonet J., MHNG; 1 ex., CH, LU, Sempach, Vogelwarte, IX.1980, leg. Rezbanyai-Reser L., det. Herger P., NMLU.

Published data. ¹Genf and Vallorbes by Lasserre H., ¹Schaffhausen by Stierlin G. and ¹Wallis by Venetz I. (Stierlin and Gautard 1867); Mendrisio by Frey-Gessner E. (Stierlin 1883); ¹Alpes de Moerell [Mörel] and ¹Glacier d'Aletsch by Martin C. (Favre 1890); ¹[Schweiz] and ¹Schaffhausen (Stierlin 1898); ¹Chiasso by Fontana P. (Fontana 1947); 1 ex., LU, Sempach, Vogelwarte, 21.–30. IX.1980, leg. Rezbanyai-Reser L. (Rintelen and Herger 1997); Switzerland (Kovář 2007; Nedvěd 2015).

Comment. Even though this species was frequently recorded from Switzerland in the old literature, only a small number of records can be reliably assigned to this species, confirming the presence of a few scattered populations within the country. Very rare and localized in Switzerland, this species was principally found in the south of the country, in the canton of Ticino, although one specimen was found in the canton of Luzern in 1980 using a light trap (the attraction by light was already noticed by Klausnitzer (2019, 2020)). *Calvia quindecimguttata* lives in deciduous forests in wetlands, marshes and pond banks, mainly on alders (*Alnus* spp.) and willows, where it feeds on aphids, psocopterans and immature stages of chrysomelids (probably *Agelastica alni* (Linnaeus, 1758) or *Plagiosterna aenea* (Linnaeus, 1758)) (Nedvěd 2015; Klausnitzer 2019b, 2020). It is fairly widely distributed in Central Europe but is always considered as rare.

C9) *Ceratomegilla alpina redtenbacheri* (Capra, 1928)

Fig. 1E

Examined material. 1 ex., Suisse, Grisons, Val Mora, 3.VIII.1974, leg. Besuchet C., det. Fürsch H., MHNG.

Comment. *Ceratomegilla alpina* is represented by two subspecies in the Palearctic region: *C. a. alpina* is present in Austria, France (Alps), Italy (north), Liechtenstein and Switzerland, and *C. a. redtenbacheri* is present in Austria (Alps), Bosnia and Herzegovina (Kulijer 2015), Bulgaria, Germany (Bayern), Poland (Tatra), Romania, Slovakia (Tatra) and

Ukraine (Karpaty). If the nominal subspecies is very widely distributed in the Alps in Switzerland and sometimes quite abundant at altitude, the same is not true for the subspecies *redtenbacheri*, which is only known from one specimen, captured in flight at 2200 m in the Val Müstair region, bordering the Tyrol, where the species is also known. Specific research is necessary to confirm the presence of a real native population or the validity of the subspecies distinction.

C10) [*Ceratomegilla (Ceratomegilla) rufocincta rufocincta* (Mulsant, 1850)]

Published data. ¹Switzerland (Kovář 2007).

Comment. *Ceratomegilla rufocincta* is represented by two subspecies in Europe: *C. r. rufocincta* and *C. r. doderoi*. No specimens referring to the nominal subspecies were found in the controlled collections in Switzerland, but the alpine subspecies *doderoi* occurs in our country at high elevation. Kovář (2007) announced the nominal subspecies from Italy (Alps) and Switzerland. Coutanceau (2014) does not consider any subspecies and announced *C. rufocincta* from the southern Alps in France, Italy and Switzerland. This taxon is not considered as belonging to the Swiss fauna.

C11) *Coccinella (Chelonitis) venusta adalioides* (Capra, 1944)

Fig. 1F

Examined material. 1 ex., Kt. Wallis, Col de Fenêtre, VII.1903, leg. [Steck T.], coll. Linder A., ETH; 1 ex., Simplon VS, 26.VI.2013, leg. Marggi W., coll. Sanchez A.

Published data. Col de Fenêtre, VII.1903, coll. Steck T. (Linder 1953); Walliser Alpen (Fürsch 1967); ¹1 ex., VS, Breithorn, 18.VII.1984 by Kiener S. (Kiener 1995).

Comment. This species is represented by two subspecies: *C. venusta venusta* (J. Weise, 1879) and *C. venusta adalioides*. Kovář (2007) announces the nominal subspecies only from the French Alps and the subspecies *adalioides* only from the Italian Alps. Coutanceau (2014) announces the nominal subspecies from the French Alps and from Italy, whereas he mentions *adalioides* from the Alpes-maritimes in France and from Italy. In Switzerland, only two specimens belonging to the subspecies *adalioides* were found, in the Alps in the canton of Valais. The specimen from the Breithorn cited by Kiener (1995) was not found in any collection. *Coccinella venusta adalioides* is found in high altitude meadows, in low vegetation, under rocks and at the foot of cliffs, sometimes with the morphologically similar *Ceratomegilla rufocincta doderoi*. Additional surveying in the Valais may yield reliable data on this species.

