Zootaxa 4013 (3): 369–398
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.4013.3.3
http://zoobank.org/urn:lsid:zoobank.org:pub:7C9F9BF9-2AC4-41B3-A2E6-2CE9F241C46A

European *Rhogogaster* s. str., with notes on several Asian species (Hymenoptera: Tenthredinidae)

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Abstract

The European *Rhogogaster* s. str. species are revised, and several nominal taxa from Asia discussed. The taxonomic identity of the type species *Tenthredo viridis* Linnaeus, 1758 is different from that assumed in the past. *Tenthredo dryas* Benson, 1943 is **syn. nov.** of *R. viridis*. The name *Rhogogaster scalaris* (Klug, 1817), **species revocata**, is to be applied to *Rhogogaster viridis* auct. New subjective junior synonyms of *R. scalaris* (Klug, 1817) are *R. chlorosoma podkumokensis* Muche, 1973, **syn. nov.** and *Tenthredo* (*Rhogogaster*) *carpatica* Zhelochovtsev & Zinovjev, 1988, **syn. nov.** *Rhogogaster magniserrula* Viitasaari, **spec. nov.** is described from Finland and Russia. The former synonym of *R. viridis* auct., *Tenthredo hebraica* Geoffroy in Fourcroy, 1785, is treated as *species incertae sedis* within *Rhogogaster*. The Asian *Rhogogaster viridis* var. *sibirica* Enslin, 1912, is regarded as a valid species, *Rhogogaster sibirica* Enslin, 1912, **stat. nov.**, and *Rhogogaster kudiana* Rohwer, 1925, is a subjective **syn. nov.** of *R. sibirica*. A key to the European *Rhogogaster* s. str. with special emphasis on Fennoscandia is given.

The following nominal taxa are excluded from *Rhogogaster*: *Rhogogaster viridis* forma *montana* Betrem, 1933, is **syn. nov.** of *Tenthredo olivacea* Klug, 1817; *Sciapteryx virescens* Jakowlew, 1887, is *Tenthredo* (*Eurogaster*) *virescens* (Jakowlew, 1887), **comb. nov.**; *Tenthredo interrupta* Fabricius, 1804 (nomen oblitum) is **syn. nov.** of *Tenthredopsis tessellata* (Klug, 1817) (nomen protectum). *Tenthredo viridis* Poda, 1761, *Tenthredo straminea* Schrank, 1776, *Tenthredo analicornis* [sic!] Gmelin, 1790, and *Tenthredo chloros* Rudow, 1871 are considered to be *species incertae sedis* within Tenthredinidae.

Lectotypes are designated for *Tenthredo interrupta* Fabricius, 1804, *Sciapteryx virescens* Jakowlew, 1887, *Sciopteryx gilva* Konow, 1908, *Rhogogaster viridis* var. *sibirica* Enslin, 1912, *R. viridis* forma *montana* Betrem, 1933, *R. chlorosoma podkumokensis* Muche, 1973, *R. genistae viridifrons* Muche, 1973 and *Tenthredo* (*Rhogogaster*) *carpatica* "Bokotey" [= Zhelochovtsev & Zinovjev], 1988.

Key words: Symphyta, sawflies, Palearctic, new species, new synonyms, key

Introduction

Rhogogaster Konow, 1884 in a broader sense currently comprises nearly 40 valid sawfly species. It is restricted to the northern hemisphere. Live imagines are usually mainly green, and more or less black marked. The pale color may be partly, especially dorsally, yellowish green (Fig. 1a–1b). After death, the pale color tends to become yellowish to straw. Exceptionally, the green coloration is completely replaced by yellow also in live specimens. The identification of *Rhogogaster* species remains frequently uncertain, even although at most a handful of species is to be found in any one area. The proportion of *Rhogogaster* specimens in sawfly collections from northern European localities is usually much higher than in samples from central or southern Europe. After an examination of about 500 northern European *Rhogogaster* s. str. by the first author (AT), the identification of many specimens remained doubtful. To tackle this problem, the diagnostic characters of the group were evaluated, several types were studied, and a key to the northern European species of the group was designed. Independently, the second author (MV) already recognized a hitherto undescribed species from Finland some years ago. In this paper we combine the results of our studies. To avoid confusion in the subsequent text, we point out now, that the name

Accepted by A. Lelej: 20 Jul. 2015; published: 9 Sept. 2015

"Rhogogaster viridis" is applied in this paper according to the identity of the lectotype, which represents the rare species that was usually named "*Rhogogaster dryas* (Benson, 1943)" during the last 70 years. The common "green sawfly" (*R. viridis* auct.) is now named *Rhogogaster scalaris* (Klug, 1817).

Our work treats the European taxa of *Rhogogaster* in a restricted sense. Furthermore, some nominal Asian species are discussed. In subsequent papers the species from Asia and Northern America will be studied in cooperation with other specialists (H. Goulet, A. Shinohara, M. Wei).

Material and methods

Morphological terms follow Viitasaari (2002). This study is based mainly on material of the SDEI and the Swedish Malaise Trap Project (about 1200 specimens actually examined by AT), the collection of MV and the FMHEL (about 1900 specimens examined by MV during the last 30 years), and type material from various collections. Unless noted otherwise, the types were examined by AT. Numbers of examined specimens per species are given in the key. The data provided by AT reflect the frequency of the species in the examined collections, whereas the data provided by MV at least partly result from a preselection of specimens in the field. Therefore, as a result *R. viridis* makes up about 1% of AT's samples, and about 10% of MV's samples. Several colleagues kindly checked their material in order to support this study, or made their material available for examination.

Photos were taken by AT at the SDEI with a Leica DFC 495 digital camera and M205 C microscope. Composite images with an extended depth of field were created from stacks of images using the software CombineZP, and finally arranged and partly enhanced with Ulead PhotoImpact X3. Photos of live animals were taken with a Panasonic DMC-TZ10. Permanent links (DOIs) are given for high resolution figures, and also for plates with figures that are not included in this paper.

The BOLD TaxonID Tree was obtained using the standard methods offered by BOLD systems (http://v3.boldsystems.org/) and graphically modified with PhotoImpact X3.

The phylogenetic reconstruction was conducted in MEGA6 (Tamura *et al.* 2013), using the Maximum Likelihood method based on the Tamura-Nei model (Tamura & Nei 1993).

The distribution map for *R. magniserrula* was prepared with Map data, © Basarsoft, Google.

The characters used in the key are assessed and discussed in that chapter.

Body size measurements are rounded to half a millimeter.

Abbreviations

AT	Andreas Taeger
BMNH	The Natural History Museum, London, United Kingdom
coll.	collection
FMHEL	Zoological Museum, Finnish Museum of Natural History, University of Helsinki, Finland
HNHM	Hungarian Natural History Museum, Department of Zoology, Budapest, Hungary
LNMO	Landesmuseum Natur und Mensch, Oldenburg, Germany
LSUK	Linnean Society of London, United Kingdom
MFNB	Museum für Naturkunde Berlin - Leibniz Institute for Evolution and Biodiversity Science, Germany
MLZU	Lund Museum of Zoology - Insect collections, Lund, Sweden
MV	Matti Viitasaari
RMNH	Naturalis Biodiversity Center, Leiden, The Netherlands
SDEI	Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany
USNM	Smithsonian National Museum of Natural History, Washington, USA
ZIRAS	Zoological Museum, Academy of Science, St. Petersburg, Russia
ZMUC	Zoological Museum, University of Copenhagen, Denmark
ZMUM	Zoological Museum of Moscow University, Moscow, Russia
ZMUT	Zoological Museum, University of Turku, Finland
ZSM	Bavarian State Collection of Zoology (Zoologische Staatssammlung), München, Germany

History

Konow (1884) erected *Rhogogaster* for six European species. Apart from *Tenthredo viridis* Linnaeus, 1758, *T. picta* Klug, 1817, and *T. punctulata* Klug, 1817, he included three species which are now placed in *Aglaostigma* Kirby, 1882. Konow (1885) unnecessarily emended the name to *Rhogogastera.*

The limits of *Rhogogaster* have changed several times since its description. Several species today placed in *Aglaostigma* following Ross (1937) were frequently included in *Rhogogaster* (e.g., Enslin 1910 & 1912, Berland 1947). Benson (1943) treated *Rhogogaster* as a synonym of *Tenthredo* Linnaeus, 1758. Zhelochovtsev & Zinovjev (1988) treated it as a subgenus of *Tenthredo* Linnaeus, 1758. Benson (1965) keyed 23 species of the world fauna, including some *Tenthredo* species ("*arctica* group"). Lacourt (1997) described the genus *Cytisogaster* for Benson's *Rhogogaster picta* group (type species: *Rhogogaster genistae* Benson, 1947). Taeger *et al.* (2006) treated *Cytisogaster* as a subgenus of *Rhogogaster*.