C12) *Coccinella (Coccinella) trifasciata trifasciata* Linnaeus, 1758

Fig. 1G

Examined material. 1 ex., Helvet., leg. Anonymous, ETH; 2 ex., Stürvis, leg. & coll. Killias E., BNM; 2 ex., Stürvis, leg. Anonymous, det. Besuchet C., BNM; ³1 ex., Suisse,

leg. Mellet A., coll. Maerky C., MHNG; ³1 ex., Hte Engadine, VIII., leg. & coll. Toumayeff G., MHNG; 2 ex., Alp La Schera, 28.VII.1919, 3.VIII.1921, leg. & coll. Handschin E., BNM; 1 ex., Stavelchod, 10.VIII.1921, leg. & coll. Handschin E., BNM; 1 ex., Albula, Zavretta, 30.V.1950, leg. Wolf J.-P., ETH; 1 ex., Albula, 13.VII.1950, leg. Wolf J.-P., ETH; 1 ex., Buffalora, 17.VI.1952, leg. & coll. Handschin, BNM; 23 ex., Kt. Graubünden, Scans, VII.1952, leg. Linder A., coll. Besuchet C., MZL, coll. Linder A., ETH, coll. Louis P., NMBE, coll. Schenk H., NMBE, coll. Toumayeff G., MHNG; 2 ex., Bernina, VIII.1964, leg. & det. Linder A., NMBE; 1 ex., Bernina, VIII.1964, leg. & det. Linder A., coll. Kiener S., MHNG; 1 ex., Flumserberg, Zieger, 13.VII.1965, leg. Hugentobler H., MHNG; 1 ex., GR, PNS [Parc national Suisse – swiss national park], Munt la Schera, 8.VIII.1977, leg. & coll. Scherler P., NMBE; 1 ex., Ofenpass, 17.VII.1985, leg. Rössler G., det. Besuchet C., TLMF; 1 ex., Pontresina, 22.VII.1986, leg., det. & coll. Köstlin R., SMNS; 2 ex., Zermatt VS, 8.VII.2022, 18.VII.2022, leg. & coll. Sanchez A.

Published data. Morteratsch-Gletscher and am Paradies by Meyer-Dür R. L. (Stierlin 1862); Stürviser Alp in Bündten by Killias E. (Stierlin 1883); Davos by Nagel H. and Stürviser Alp by Stoffel A. (Caflisch 1894); Oberengadin (Stierlin 1898); Alp la Schera, 28.VII.1919, by Handschin E., Alp la Schera, 3.VIII.1921, Stabelchod, 10.VIII.1921, by Handschin E. and Buffalora, VI.1953, by Aubert J. (Handschin 1963); Flumserberg, Zieger, VII.1965, by Hugentobler H. (Hugentobler 1966); Arosa by Müller-Rutz J., Bernina and Scans by Linder A. and Vals by Jörger J. B. (Linder 1967).

Comment. In the Palearctic region, this species is only represented by the nominal subspecies, distributed in Austria, Belarus, Finland, Italy, Norway, Russia, Sweden and Switzerland. In this last country, *C. trifasciata trifasciata* is rare and localized and seemed restricted to the east, where it was not found for more than 30 years. Nevertheless, it was found in 2022 in an alpine meadow located at 2640 m, in the region of Zermatt, located much further west. Little information is available concerning its ecology except for its presence at high altitude in Switzerland.

C13) [*Coccinella (Spilota) undecimpunctata undecimpunctata* Linnaeus, 1758]

Examined material. ³1 ex., Genève, Sierne, leg. & coll. Maerky C., MHNG; ³1 ♂, Genf, leg. Lasserre H., ETH; ³1 ex., Suisse, Valais, leg. Odier J., coll. Maerky C., MHNG; ³1 ex., Veyrier, 15.VI., leg. Maerky C., MHNG; ³1 ex., Alpes, Forclaz, 21.VI., leg. & coll. Maerky C., MHNG; ³7 ex., Zurich, VIII., leg. & coll. Toumayeff G., MHNG; ³3 ex., Chancy, 2.IX., leg. Maerky C., MHNG; ³1 ex., Alpes vaudoises, 21.VII.1887, leg. & coll. Gaud A., MZL.

Published data. ¹Suisse (Fuesslin 1775); ³Genf by Lasserre H., ¹Lausanne by Mellet L. and ¹Peney by Genf by Tournier H. (Stierlin and Gautard 1867); ¹Chiasso by Fontana P. (Fontana 1947); ²Blaisch Bella, 9.VII.1945 and ¹Val Plavna, 30.VII.1953 by Handschin E. (Handschin 1963).

Comment. All examined specimens belong to problematic collections that should not be considered (see Monnerat et al. 2015). None of the numerous citations in the older literature are reliable, as none of them are based on dissected male specimens and may refer to other species. Therefore, this species is not considered as belonging to the Swiss fauna according to the scarce information available. Concerning the literature data from Handschin (1963), two specimens from Blaisch Bella (9.VII.1945) were found in the Handschin collection at the BNM but they were *C. quinquepunctata*. For the data from Val Plavna, no specimens with such information were found in the Handschin's collection. This species has halophilic preferences and usually lives near the sea or in salt marshes, conditions that obviously do not exist in Switzerland. *Coccinella undecimpunctata undecimpunctata* is rare in Central Europe : Austria, Belgium, Czech Republic, Denmark, Georgia, Germany, Hungary, Luxembourg, Netherlands, Poland and Slovakia (Kovář 2007; Klausnitzer B. pers. comm.). The species is mainly aphidophagous, but can also feed on coccids, nectar and pollen (Nicolas and Pique 2008; Nicolas 2009; Canepari 2011; Nedvěd 2015). According to Nicolas and Pique (2008), it has been caught in Aisne in France on herbaceous plants found in wastelands and along roadsides, on black pines (*Pinus nigra* J. F. Arnold) but also on deciduous trees like *Salix cinerea* L. and *Quercus robur* L. It overwinters among stones and in buildings (Nedvěd 2015).

C14) *Oenopia impustulata* (Linnaeus, 1767)

Fig. 1H

Examined material. 5 ex., Katz. [Katzensee], leg. & coll. Hugentobler H., ETH; 2 ex., Genève, La Batie, VI.1949, leg. & coll. Toumayeff G., MHNG; 1 ex., Genève, Chancy, IV.1956, leg. & coll. Toumayeff G., MHNG; 7 ex., 29.IV.–23.V.2022, 22.VI.–12.VII.2022, 12.VII.2022, 12.VIII.2022, Les Ponts-de-Martel NE, leg. & coll. Chittaro Y.; 2 ex., 1 ♂, 1 ♀, 22.V.2022, Les Ponts-de-Martel NE, leg. & coll. Chittaro Y. & Sanchez A.

Published data. ¹⁾[Schweiz] by Heer O. (Bremi-Wolf 1856); ¹⁾St. Gallen by Täschler M. (Täschler 1872); ¹⁾Sierre et environs by Schacht W. (Schacht 1879); ¹⁾Fully, ¹⁾La Souste and ¹⁾Lausanne by Bugnion E. (Favre 1890).

Comment. This species is rare in Central Europe. In France, it is present in the Rhône Valley, in Alsace and in Seine-et-Loire (Coutanceau 2014). In Switzerland, only a very small number of specimens from four localities in the cantons of Geneva, Neuchâtel and Zürich confirm the occurrence of this species, where it appears to be rare. In 2022, after 60 years without any record in Switzerland, one specimen was found using an interception trap and eight specimens by beating birches (*Betula* sp.), all in a birch forest bordering a bog. It lives in heath, sand and bog areas, where it feeds on aphids almost exclusively on birches (especially *Betula pendula* Roth and *B. pubescens* Ehrh.) (Ziegler and Teunissen 1992; Nicolas 2009; Nedvěd 2015; Klausnitzer 2020). It is important

to note that *O. impustulata* can easily be confused with dark forms of *O. conglobata*, a widespread species in Switzerland.

C15) [*Chnootriba elaterii* (P. Rossi, 1794)]

Examined material. ^{3,4,6,8)}1 ex., Genève, Chancy, leg. & coll. Maerky C., MHNG; ^{3,4,6,8)}5 ex., Genève, Peney, leg. Täschler H., coll. Maerky C., MHNG; ^{3,4,6,8)}1 ex., Genf, leg. Täschler M., MHNG; ^{3,4,6,8)}1 ex., Jura, Dôle, leg. & coll. Maerky C., MHNG.

Published data. ^{1,8)}Switzerland (Kovář 2007; Nedvěd 2015).

Comment. This phytophagous species living on Cucurbitaceae and Solanaceae is known from Europe, North Africa and Western Asia. In France, it is only found in Corsica (Coutanceau 2014). All specimens examined belong to the problematic collection of C. Maerky (see Monnerat et al. 2015) and are therefore not retained as valid records. *C. elaterii* does not belong to the Swiss fauna.

C16) [*Henosepilachna vigintioctopunctata* (Fabricius, 1775)]

Published data. ^{1,8)}[Schweiz] by Heer O. (Bremi-Wolf 1856); ^{1,8)}Genf by Tournier H. and Schaffhausen by Stierlin G. (Stierlin and Gautard 1867).

Comment. *Henosepilachna vigintioctopunctata* is a species native to Asia which is not present in Central Europe. Despite several publications announcing it from Switzerland, no specimen was found in the collections examined.