Furthermore, Lacourt (1997) created the tribe Rhogogasterini for *Rhogogaster*, *Cytisogaster*, and *Tyloceridius* Malaise, 1945. If *Cytisogaster* is excluded from *Rhogogaster*, all remaining West Palaearctic species belong to Benson's (1965) *viridis* and *californica* groups (here subsequently called *Rhogogaster* s. str.). Taeger *et al.* (2010) recorded 40 species of *Rhogogaster* s.l. worldwide, and placed seven of these in *Rhogogaster* s. str. and six in *Cytisogaster.* The remaining 27 species were left unplaced within the genus. Taeger (2013) synonymized three nominal species with older *Tenthredo* Linnaeus, 1758 species. Prous *et al.* (2014) removed *R. polaris* from synonymy.

Definition of *Rhogogaster*

The genus belongs to the Tenthredininae. It is difficult to separate from *Tenthredo* s.l. (about 1000 species), and its status requires future evaluation in the course of a re-classification of the Tenthredininae. Currently, *Rhogogaster* is kept separate, but it is possible, once phylogenetic relationships of the Tenthredininae have been analysed more thoroughly, that the species will have to be included in *Tenthredo* in the future.

Ross (1937) used the shape of the mandibles to characterize *Rhogogaster* in a broader sense. The more or less rectangular basal tooth of the right mandible (fused 3rd and 4th tooth, Fig. 1c) was also used for the separation of *Rhogogaster* s.l. by Zhelochovtsev & Zinovjev (1988), Taeger (1991) and Goulet (1996). Unfortunately, this character is frequently hard to see, as the mandibles are usually closed and covered by the clypeus and labrum, and older pinned specimens are difficult to relax to enable the mandibles to be opened. In males, for example in *R. punctulata*, the rectangular tooth may be flat and tends to be bidentate (Fig. 1d). Nevertheless, this character is considered to be the principal character of the genus in a broader sense, even if it is only reliable for females.

Groups within *Rhogogaster*

Benson (1965) divided the genus into the following six species groups:

1. For the *picta* group, Lacourt (1997) created the genus *Cytisogaster.*

2. The *lateraria* group includes no European taxa and is not discussed here.

3. Benson's *arctica* group consists mainly of species that are placed in *Tenthredo* today. The former *R. arctica* Kiær, 1898 (today known as *Tenthredo aaliensis* (Strand, 1898)) is the type species of *Eurogaster* Zirngiebl, 1953. Currently, the species of the *Tenthredo mesomela* group are also placed in *Tenthredo* (*Eurogaster*). This placement is based on the similar shape of mandibles, the shape of the saw, and similar COI-5P barcoding data. *Rhogogaster nigrita* Mocsáry, 1909, *R. vallicola* Mocsáry, 1909 (a synonym of *T. heros* Jakowlew, 1891) and *R. virescens* (Jakowlew, 1887) in Benson (1965) also belong here. *Sciopteryx gilva* Konow, 1908, was treated by Benson (1965) as a synonym of *R. virescens*, and later (Benson 1968) as valid. Its placement in *Rhogogaster* may be correct, see discussion below.

4. Benson (1965) treated in his *opacella* group only one species. *Rhogogaster opacella* sensu Benson is taxonomically ambiguous as the lectotype of *R. opacella* Mocsáry, 1909 belongs to *T. stulta* Jakowlew, 1891 (Taeger 2013).

5. The *californica* group consisted of *R. dryas* (now treated as a synonym of *R. viridis*) and *R. californica* (including *R. polaris* as its synonym).

6. The *viridis* group of Benson (1965) comprises nine species, including *R. viridis* auct. (= *R. scalaris*), *R. chlorosoma*, and *R. punctulata*. These nine species all seem to belong to *Rhogogaster*. The Asian species of the group need closer scrutiny.