C17) *Hyperaspis* (*Hyperaspis*) *concolor* (Suffrian, 1843)

Fig. 1I, J

Examined material. 1 ♀, Kt. Tessin, Taverne, VI.1938, leg. & coll. Linder A., ETH; 1 ex., Tessin, Biasca, 30.VII.1948, leg. Wolf J.-P., ETH; 1 ex., Kt. Tessin, Mendrisio, VI.1949, leg. & coll. Linder A., ETH; 1 ♂, Kt. Graubünden, Grono, V.1952, leg. & coll. Linder A., ETH; 1 ex., TI, Stabio, 18.VI.1971, leg. Spälti A., det. Klausnitzer B., MHNG; 3 ex., 2 ♂, Suisse, TI, Meride, 14.VIII.1976, 11.VI.1982, leg. & coll. Scherler P., NMBE; 2 ex., CH, TI, Somazzo, Torretta-O.[Ost], 16.V.1990, 1.VIII.1990, leg. Rezbanyai-Reser L., det. Herger P., NMLU; 1 ♂, Courroux JU, 4.–27.V.2016, leg. & coll. Chittaro Y.; 1 ♂, Vollèges VS, 17.VII.–15.VIII.2017, leg. & coll. Sanchez A.; 1 ♂, Fully VS, 11.IV.–9.V.2019, leg. & coll. Chittaro Y.; 1 ♂, 1 ♀, Sion VS, 7.IV.–29.VII.2020, leg. & coll. Sanchez A.

Published data. Switzerland (Kovář 2007; Nedvěd 2015).

Comment. *Hyperaspis concolor* is a rare and localized species in Europe. In the neighbouring countries, it is known from France (from the Mediterranean region, from Paris (Bois de Boulogne) and from Indre-et-Loire (Coutanceau 2014)), from Austria, Germany and

Italy. While also quite rare in Switzerland, there are scattered records from various parts of the country, particularly in the south. This thermophilic species lives in xerothermic meadows, pastures and forest margins, on grass, herbs and deciduous trees (Nedvĕd 2015; Klausnitzer 2020).

C18) [*Hyperaspis (Hyperaspis) erythrocephala* (Fabricius, 1787)]

Published data. ^{1,8)}Switzerland, uncertain data (Nedvĕd 2015).

Comment. *Hyperaspis erythrocephala* is a rare and thermophilic species present in Central-Eastern Europe in Austria, Czech Republic, Hungary, Poland and Slovakia. Its presence is considered uncertain in Germany and Switzerland by Nedvĕd (2015). We didn't find any specimens belonging to this species in the examined collections and we therefore advise the removal of this species from the list of the Swiss fauna.

C19) *Hyperaspis (Hyperaspis) peezi* Fürsch, 1976

Fig. 1K, L

Examined material. 1 ♂, Sierre, 22.VII., leg. Favre E., MHNG; 3 ♂, Kt. Wallis, Brig, VIII.1935, leg. & coll. Linder A., ETH; 2 ♂, Kt. Wallis, Leuk, VI.1937, leg. & coll. Linder A., ETH; 1 ♂, 2 ♀, Suisse, Valais, s/Gampel, 14.VII.1996, leg. Besuchet C., MHNG; 1 ♂, 1 ♀, Suisse, Valais, Gampel, 14.VIII.1996, leg. Besuchet C., MHNG; 1 ♂, Leuk VS, 31.III.2012, leg. & coll. Chittaro Y., det. Büche B.; 1 ♂, Anniviers VS, 14.–30.VIII.2013, leg. & coll. Sanchez A.; 1 ♂, Varen VS, 3.VII.–5.VIII.2015, leg. & coll. Chittaro Y., det. Büche B.; 1 ♂, Lens VS, 26.III.–18.IV.2019, leg. & coll. Sanchez A.

Comment. *Hyperaspis peezi* is a very rare and localized species, only known from southeastern France and Corsica (Coutanceau 2014), Croatia, Italy, Slovenia and Switzerland. In Switzerland, the species seems restricted to the canton of Valais. Very little information is available on its ecology, but all Swiss specimens were collected in sunny, hot, dry areas, where pines (*Pinus sylvestris* L.) and oaks are dominant. Very close to *H. reppensis* (Fig. 1O, P), its identification requires the examination of the male genitalia.

C20) *Hyperaspis (Hyperaspis) pseudopustulata* Mulsant, 1853

Fig. 1M, N

Examined material. 1 ♂, Helvetia, Ticino, Medeglia, torbiera Boscior, 6.V.1992, leg. Rampazzi F., MSNL; ¹⁾1 ex., Allondon, 7.V.1992, leg. & det. Johnson C., MAMU.

Published data. Switzerland, uncertain data (Nedvĕd 2015).