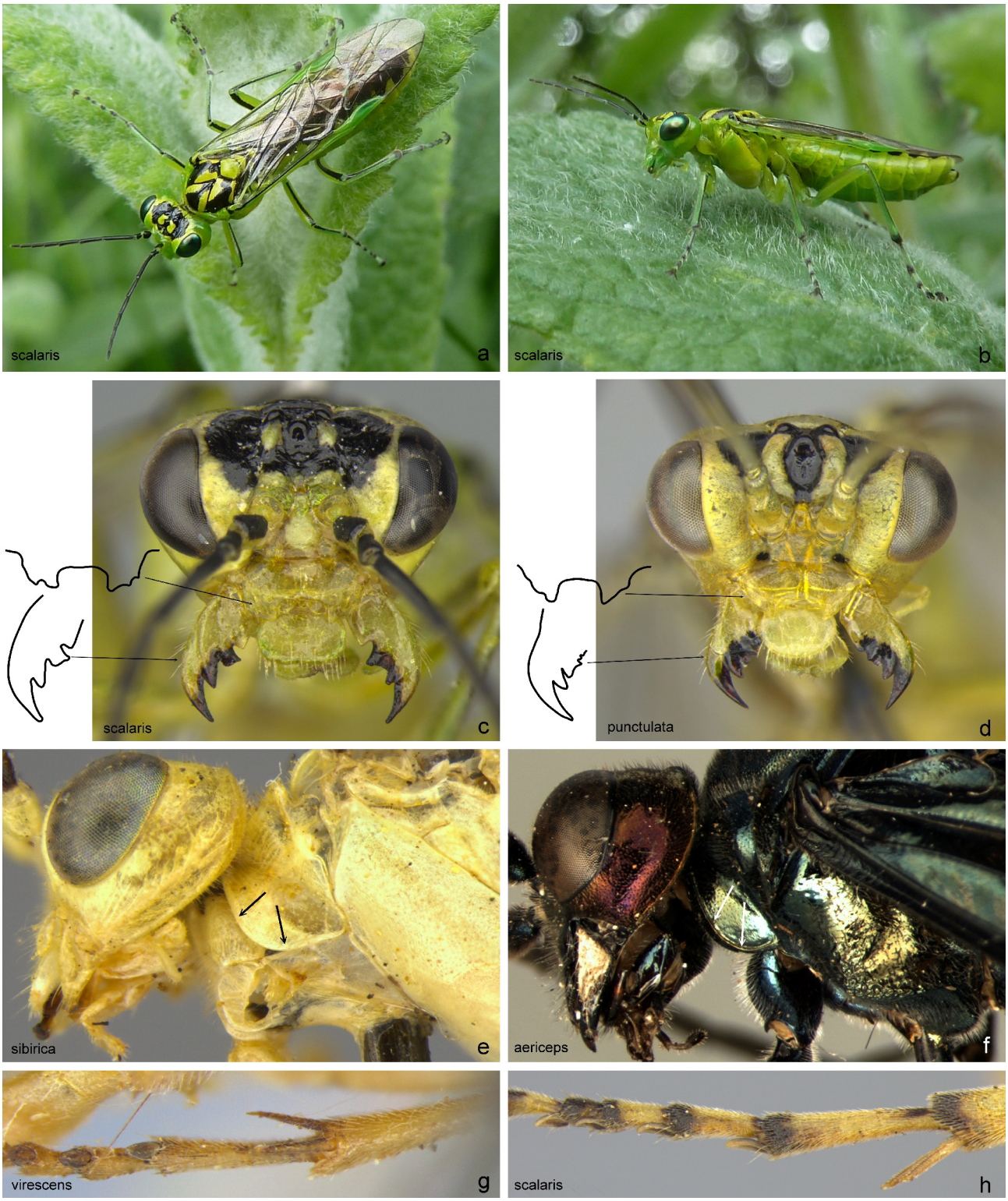

FIGURE 1. a–b: *Rhogogaster scalaris* ♀ alive, from France, Midi-Pyrénées: Barèges 3km ENE; 1450 m—**a** dorsal view **b** lateral view. **c–d**: face and shape of mandibles and clypeus in frontal view—**c** *R. scalaris* ♀, **d** *R. punctulata* ♂. **e–f**: head and thorax laterally, arrows in direction of anterior and ventral margin of pronotum—**e** *R. sibirica*: without submarginal furrow, **f** *Tenthredo aericeps* Konow, 1907: with submarginal furrow. **g–h**: apex of hind tibia, tibial spurs and basal tarsomeres—**g** *T. virescens* (lectotype), **h** *R. scalaris* (lectotype).

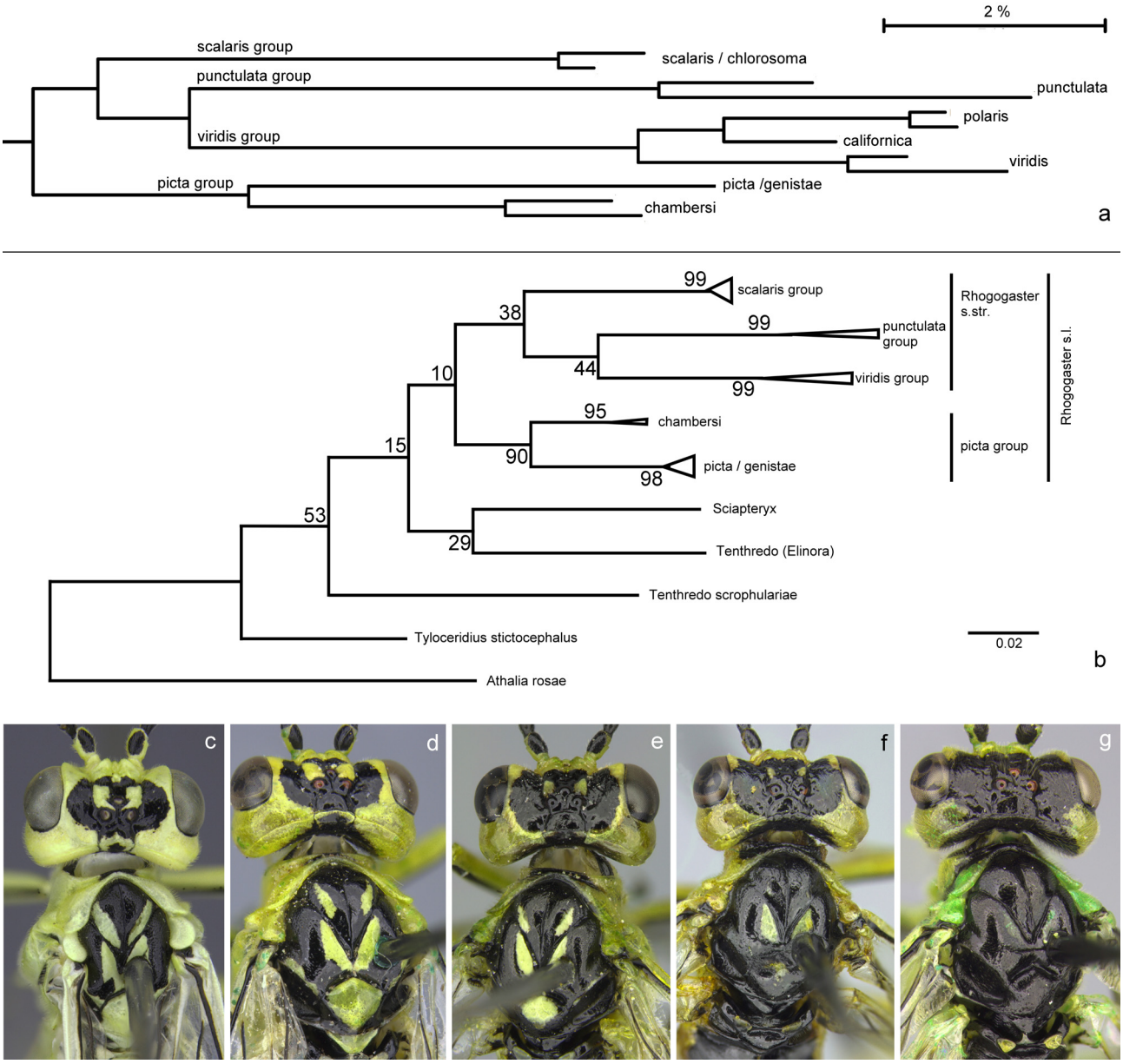

FIGURE 2. a Modified BOLD TaxonID Tree to illustrate the percentage distance of COI-5P sequences of *Rhogogaster* groups. **b** Molecular Phylogenetic analysis by Maximum Likelihood method, based on COI-5P data. The evolutionary history was inferred by using the Maximum Likelihood method based on the Tamura-Nei model (Tamura & Nei 1993). The tree with the highest log likelihood (-3631.1492) is shown. The percentage of trees in which the associated taxa clustered together is shown next to the branches. Initial tree(s) for the heuristic search were obtained automatically by applying Neighbor-Join and BioNJ algorithms to a matrix of pairwise distances estimated using the Maximum Composite Likelihood (MCL) approach, and then selecting the topology with superior log likelihood value. The tree is drawn to scale, with branch lengths measured in the number of substitutions per site. The analysis involved 65 nucleotide sequences. Codon positions included were 1st+2nd+3rd+Noncoding. All positions containing gaps and missing data were eliminated. There were a total of 556 positions in the final dataset. Evolutionary analyses were conducted in MEGA6 (Tamura *et al.* 2013). (Capture as provided by MEGA6, references adopted). **c**–**g**: color variability of *R. scalaris*—**c** ♂ (France, Midi-Pyrénées: Barèges), **d**–**e** ♀ (Sweden, Malung), **f** ♀ (Sweden, Abisko), **g** ♂ (Sweden, Härjedalen, Hede)

Currently, COI-5P barcodes are available to us only for European and a few Nearctic *Rhogogaster*. These data correlate more or less clearly with the morphological differences (structure of male genitalia, shape of serrulae, shape and sculpture of mesoscutellum and its appendage, see also the key below).

There are four distinct groups (clusters) for the European species:

1—*R. picta, R. chambersi, R. genistae* (Benson's *picta* group, "*picta* group" in Figs 2a–b)
2—*R. viridis, R. polaris* (Benson's *californica* group, "*viridis* group" in Figs 2a–b);
3—*R. scalaris, R. chlorosoma* (a part of Benson's *viridis* group, "*scalaris* group" in Figs 2a–b);
4—*R. punctulata* (a part of Benson's *viridis* group, "*punctulata* group" in Figs 2a–b).

The differences between the barcodes of these clusters are about 8 % or somewhat higher (Fig. 2a). The relationships between these groups remain uncertain, and therefore the same applies to the status of the *Cytisogaster* (*picta* group). Only the four groups as listed above are reliably supported by bootstrap values of 90–99 %. There are some indications that the *picta* group may be the sister group of the remaining *Rhogogaster*, but this hypothesis is insufficiently supported (bootstrap values 10–53 %) (Fig. 2b). We tentatively treat the species of the *picta* group as a part of *Rhogogaster* s. l., and the remaining groups as *Rhogogaster* s. str.

In addition to the special form of the mandibles as described above, the European *Rhogogaster* s. str. are characterized as follows. It should be noted that this character set does not apply to all Asian species.

a Pterostigma monochrome green, at most very slightly darkened basally (Fig. 1a)

b Temples (postocular area) green (often fading to straw-yellow in dead specimens; exceptionally, live individuals are yellowish, Figs 4a–4x)

d Tarsi ringed green and black in ♀ (Figs 1b, 1h, 7h), in ♂ usually black-lined posteriorly

e Clypeus anteriorly more or less roundly emarginated, lateral parts apically more or less serrated, depth of emargination about one third of the length of the clypeus (Figs 1c, 1d, 7j)

f Body ventrally nearly completely green (Fig. 1b)

g Tips of middle and hind tibial spurs blunt, ± translucent (Figs 1h, 7h)

h Pronotum in lateral view anteriorly and ventrally without submarginal furrow (Fig. 1e)

Bionomics

The imagines of *Rhogogaster* s. str. are usually to be found between the middle of May and the end of July on the leaves of various trees and shrubs, whereas flowers are usually not visited. Hobby (1931) recorded a female of *R. punctulata* preying on a nematine male (Tenthredinidae). Other records of predation by *Rhogogaster* seem to be uncertain. Neither author of the current paper ever observed this behaviour of *Rhogogaster* imagines. However, our colleague O. Lønnve (Oslo, personal communication) fed a captured female of *R. punctulata* with flies for several days. The species are univoltine. Larvae of at least some taxa are apparently polyphagous. As there is commonly a rather high rate of misidentification of *Rhogogaster scalaris* and *chlorosoma* in collections (we estimate up to about one third of the material), the exact association of the host plants of these two species is uncertain.
Lacourt (1999) listed the host plants as follows:

R. chlorosoma: *Salix* spp., *Populus tremula*, *Alnus* spp., *Betula* spp., *Corylus avellana*, *Sorbus* spp., *Filipendula ulmaria*, *Prunus* spp., *Pteridium aquilinum*.
We examined a specimen reared from *Lycopus europaea*, erroneously recorded as *R. scalaris* ("*viridis*") by Pschorn-Walcher & Altenhofer (2000).

R. scalaris ("*viridis*"): *Salix* spp., *Populus* spp., *Alnus* spp., *Betula alba*, *B. pendula*, *Epilobium* spp., *Circaea lutetiana*, *Quercus* spp., *Filipendula ulmaria*, *Frangula alnus*, *Vicia cracca*.
In addition, records are known for *Ranunculus, Stellaria* spec. (Lorenz & Kraus 1957) and *Agrimonia eupatoria* (Macek 2012).

R. punctulata: *Salix* spp., *Alnus* spp., *Betula alba*, *B. pendula*, *Corylus avellana*, *Prunus* spp., *Rosa* spp., *Sorbus* spp., *Fraxinus excelsior*.
Furthermore, *Crataegus* spec. (Pschorn-Walcher & Altenhofer 2000) and *Rubus idaeus* (Kangas 1985) are recorded for *R. punctulata*.

R. viridis ("*dryas*"): *Populus tremula*. 89 imagines from Finland were examined by MV. The species is present throughout the country, apparently absent only in the highlands of the northwestern Finnish "arm". *Populus*

tremula is absent there. This may indicate that *R. viridis* is not polyphagous.
The host plants of *R. gayuboi*, *R. magniserrula* and *R. polaris* are still unknown.

Taxonomic notes

(1) Nomenclature of the European *Rhogogaster* s. str.

***Rhogogaster* Konow, 1884: 338.**

Rhogogastera Konow, 1885: 123. Unjustified replacement name for *Rhogogaster* Konow, 1884.

Type species: *Tenthredo viridis* Linnaeus, 1758, by subsequent designation of Rohwer 1911: 89. Gender feminine.

Taeger *et al.* (2010) listed the following seven taxa under *Rhogogaster* (*Rhogogaster*):
R. californica (Norton, 1862) (+ 3 subjective synonyms);
R. carpatica (Zhelochovtsev, 1988);
R. chlorosoma (Benson, 1943);
R. dryas (Benson, 1943) (+ 1 subjective synonym);
R. gayuboi Llorente, 1988;
R. punctulata (Klug, 1817);
R. viridis (Linné, 1758) (+ 15 subjective synonyms).

As a result of the current work we consider the following European *Rhogogaster* s. str. to be valid:

R. chlorosoma (Benson, 1943);
R. gayuboi Llorente, 1988;
R. magniserrula Viitasaari **spec. nov.;**
R. polaris Lindqvist, 1964 (= *R. californica* auct. partim);
R. punctulata (Klug, 1817);
R. scalaris (Klug, 1817) (= *R. viridis* auct., nec Linnaeus, = *R. carpatica,* **syn. nov.**);
R. viridis (Linné, 1758) (=*R. dryas*, **syn. nov.**).

Rhogogaster chlorosoma (Benson, 1943)

(Figs 3c, d, h, i, s, 4b, c, 6c, k, compare 5a, b, j, l)

Tenthredo chlorosoma Benson, 1943: 139, 142–143. Holotype ♂, not examined (BMNH). Type locality: Czech Republic: Chodau (Chodov). 1♂ 1♀ paratype from the type locality (SDEI, both damaged, ♀ see http://dx.doi.org/10.6084/m9.figshare.1378995) .

Rhogogaster scalaris sensu Thomson (1871) and Zhelochovtsev & Zinovjev (1988)

Discussion. In the original description Benson (1943) listed *Tenthredo chloros* Rudow, 1871, *Rhogogaster viridis* var. *sibirica* Enslin, 1912, and *R. viridis* forma *montana* Betrem, 1933 as questionable synonyms. In the course of this study these taxa were excluded from synonymy of *chlorosoma*. *Rhogogaster chlorosoma podkumokensis* Muche, 1973 is a synonym of *R. scalaris* (see below).

The species is very similar to *R. scalaris*, the COI barcodes of *R. chlorosoma* and *R. scalaris* fall in the same cluster and do not allow the separation of the taxa. The males are well characterized by the large plantar lobes and the shape of the penis valves. The females also have large plantar lobes, but the range of their size overlaps with *scalaris*. The saw does not differ from that of *scalaris*. Usually the color characters given in the key may help to identify the females. The coloration of *chlorosoma* and *scalaris* is variable. However, the coloration pattern may be comparatively stable in restricted areas, and the identification of the species based on color characters may be fairly reliable in such areas.

Benson (1965) distinguished the coloration of *chlorosoma* and *scalaris* ("*viridis*") as follows:

(*chlorosoma*) "Very pale. Abdomen in male may be entirely pale but usually with a narrow black medial line; female with at most a medial vitta of separated black spots."

(*scalaris*) "Very variable in colour but often much darker than *chlorosoma* (male with at least black vitta on abdomen, and both male and female may be entirely black above)."