Comment. The presence of this species in Switzerland is supported by only one male captured in 1992 in a peat bog in the canton of Ticino in the south of the country. The identification of the specimen from Ge-

neva (Allondon) has not been confirmed for the moment and a misidentification with *H. reppensis* remains possible without the observation of the male genitalia. *H. pseudopustulata* is widely distributed in Central Europe (Nedvĕd 2015; Klausnitzer 2020) but is always rare, and its presence in Switzerland was considered as uncertain (Nedvĕd 2015). In France, it is present in the northern half of the country, but probably also in the southern half (Coutanceau 2014). It is a thermophilic species living at water margins on semiaquatic plants (Nedvĕd 2015; Klausnitzer 2020), but some authors hypothesize that it may also live in drier biotopes (Bogaert et al. 2012; Biranvand et al. 2020).

C21) [*Hyperaspis (Hyperaspis) quadrimaculata* (Redtenbacher, 1843)]

Examined material. ^{3,4,6,8)}1 ex., Veyrier, leg. Maerky C., MHNG.

Published data. ^{1,8)}[Schweiz] (Bremi-Wolf 1856).

Comment. This species is only distributed in Eastern Europe: Albania, Austria, Bulgaria, Czech Republic, Hungary, Greece, Romania and Slovakia. The only specimen with “a Swiss label” belongs to the problematic collection of Charles Maerky, which should not be considered (Monnerat et al. 2015). Therefore, the data available are insufficient to retain this species as part of the Swiss fauna.

C22) [*Novius cardinalis* (Mulsant, 1850)]

Examined material. 17 ex., Tessin, Locarno, 6.VIII.1946, leg. & coll. Simonet J., MHNG; 2 ex., Locarno, 27.IX.1951, leg. & coll. Schenk H., NMBE; 10 ex., Kt. Tessin, Locarno, IX.1951, leg. & coll. Linder A., ETH; 5 ex., Tessin, leg. Anonymous, ETH; 2 ex., Morcote, VI.1960, leg. & coll. Van de Gümster J., MHNG; 17 ex., CH, TI, Isola Brissago, 28.VIII.1992, 23.VII.1993, 24.VII.1993, 6.VIII.1993, 7.VIII.1993, leg. Rezbanyai-Reser L., coll. Focarile A., MHNG & MSNL.

Published data. 15 ex., Locarno, 6.VIII.1945, leg. Simonet J. and 10 ex., Locarno, IX.1951 (Linder 1968).

Comment. *Novius cardinalis* is an Australian species which has been introduced in many countries in the World (including Europe) for the biological control of *Icerya purchasi* Maskell, 1879 (Hemiptera, Monophlebidae), an important pest of citrus trees (Martin 2016). In France, it has been introduced several times and is now acclimatized in various parts of the country, especially in the southern region and in Corsica, in the Jura and in Paris (Coutanceau 2014). In Switzerland, it has occasionally been found between 1946 and 1993 in Ticino, in Locarno and on the Isola di Brissago, where there is a botanical garden. Numerous specimens have been found each time and it seems that these mentions in Switzerland are the result of multiple introductions. As the species has almost never been found two years in a row, it is assumed that it cannot overwinter here. Up till now, the species is therefore not considered naturalized in Switzerland.

C23) *Clitostethus arcuatus* (P. Rossi, 1794)

Fig. 1Q

Examined material. 2 ex., Kt. Waadt, Clarens, III.1944, II.1945, leg. & coll. Linder A., ETH; 1 ex., Préverenges, 6.VI.1950, leg. & coll. Besuchet C., MZL; 1 ex., Vidy, 18.VI.1950, leg. & coll. Besuchet C., MZL; 1 ex., Genève, London [Allondon], IV.1956, leg. & coll. Toumayeff G., MHNG; 1 ex., Suisse, Vaud, St. Léger, 11.IV.1959, leg. & coll. Scherler P., NMBE; 1 ex., Suisse, Vaud, Mormont, 6.VI.1959, leg. & coll. Scherler P., NMBE; 1 ex., VD, Bavois, VI.1974, leg. Toumayeff G., MHNG; 1 ex., TI, Loco, IV.1975, leg. Toumayeff G., MHNG; 4 ex., Suisse, VD, Grangettes, 20.VI.1995, 13.VII.1995, 19.VII.1995, 3.VIII.1995, leg. Anonymous, det. Calame F., MZL; 1 ex., CH, AG, Untersiggenthal, Iflue, 16.VII.1998, leg. & det. Walter T., ETH; 4 ex., Meinier GE, 15.–30.V.2015, 30.V.–14.VI.2015, 30.VI.–15.VII.2015, leg. Faye J.-D., LEBA; 1 ex., Gy GE, 6.VI.2016, leg. Guibert B.; 1 ex., Vully-les-Lacs VD, 25.VII.–7.VIII.2018, leg. Knoblauch A., coll. Chittaro Y.; 1 ex., Chevroux VD, 8.–25.V.2020, leg. Perret-Gentil N., coll. Chittaro Y.