Though *chlorosoma* tends on average to be paler than *scalaris*, the latter may be nearly completely pale, and thus clearly paler than dark specimens of *chlorosoma*. Consequently, identifications of females remain uncertain, if the usual local color pattern of the species is unknown, and the size of the plantar lobes falls in the overlapping range (length between the 1st and 2nd lobes about 0.9–1.1 × their own length). The examination of nuclear genes might help to separate the taxa in the future.

Rhogogaster naias Benson, 1965 and *R. auctor* Weiffenbach, 1967 are known only from Turkey. Both are similar to *chlorosoma*, but the male genitalia are very different (Figs 6d, i). At present, we are unable to separate their females from *chlorosoma*.

Rhogogaster gayuboi **Llorente, 1988**

(Figs 3u–y)

Rhogogaster gayuboi Llorente, 1988: 361–364. Holotype ♂ (not examined, coll. Llorente). Type locality: Spain: León: Sorbeira.

Discussion. The species was described based on three males from NW and C Spain (León: Sorbeira; Madrid: Montarco; Avila: Arévalo). The types could not be located. According to Llorente (1988), the paratype from Madrid should be in the Museo Nacional de Ciencias Naturales, Madrid, but could not to be found there (Taeger *et al.* 2014, M. Paris, personal communication). Without examination of the type, the exact placement in *Rhogogaster* remains uncertain. The shape of the penis valve resembles in some respects *R. scalaris*. Because their distributions and coloration are very different, as far as these are known, the possibility that *R. gayuboi* is the male of *R. magniserrula* may be excluded.

Rhogogaster magniserrula **Viitasaari, spec. nov.**

(Figs 4n–p, 5e, f, n, 6p, 7a–q)

Material examined. Holotype ♀ (high resolution figures see http://dx.doi.org/10.6084/m9.figshare.1324048). Finland: "Suomi PP: Simo 12.6.1948, O. Peltonen" (ca. 65.670°N, 25.052°E), coll. SDEI.

Paratypes: Finland: 1 ♀ Sipoo, Nevas, 6687:3412, margin of deciduous forest, (ca. 60.285°N, 25.408°E) 14–20.7.1985, A. Albrecht leg., coll. MV; 1 ♀ EnL, Enontekiö, Pallastunturit, Röyninkuru, (Grid2E) 756:337, 26.7.1951, J. Kaisila leg. (ca. 68.074°N, 24.058°E), coll. MV. This specimen was found on snow and the record was published as "*R. viridis* L.", identified by T. Kontuniemi [Kaisila 1952: 19]. This paper gives a fairly accurate location between Saivokero and Vuontiskero (http://dx.doi.org/10.6084/m9.figshare.1411048). Russia: 1 ♀ "Kirov: Kirov: Vyatka 15–23 July 2001. Sweep-net. Leg. Erik Heibo" (ca. 58.462°N, 49.877°E), coll. E. Heibo (http://dx.doi.org/10.6084/m9.figshare.1375774).

Description. The species is described in the key below.

Variability. The holotype and the paratype from Sipoo are very similar to each other, whereas the specimen from Enontekiö is somewhat paler, but all three are clearly darker than the paratype from Russia. The saw of the latter specimen is strongly worn (Fig. 5f). Nevertheless, there is little doubt that these four specimens are conspecific. The specimen from Russia has a much paler abdomen: all terga apically largely green, and the black patches only cover about half of the length of the terga (Fig. 7n). In contrast, the Finnish specimens have mainly black terga with narrow green apical margins (terga 2–3 medially almost completely black, Fig. 7a). Furthermore, in the Russian specimen the black color on and beside the postocellar area, and on the occiput is clearly reduced (Fig. 7q). In addition, in the specimen from Kirov, the black line between the mesoscutellum and its appendage is missing (Fig. 7o), the mesopleural groove is not marked with black, and the femora of the front and middle legs are not continuously black-lined posteriorly as in the specimens from Finland.

Discussion. The species belongs in the group of *R. viridis* (*viridis*, *polaris*, *sibirica, californica* s.l.). The angle of the incision behind the postcalcar (cypsella) is less than 45°, as usual in the group (Figs 5e, f). Furthermore, the densely sculptured appendage of the mesoscutellum and the shape of the frontal field agree with the usual character states in this group (Fig. 7k). The most distinctive external character of the species is the pale coloration of the head. The frontal ridges are not black in the lower part as in *viridis* and *polaris*, but green, in the holotype with an indistinct small dark pit in the lower part. A similar 'ω'-like black marking is to be found in European *Rhogogaster* only in *R. punctulata*, but in this species the postocellar area is almost completely green, and the abdomen is much paler. Exceptionally (1♂ 1♀ of 340 examined specimens), very pale specimens of *R. chlorosoma* with similar head coloration occur. This form is dorsally much paler than *magniserrula*, the occiput is nearly completely pale (http://dx.doi.org/10.6084/m9.figshare.1394863), and the genitalia are different.

In the eastern Palearctic *R. sibirica* (see below) the color of the head is even much paler than in *magniserrula*, and upper thorax and abdomen are nearly completely pale. Thus the amount of black on the head in the *viridis* group decreases in the order *viridis* (Figs 4i–k) – *polaris* (4l) – *magniserrula* (4n–p) – *sibirica* (4m).

The species is the most rarely collected European *Rhogogaster*. We cannot exclude, that undiscovered specimens of the species are mixed in larger collections under "*viridis*" in a broader sense. The coloration of the head should make it rather easy to recognize them.

Even though the male remains unknown, it seems not unlikely that it is similar to the female, and the general shape of its penis valves resembles that of *viridis*, *polaris* and *sibirica*.

Distribution. Fig. 6p. The types were all collected in the boreal coniferous forest zone of NE Europe. The three records from Finland cover nearly the entire north-south extent of this country. Therefore, the species is at least to be expected in northern Sweden. The record from Kirov also suggests a more eastern distribution in northern Russia.

Etymology. The name *magniserrula* refers to the large serrulae of the saw and is to be treated as a noun.

Rhogogaster polaris Lindqvist, 1964

(Figs 3e, q, r, 4l, 5d, g, i, k, 6f, o)

Rhogogaster polaris Lindqvist, 1964: 121. Holotype ♂ (MZLU, not examined). Type locality: Norway: Tromsö, Målselva, Kundhaug.

Discussion. Benson (1965) synonymized *R. polaris* with *R. californica* (Norton, 1862), but Prous *et al.* (2014) treated the species as valid. The relationship between the Nearctic *R. californica* and the Palearctic *polaris* needs further investigation. Currently, the species are separated only because of their different COI barcodes (about 3 % divergence). Furthermore, the taxa have a different distribution pattern, as *polaris* seems to be a species with a very restricted northern distribution, whereas *californica* is widely distributed in the Nearctic realm (Prous *et al.* 2014). However, the taxonomy of the Nearctic *Rhogogaster* still needs to be checked, and it is uncertain if the synonymy of *Tenthredopsis evansii* Harrington, 1889 from Ontario and *Tenthredo ripula* MacGillivray, 1923a from Oregon with *R. californica* is really correct. The barcoding data of specimens from various localities in Canada form at least two clusters, and no data are yet available for specimens from California. In line with general patterns of distribution, a Holarctic distribution of the subarctic *R. polaris* would not be unexpected. At present it seems best to treat the European taxon as a separate species. We have seen males from Norway, Sweden, Finland and eastern Russia (Magadan obl., upper Kolyma river, station Aborigen, ca. 61.983°N, 149.331°E, 15.7.1987, leg. MV). The southernmost confirmed record of *polaris* is a female from Sweden: Kopparbergs Län: Öje (60.810°N, 13.866°E, 11.06.2013, coll. SDEI, barcoded). Furthermore, a female from Russia (Karelia, Petrozavodsk, ca. 61.837°N, 34.285°E) was examined. However, the separation of the females of *polaris* and *viridis* is difficult, and apart from the clear difference in the barcodes, there are only weak differences in coloration. Therefore, whenever possible, records of both species should be based on males or specimens with barcode data. We have seen no males of *R. polaris* from the more southern parts of the known distribution area. The record of a male from France (Hautes Alpes, Vars, as *R. californica*; Chevin 1972) requires confirmation. *Rhogogaster similis* Lindqvist, 1959 is based on a female and fits *viridis* better than *polaris*, if the color difference (the darker head) proves to be reliable. Hitherto, *polaris* specimens which are as dark as the *similis* type are unknown.

Rhogogaster punctulata (Klug, 1817)

(Figs 1d, 3a, b, 4a, 5h, 6e, l)

Tenthredo (*Allantus*) *punctulata* Klug, 1817: 195. Type(s) lost. Type locality: Österreich (Austria).

Discussion. Results of barcoding place European specimens identified as *R. punctulata* in two different clusters (difference of about 4 %), but no morphological characters were found to separate these two barcode types. Thus, the available specimens are currently treated as one species.

Rhogogaster scalaris (Klug, 1817), species revocata

(Figs 1a–c, h, 2c–g, 3f, k–n, t, 4d–h, 5a, b, j, l, 6a, b, j)

Tenthredo (*Allantus*) *scalaris* Klug, 1817: 194–195. Lectotype ♀, designated by Blank & Taeger (1998), examined by AT (MFNB, http://dx.doi.org/10.6084/m9.figshare.1157599). Type locality: "Deutschland".

Rhogogaster viridis auct., nec Linnaeus

Tenthredo pictipes Förster, 1850: 287–288. Holotype ♀ lost. Type locality: "in der Nähe von Aachen".

Rhogogaster viridis var. *melanonota* Enslin, 1912: 93. Syntype(s) lost. Type locality not given (Europe).

Rhogogaster viridis var. *melanota*, misspelling: Enslin 1918: 722

Rhogogaster viridis var. *nigroscutellata* Forsius, 1918 (04.V.): 150. Syntype(s) ♂ (not examined, but photos taken by Kari Kaunisto, ZMUT, see http://dx.doi.org/10.6084/m9.figshare.1340006). Type locality: "Finland, Kirchspiel Karislojo".

Rhogogaster viridis var. *lapponica* Enslin, 1918(01.VII.): 722. Syntype(s) lost. Type locality: "Lappland".

Rhogogaster chlorosoma podkumokensis Muche, 1973: 85. **Lectotype** ♂, **hereby designated** (NFMB, http://dx.doi.org/10.6084/m9.figshare.1352078). Type locality: Russia: Kislovodsk, **syn. nov.**

Tenthredo (*Rhogogaster*) *carpatica* Zhelochovtsev & Zinovjev, 1988: 221. **Lectotype** ♂ **hereby designated (**ZMUM**,** http://dx.doi.org/10.6084/m9.figshare.1275152). Type locality: Ukraine: Hora Rivna (= Polonina Runa, = Polonina Rovna), Srednij Kamenec, 1250–1340 m a.s.l. (ca. 48.80°N, 22.81°E), **syn. nov**.

Rhogogaster poloninicus Bokotej, 1959, nom. nud.

Discussion. The synonyms listed under *R. viridis* (auct.) by Taeger *et al.* (2010) were re-evaluated according to their original descriptions or types. As a result, several names are no longer associated with *scalaris* or *viridis*. They are treated instead as *species incertae sedis*: see below. The color pattern of the legs of specimens from northern North America is somewhat different from that of European specimens. Therefore, the Nearctic *R. ruga* MacGillivray, 1923 (July) and *R. respectus* MacGillivray, 1923 (December) which were synonymized by Ross (1943) with *viridis* (auct.), are not treated here, and are excluded currently from the synonymy of *scalaris*.

The specimen which has been claimed to be the holotype of *Tenthredo pictipes* (http://dx.doi.org/10.6084/m9.figshare.1380114, Taeger & Blank 2011), is not the type, as the original description was based on a specimen without front legs, whereas the illustrated specimen is complete. Förster (1850) described a very dark form with largely black upper head, black occiput and black mesonotum. So far, such dark forms are only known in *R. scalaris*.

The description of the variety *melanonota* (Enslin 1912: 93)[1] also fits this very dark form of *scalaris*.

Specimens that agree with the description of the variety *nigroscutellata* (Forsius 1918:150)[2] from Lapland were examined (Fig. 2g) and are currently associated with *R. scalaris*.

The specimen claimed to be a type of the variety *lapponica* in the ZSM disagrees with the original description of Enslin (1918)[3]. The specimen bears green markings on the mesonotum and the scutellum, and therefore it cannot be considered to be a type of *lapponica*. Specimens from Lapland that fit Enslin's description were examined and are currently associated with *R. scalaris*.

1. Enslin (1912: 93) "... der Brustrücken [kann] vollkommen schwarz werden, so dass nur noch das Schildchen grün bleibt = var. nov. *melanonota*"
2. Forsius (1918: 150) "Bei ♂ var. nov. *nigroscutellata* ist das Schildchen schwarz, und nur die Seitenlappen des Mesonotums tragen einen kleinen, grünen Fleck. Ich kenne diese Varietät nur aus Finland, Kirchspiel Karislojo (ipse)".
3. Enslin (1918: 722–723) "In Lappland kommen sehr dunkle Formen vor, die ich var. nov. *lapponica* nenne. Diese Tiere gleichen im allgemeinen der var. *melanota* [sic!], doch dehnt sich bei ihnen die schwarze Färbung noch weiter aus, so daß größtenteils auch das Schildchen schwarz ist und auch der Hinterkopf fast ganz schwarz erscheint."

Rhogogaster chlorosoma podkumokensis was synonymized with *chlorosoma* by Lacourt (1999) without explanation. However, the shape of the penisvalve agrees with *R. scalaris*, and the plantar lobes are smaller than in *chlorosoma*. The taxon was described based on 13♀ 10 ♂. Muche labeled one male as type, and other specimens as paratypes, but did not publish this information. Therefore, the type specimens are to be considered as syntypes. The specimen labeled by Muche as "Typus" is hereby designated as lectotype.

Zhelochovtsev & Zinovjev (1988) keyed "*Tenthredo* (*Rhogogaster*) *carpatica* Bokotey [= Bokotej]", but because this species had not previously been described, they became authors of the species name. The description comprises only the insufficient information in this key. Regarding the genitalia, it is only stated that they are different from *R. dryas* (= *R. viridis*). On 11th October 2001 Dr Lajos Zombori (Budapest) gave the following important information via e-mail (English slightly modified): "I phoned J. Bokotey (who now lives in Hungary) and he told me that he wanted to describe a new *Rhogogaster* species, on the basis of a series of over one hundred specimens. He never did this, although a name, *R. poloninicus* sp. nov., was published in 1963 without any description of the animals, and only the locality was mentioned. At this time, however, Zhelochovtsev suggested to him to name it *carpaticus*. At a congress in 1963 Bokotey read the description of the new species *poloninicus* in front of an audience, but the paper was never published"

This information indicates that "*carpatica* Bokotey" is the same as the nomen nudum "*poloninicus* Bokotej". Bokotej's information (1959, 1962) about the type locality and collection data made it possible for Y. Sundukov to identify three specimens in the collection of the Zoological Museum in Moscow on which the species description of 1988 is based. Zhelochovtsev prepared the manuscript of the key, but died already in 1976, and Zinovjev later completed this and had it published. The name "*carpatica*" was thus made unintentionally available by these authors.

The coloration of the three available males is rather variable. The mesoscutellum of the lectotype is almost black with a faint pale patch, but largely green in the paralectotypes (http://dx.doi.org/10.6084/m9.figshare.1408861).