Published data. ¹Basel by Imhoff L. (Stierlin and Gautard 1867); ¹Fully, ¹Martigny and ¹Ravoire by Favre E. (Favre 1890); Switzerland (Kovář 2007; Nedvěd 2015).

Comment. *Clitostethus arcuatus* is a Mediterranean species which has expanded its range northward into Central Europe in recent decades, probably possible due to the effects of global warming (Bathon and Pietrzik 1986; Pütz et al. 2000). While quite rare in Switzerland, there are scattered records from various parts of the country, always found as isolated individuals, although it was reported that it could be found in large numbers in Italy (Canepari 2011). It is one of the smallest European ladybird species and it moves very quickly in hot weather, so it can easily go unnoticed. Thermophilic, it lives on deciduous and coniferous trees, also in parks and gardens, where adults and larvae feed on Aleyrodidae (Homoptera), Aphididae (Hemiptera) and Tetranychidae (Acari) (Gourreau 1974; Canepari 2011; Nedvěd 2015; Klausnitzer 2019b, 2020). According to Pütz et al. (2000), Coutanceau (2014), Klausnitzer (2019) and Szawaryn and Marczak (2021), it is regularly found on or near ivy (*Hedera helix* L.), but also on hawthorn (*Crataegus* spp.), blackthorn (*Prunus spinosa* L.), apple tree (*Malus* spp.), blackberry (*Rubus* spp.), skipping weed (*Impatiens* spp.), celandine (*Chelidonium* spp.), wood vine (*Clematis* spp.) and various cultivated plants. In winter, it can be found overwintering in the leaf litter (Nedvěd 2015).

C24) *Nephus (Bipunctatus) bisignatus* (Fürsch, 1984)

Fig. 1R–T

Examined material. 2 ♂, 1 ♀, 3 ex., Davos, Seeh. [Seehorn], 6.XI.1935, leg. Wolf J.-P., ETH; 1 ♂, Filisur, 1.III.1936, leg. Wolf J.-P., ETH; 1 ♂, Davos, 29.III.1936, leg. Wolf J.-P., ETH; 2 ♂, 1 ♀, 2 ex., Davoser Tal, Se. [Seehorn], 24.X.1936, leg. Wolf J.-P., ETH; 1 ♂, 1 ♀, Davos, Seeh. [Seehorn], 13.X.1937, leg. Wolf J.-P., ETH; 1 ♂, Gola di Lago, 8.VIII.1962, leg. & coll. Scher-

ler P., NMBE; 4 ♂, Svizzera, TI, Locarno, Monte Bré, 13.–20.V.1997, leg. Moretti M., MSNL; 1 ♂, Wengi BE, 27.VI.2019, leg. Fürst J., coll. Sanchez A.; 1 ♂, Messen SO, 6.VI.2019, leg. Fürst J., coll. Sanchez A.

Published data. Switzerland (without mention of the subspecies) (Nedvěd 2015).

Comment. *Nephus bisignatus* is represented in the Palearctic region by two subspecies: *N. b. bisignatus* (Boheman, 1850) distributed in the Azores, Croatia, Czech Republic, Denmark, Finland, France, Great Britain, Greece, Netherlands, Norway, Portugal, Slovakia and Sweden and *N. b. claudiae* present in Austria, Germany, Hungary, Netherlands and Sweden (Kovář 2007; Klausnitzer B. pers. comm.). In the bordering countries, only the subspecies *bisignatus* is present in Italy (Canepari 2011) and France (Coutanceau 2014) and only the subspecies *claudiae* is present in Austria and Germany (Kovář 2007). Therefore, both subspecies are potentially present in Switzerland. Nevertheless, due to the difficulties of attributing the Swiss specimens to one or the other of these subspecies with certainty, we prefer to identify this taxon only to the specific level. Future research may perhaps clarify the situation in Switzerland. *N. bisignatus* is a thermophilic species which lives on woody plants, in herbaceous and dwarf shrub vegetation, where it feeds on mealybugs (Nedvěd 2015; Klausnitzer 2019b). According to Nedvěd (2015) and Klausnitzer (2019), the species has psammophil preferences and lives near the sea coasts. In Switzerland, where these conditions do not occur, the specimens were found between 600 and 1800 m above the sea level.

C25) [*Nephus (Bipunctatus) kiesenwetteri* (Mulsant, 1850)]

Examined material. ^{3,4,6,8}1 ex., Suisse, Tessin, leg. Odier J., det. Fürsch H., coll. Maerky C., MHNG.

Comment. In Europe, this species is only present in the Mediterranean region: France (only Corsica), Italy (mainland, Sardinia and Sicily), Malta and Spain (mainland and Balearic Islands) (Kovář 2007; Canepari 2011; Coutanceau 2014). In Switzerland, the only specimen examined belongs to the problematic collection of C. Maerky (see Monnerat et al. 2015) and is therefore not retained as a valid record. Moreover, *N. kiesenwetteri* grows on *Tamarix* spp. (Canepari 2011; Coutanceau 2014; Nedvěd and Đurić 2022), a plant genus absent from Switzerland.

C26) [*Nephus (Nephus) binotatus* (C. N. F. Brisout de Barneville, 1863)]

Examined material. ^{3,4,6,8}1 ex., Tessin, leg. Ghidini A., det. Fürsch H., coll. Maerky C., MHNG.

Comment. The only specimen cited here belongs to the problematic collection of C. Maerky (see Monnerat et al. 2015) and is therefore not retained as a valid record. *Nephus binotatus* is only present in the Mediterranean region, in southern France and Corsica, in Spain and the Balearic Islands and in Portugal (Coutanceau 2014; Soares 2021; Nedvěd and Đurić 2022).

C27) *Scymniscus anomus* (Mulsant & Rey, 1852)

Fig. 1U, V

Examined material. 1 ♂, Helv., Ticino, Gerre di Losone, leg. & coll. Focarile A., det. Canepari C., MSNL; 1 ♂, Gerre di Losone, 20.–24.VI.1981, leg. Franscella C., det. Canepari C., MSNL.

Comment. *Scymniscus anomus* is a Mediterranean species only known from the Mediterranean region (and Corsica) in France (Coutanceau 2014), Austria (Klausnitzer B. pers. comm.), Greece, Italy, Hungary, Slovakia and Spain. In Italy, it is considered as widespread but uncommon (Canepari 2011). In Switzerland, two males were caught in a wetland in the canton of Ticino (the second using a pitfall trap) and thus allow us to record this species as new for the country.

C28) [*Scymniscus horioni* (Fürsch, 1965)]

Published data. ^{1,8)}Switzerland, uncertain data (Nedvĕd 2015).

Comment. This species, known in Europe from Albania, Austria, Bosnia and Herzegovina, Croatia, Czech Republic, Greece, Hungary, Italy and Slovakia, is not considered indigenous to Switzerland on the basis of the available data: only one publication announces it for Switzerland, without any specimen referring to this species in the examined collections. Moreover, Nedvĕd (2015) already considered its presence in Switzerland to be uncertain.

C29) [*Scymnus (Pullus) fraxini* Mulsant, 1850]

Examined material. ^{3,4,6,8)}1 ex., Suisse, Tessin, leg. Odier J., det. Fürsch H., coll. Maerky C., MHNG.

Comment. The only specimen labelled from Switzerland belongs to the problematic collection of C. Maerky (see Monnerat et al. 2015) which should not be considered. This species is principally distributed in the Mediterranean region and the near East, but has also been found in France in Alsace (Gourreau 1974) and in Indre-et-Loire (Cloupeau et al. 2012), and in Austria and Slovakia (Klausnitzer B. pers. comm.). Therefore, it could also be found in Switzerland. According to Coutanceau (2014), *S. fraxini* feeds on coccids.

C30) *Scymnus (Scymnus) doriae* Capra, 1924

Fig. 1W, X

Examined material. 1 ♂, 1 ♀, 1 ex., Helvetia, Ticino, Magadino, leg. & coll. Focarile A., MSNL; 1 ♂, Helvetia, Ticino, Chiasso, 8.VII.1938, leg. Fontana P., det. Canepari C., MSNL; 1 ♂, VS, Rarogne, VII.1974, leg. Toumaïeff G., MHNG.

Comment. *Scymnus doriae*, originally described from Florence, is a rare species known from the Mediterranean Region and Corsica in France (Coutanceau 2014), Austria (Tyrol), Bulgaria, Hungary, Italy, Poland, Serbia and Montenegro, and in eastern Germany (Klausnitzer B.

pers. comm.). Only a very small number of specimens from three localities confirm the occurrence of this species in Switzerland, where it appears to be rare. This species may be only distinguished from the very similar *S. frontalis* (and other species from this group) by the examination of the male genitalia. According to Klausnitzer (2020), *S. doriae* may be expanding its distribution northward in Europe.

C31) [*Scymnus (Scymnus) marginalis* (P. Rossi, 1794)]

Examined material. ^{3,4,6)}1 ex., Genève, leg. Melly A., det. Fürsch H., coll. Maerky C., MHNG; ^{3,4,6)}2 ex., Suisse, Tessin, leg. Odier J., det. Fürsch H., coll. Maerky C., MHNG.

Published data. ^{1,4,6)}[Schweiz] by Stierlin G. (Breim-Wolf 1856); ^{1,4,6)}Genf by Chevrier F., ^{1,4,6)}Schaffhausen by Stierlin G. and ^{1,4,6)}Vevey by de Gautard V. (Stierlin and Gautard 1867); ^{1,4,6)}Mendrisio by Frey-Gessner E. (Stierlin 1883); ^{1,4,6)}Fully and Martigny by Favre E. (Favre 1890).