The types agree with the description of *Tenthredo pictipes* and the dark varieties discussed above. Similar forms were also found in the Harz Mountains in Germany. The penis valves of the *carpatica* types are not different from the valves of *R. scalaris*. Currently, these dark forms are considered to belong to *scalaris*. The specimen recorded as *Rhogogaster carpat(h)ica* by Zombori & Ermolenko (2001) and Roller & Haris (2008) belongs to the *R. picta* group (http://dx.doi.org/10.6084/m9.figshare.1150166).

The species is frequently mixed up with *R. chlorosoma*. See discussion there.

***Rhogogaster viridis* (Linnaeus, 1758)**

(Figs 3o, p, 4i–k, 5c, m, 6h, n)

Tenthredo viridis Linné, 1758: 557. Lectotype ♀, designated by Malaise & Benson (1934), examined by MV(LSUK, http://linnean-online.org/16692/). Type locality: "Europa".

Tenthredo dryas Benson, 1943: 139, 141–142, **syn. nov.** Holotype ♂, not examined (BMNH). Type locality: Great Britain: England: Herts, Bricket Wood. 1♀ paratype from the type locality examined by AT (SDEI, http://dx.doi.org/10.6084/m9.figshare.861169).

Rhogogaster similis Lindqvist, 1959: 68. Holotype ♀, examined by MV (FMHEL, https://kotka.luomus.fi/view?uri=http://id.luomus.fi/GL.2359). Type locality: SW Finland: Föglö. Synonymy by Benson (1963) with *R. viridis* (auct. = *scalaris*), synonymy with *dryas* by Viitasaari (1980).

Discussion. Malaise & Benson (1934) examined the Linnean types of sawflies and selected the lectotype of *viridis* with the words "1 ♀ *Rhogogaster viridis* L., auct., labelled 'viridis' agrees with the description and is no doubt the type. 1 ♀ also belongs to this species" (lectotype designation according to ICZN 1999, Art. 74.5). Benson (1943), when describing *Tenthredo dryas*, and in the course of his revision of *Rhogogaster* (Benson 1965), obviously did not re-examine the lectotype of *viridis*. Unfortunately, the *viridis* type is conspecific with *dryas*. Its identity is apparent from the photos at http://linnean-online.org/16692 (coloration, sculpture of the mesoscutellar appendage), and was confirmed by the examination of the specimen by MV. Consequently, the rather rare species that during recent decades was usually called *R. dryas,* now has to be called *R. viridis*, whereas the common *R. viridis* auct. needs another name (*R. scalaris*). We have examined *viridis* specimens from Bulgaria, Estonia, Finland, Germany, Great Britain, N Kazakhstan (Shuchinsk), Russia (Irkutsk) and Sweden.

(2) Notes on some Asian *Rhogogaster*

***Rhogogaster auctor* Weiffenbach, 1967**
(Figs 4r, 6d)

Rhogogaster auctor Weiffenbach, 1967: 17–19. Holotype ♂ (LNMO, examined, http://dx.doi.org/10.6084/m9.figshare.936939). Type locality: Turkey: cil. Taurus, "Cittehan" (= Çiftehan). Paratype ♀ (Turkey: Kizilcahamam, http://dx.doi.org/10.6084/m9.figshare.1383171)

Discussion. The male (holotype) is very well characterized by the shape of the penis valve. The morphology is otherwise very similar to *chlorosoma* (see also discussion there). The figure of the valve given by Weiffenbach (1967) is badly drawn. Photos of the valves are shown in Fig. 6d. The association of the female (paratype) is uncertain, as it was not collected at the type locality in the Taurus Mountains, but in northern Turkey (Kizilcahamam), where other species of the group may occur.

***Rhogogaster bactriana* Benson, 1965**
(Fig. 4t)

Rhogogaster bactriana Benson, 1965: 111–112. Holotype ♂ (HNHM, not examined). Type locality: Afghanistan "Paghman-Geb., 2000 m".
Rhogogaster bactriana lindti Muche, 1978: 357–358. Holotype ♂ (MFNB, penis valves examined) Type locality: Tajikistan: "Turkestan, Serawshan-Schlucht, Dorf Oburolow, 2000 m".

Discussion. The holotype of *lindti* could not be found in the MFNB, but some photos of the type were taken in 2005. The valvae of the holotype are still available on a slide. Both are rather damaged and disagree in many respects with the figure given by Muche. A plate consisting of the old photos of the type and images of the penis valves is available at http://dx.doi.org/10.6084/m9.figshare.1153924. The species is widely distributed in Central Asia. Without explanation, Lacourt (1999) treated *lindti* as a synonym of *bactriana*. This may be correct, but requires reappraisal within a study of Asian *Rhogogaster*.

***Rhogogaster genistae* Benson, 1947**
(Fig. 4u)

Rhogogaster chambersi genistae Benson, 1947: 98–99.
Rhogogaster genistae viridifrons Muche, 1973: 87–88. **Lectotype ♀ hereby designated** (MFNB, http://dx.doi.org/10.6084/m9.figshare.1362549). Type locality: Russia: Kislovodsk: Podkumok-Tal, Kreide-Südhang 850–1000 m. Paralectotypes: 12♀ 3♂ (MFNB), 2♀ (ZSM).

Discussion. Muche (1973) described his subspecies 15
viridifrons based on 20 ♀ and 9 ♂ syntypes. He did not designated a holotype, although one ♀ was labeled as "Typus", and the remaining specimens as "Paratypus". Accordingly, the "Typus" is hereby designated as lectotype. The whereabouts of the missing syntypes (5♀ 6♂), now paralectotypes, are unknown. Images of a male paralectotype are presented at http://dx.doi.org/10.6084/m9.figshare.1362551. Muche mentioned considerable variability of his type series. The color variability of females is figured at http://dx.doi.org/10.6084/m9.figshare.1363624. Lacourt (1999) listed *Rhogogaster genistae viridifrons* without explanation as a synonym of the widely distributed *Cytisogaster genistae*. This was accepted by Taeger *et al.* (2010). Nevertheless, the taxonomy of the group is not sufficiently resolved and the status of *viridifrons* needs further scrutiny.

Rhogogaster gilva (Konow, 1908)
(Fig. 4v)

Sciopteryx gilva Konow, 1908: 14, 22–23. **Lectotype** ♀ **hereby designated** (ZIRAS, http://dx.doi.org/10.6084/m9.figshare.865631). Type locality: China: дол. р. Джагынгол в Тибетъ (= dol. r. Dzhagyngol v Tibet" 14300); paralectotypes: 1♀ (SDEI, http://dx.doi.org/10.6084/m9.figshare.1348322), 3♀ ZIRAS, same data as the lectotype (figures of the type series: http://dx.doi.org/10.6084/m9.figshare.1365431).

Discussion. Konow (1908) described *gilva* as a variable species. Benson's treatment (1968) is based on the SDEI specimen from Konow's collection, which is perhaps not conspecific with the lectotype from the ZIRAS. The shape of the mandibles could not be checked during the present study because of the high risk of destruction of the old type specimens. A (most likely not conspecific) female specimen from Sichuan, which is morphologically very similar to *gilva,* has a mandible shape similar to that of the male of *R. punctulata* (i.e., the rectangular tooth is flat and indistinct). The taxon was sometimes treated as a synonym (Benson 1965) or subspecies (Kuznetzov-Ugamskij 1929) of *Sciapteryx virescens* (now in *Tenthredo*, see below). After the study of the types of both taxa, their synonymy is definitely rejected. Ushinskij (1940) created the subgenus *Sciapterina* for *S. virescens* and *gilva*, but did not select a type species. Therefore, according to Art. 13.3. ICZN (1999) *Sciapterina* is not available. Hitherto it was wrongly treated as a synonym of *Sciapteryx*, whereas the two associated taxa belong respectively to *Rhogogaster* and *Tenthredo*.