Comment. All Swiss literature records are very old and not verifiable, while the three specimens examined belong to the problematic collection of C. Maerky (see Monnerat et al. 2015). Therefore, this species should not be considered as native in Switzerland. *Scymnus marginalis* is a Mediterranean species living in dry biotopes and is known from the Mediterranean region and Corsica in France (Coutanceau 2014), Austria, Greece, Italy, Malta and Ukraine. Being present throughout Italy (also in the Aosta Valley (Canepari 1983)), the presence of this species in southern Switzerland remains possible.

Discussion

This commented list on the Swiss Coccinellidae is in keeping with other syntheses on various beetle families published in the past years (see for exemple Sanchez et al. 2020 or Chittaro et al. 2021). It thus improves the overall understanding of Swiss fauna. Thanks to the distribution maps based on the collected data (available on the info fauna cartographic server, www.cscf.ch and www.gbif.org), this work provides a thorough faunistic overview of the current understanding of the species of Coccinellidae in Switzerland.

Coccinellidae are represented by 81 species (82 taxa) in Switzerland, which represent about 80% of all known species in Central Europe (Nedvĕd 2015). If the large colored ladybirds (for example *Coccinella septempunctata*) are well known and their presence in Switzerland attested by many records, the story is quite different for most of the Scymnini species. Indeed, the latter are much more discreet, difficult to find and more challenging to identify because their identification almost always requires the examination of the male genitalia. Therefore, reliable data concerning these species are scarce and our understanding of their distribution in Switzerland remains incomplete. Consequently, several species went unnoticed in Switzerland up until this

publication, even if some specimens were collected long ago and were available in museum collections. This is the case, for example, of *Hyperaspis pseudopustulata*, *Scymniscus anomus*, *Scymnus doriae* and *Nephus bisignatus*, all mentioned here for the first time for Switzerland. The systematic dissection of all specimens in collections and the examination of the male genitalia has made it possible to bring them to light in Switzerland. These species are often only known from a few isolated specimens, so most are in urgent need of additional documentation. Targeted sampling of certain species or species groups in the future, while systematically extracting the genitalia of those specimens if necessary, will likely add new discoveries to our fauna.

Although there is no red list of Coccinellidae in Switzerland, several species seem to show strong decline in Switzerland or are maybe already extinct (?). This is particularly the case for several species linked to wetlands, like *Parexochomus nigromaculatus* and *Calvia quindecimguttata*, that have not been found in Switzerland for more than 40 years. As for other insect groups linked to wetlands (OFEV 2017), ladybirds are probably threatened in Switzerland as well.

Ladybirds are polyphagous but are mainly predators of phytophagous insects (Weber and Lundgren 2009). Therefore, they have been used for decades for biological control in crops and, as a consequence, have been introduced in several European countries. However, several species have been able to acclimatize to the local climatic conditions and thus to establish in Europe, the most obvious example being the Asian ladybird (*Harmonia axyridis*), today cosmopolitan and present in all European countries (Roy et al. 2016). In Switzerland, the presence of the following species is the result of accidental or intentional introductions made in this country or in neighboring countries: *Cryptolaemus montrouzieri*, *Novius cardinalis*, *Rhyzobius forestieri* and *R. lophanthae*. These four species will probably not be a problem for native species: the first two do not appear to have formed populations in the wild in Switzerland and the two *Rhyzobius*, even if they are now established, are unlikely to disrupt natural ecosystems, given their small size and their diets exclusively coccidophagous. The situation of the large and polyphagous species *H. axyridis* is quite different, as it has already been shown (van Lenteren et al. 2008; Honěk et al. 2019). In northwestern Switzerland, long-term monitoring of ladybirds showed that *H. axyridis* quickly became the dominant species on broadleaved trees and shrubs just a few years after its arrival in 2004. Following this invasion, the native species *Adalia bipunctata* clearly declined and this once dominant species has almost disappeared from the region (Kenis et al. 2020). This trend, demonstrated for a small region in northern Switzerland, seems to be confirmed on a national scale. According to the available Swiss data set, *A. bipunctata*, once a very common species, was no longer found in many localities throughout the country. The same situation was also shown in Germany (Klausnitzer 2017).

From a conservation point of view, it can be said that Switzerland harbors several rare and highly specialized species or subspecies that only occur at high altitudes in the Alps. This is the case for *Ceratomegilla rufocincta doderoi*, *C. alpina alpina*, *C. alpina redtenbacheri*, *Coccinella trifasciata trifasciata* or *C. venusta adalioides*, which are regularly found above 2000 m. Other species are very rare in Europe, like *Exochomus oblongus* or *Hyperaspis peezi*, and Switzerland plays an important role in the conservation of these species.

In the future, other species could be found in Switzerland, especially cosmopolitan species introduced in Europe for biological control, or southern species that would benefit from global warming to extend their distribution to the north.

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