Rhogogaster naias Benson, 1965
(Figs 4s, 6i)

Rhogogaster naias Benson, 1965: 112. Holotype ♂ (BMNH, not examined). Type locality: Turkey: Pr. Gumusane, near Maden, 1800 m. Paratypes 10 ♂ 12 ♀ (1♂ 1♀ in SDEI, http://dx.doi.org/10.6084/m9.figshare.929604)

Discussion. The male is very well characterized by the shape of the penis valve. The morphology is otherwise similar to *chlorosoma* (see also discussion there).

Rhogogaster robusta Jakowlew, 1891
(Fig. 4q)

Rhogogastera robusta Jakowlew, 1891: 38–39. Holotype ♀ (ZIRAS, http://dx.doi.org/10.6084/m9.figshare.996042). Type locality: China: Gansu: "Xining".

Discussion. The label data of the specimen in the collection of the Zoological Institute in St Petersburg do not agree with the record data provided in the original description. Jakowlew (1891: 6) gave "Гань-су: Синиңъ" (= Gansu: Xining) as type locality, and Potanin as collector. The specimen under discussion is labeled "Упиңъ 26/IV 85" (Upin 26/IV 85). This is an original label from the Potanin expedition 1884–1886 to China. According to the expedition report of Potanin, he was in Sigu from 24th June to 1st July, and on 26th visited the village Upin (Belokobylskij in litt. 2014). The specimen bears no identification label by Jakowlew, but a label "Wahrscheinlich Typus von Rhogogaster robusta Jak. R. Malaise". During a stay in St. Petersburg in 2014, AT checked the drawers containing the ZIRAS Symphyta collection. No other specimen that fits the description of *robusta* could be found. It should be noted that Jakowlew (1891) usually provided detailed collection data for the specimens from the Potanin expedition. In the case of *robusta* these data are missing. Today it is impossible to explain why this happened, but one could speculate that Jakowlew mixed up his notes, or the material had been only temporarily in his hands and he gave wrong data from memory. On the other hand, it seems very unlikely that Jakowlew had before him one further specimen which has meanwhile been lost and that he overlooked a second (the available) specimen from the Potanin collection. Therefore, we agree with Malaise and consider the specimen in the ZIRAS to be the holotype of *R. robusta*.

***Rhogogaster sibirica* Enslin, 1912, stat. nov.**
(Figs 1e, 3j, 4m, 6g)

Rhogogaster viridis var. *sibirica* Enslin, 1912: 93. **Lectotype ♀ hereby designated** (ZSM, http://dx.doi.org/10.6084/m9.figshare.1335872). Type locality: "Irkutsk Sibir.". Paralectotypes 1♂ http://dx.doi.org/10.6084/m9.figshare.1117951, 1♀ http://dx.doi.org/10.6084/m9.figshare.1119167 (SDEI, see discussion).

Rhogogaster kudianus (recte *kudiana*) Rohwer, 1925. Holotype ♀ (USNM, http://usnmhymtypes.com/default.asp?Action=Show_Types&Single_Type=True&TypeID=6086, not examined). Type locality: Kudia River, Amagu, Siberia (= Primorskiy Kray, Amgu River - A. Lelej, personal communication; ca. 45.83°N, 137.67°E), **syn. nov.**

Discussion. Describing *Tenthredo chlorosoma*, Benson (1943) treated *R. viridis* var. *sibirica* as a questionable synonym of *chlorosoma*. However, the examination of the *sibirica* types showed, that these represent a species of the *viridis* group. The penis valves of the paralectotype (Fig. 6g) agree with the valves of *californica* (Fig. 6m). *Rhogogaster sibirica* might be an extremely pale form of *californica*, but currently no intermediate forms are known. Therefore it seems advisable to treat *R. sibirica* as a valid species.

The type status of the *sibirica* specimens in the SDEI requires an explanation: in 1910 Enslin published a revision of the Palearctic *Rhogogaster*. He described under *viridis* a very pale form from Siberia[4], but gave no name for these specimens. His note "habe ich [...] Exemplare gesehen" ("I have seen specimens") indicates that he had no *sibirica* material of his own. In 1912 he slightly modified his 1910 description and named the form as *Rhogogaster viridis* var. *sibirica.*[5] In the course of his *Rhogogaster* study of 1910, Enslin examined specimens from Konow's collection, and in this collection (now in SDEI) is to be found a couple from "Irkutsk Sibir." that fits Enslin's description. These specimens have no identification labels by Enslin, but this is not surprising, because Enslin only later decided (1912) to give a name to this pale form. Enslin frequently kept dupla from Konow's collection, and therefore it is to be expected that the specimen labeled "Rhogogaster viridis var. sibirica Enslin ♀" (now coll. ZSM) is from the same series as the specimens in the Konow collection. Based on the discussion above, the specimen from the ZSM and the two specimens in the SDEI collection are considered to be syntypes. Zirngiebl (1965) noted that he has seen "den Typ"[6] of *sibirica* from Irkutsk. This treatment does not fulfil the requirements of a lectotype designation in the ICZN Art. 74.5, as it is clear from the description that Enslin had syntypes before him, and the specimen was not explicitly selected from this series. The ♀ of the ZSM is hereby designated as lectotype.

Rhogogaster kudiana Rohwer, 1925, from the Russian Far East agrees with *sibirica*. A specimen from Anisimovka (Russian Far East, not far from the type locality of *kudiana*, http://dx.doi.org/10.6084/m9.figshare.873867) was compared with the *sibirica* types from Irkutsk, and also with the available figures of the *kudiana* type. No relevant characters were found to distinguish two taxa. Our colleague D.R. Smith (Washington) kindly compared the type of *kudiana* with images of a specimen from Anisimovka, and provided some additional information about the type.

4. Enslin (1910: 32, under *R. viridis*) ... "So habe ich namentlich aus Sibirien Exemplare gesehen, die auf den ersten Blick viel mehr der *Rh. punctulata* Kl. gleichen, ja die schwarze Farbe ist bei ihnen noch geringer entwickelt. Es erscheint bei ihnen nur schwarz: am Kopfe ein feiner Saum um das untere Nebenauge und eine halbkreisförmige Linie, von den oberen Nebenaugen zu den seitlichen Stirnfurchen verlaufend; am Brustrücken nur teilweise die Nähte. Der Hinterleib ist durchaus grün, die schwarze Linie der Beine ist nur an den Tibien und den hintersten Schenkeln zu sehen. Tarsenspitzen und die meisten Adern und Nerven der Flügel sind schwarz."
5. Enslin (1912: 93, under *R. viridis*) ... "So ist bei der var. nov. *sibirica* der Körper fast ganz grün, nur eine wie bei *punctulata* ω-ähnliche Zeichnung des Oberkopfes—oft auch diese nur unvollständig—und am Thoraxrücken nur teilweise die Nähte schwarz, so daß das Tier heller gefärbt ist als *punctulata*; auch sind bei dieser var. die vorderen Schenkel auf der Hinterseite nicht oder nur an der Spitze schwarz liniert."
6. Zirngiebl (1965: 100) "Den Typ der Enslinschen Form var. *sibirica* habe ich gesehen. Mir diese Möglichkeit geboten zu haben, verdanke ich Herrn Dr. Franz Bachmair von den Zool. Sammlungen des Bayerischen Staates in München. Nach der Tabelle von Benson bestimmt, deckt sich das Tier mit der Form *chlorosoma*; es ist eher noch etwas heller. Es handelt sich um ein ♀, das so hell ist wie die ♂♂ und von Irkutsk aus Sibirien stammt."

(3) *Species incertae sedis* within *Rhogogaster*

***Tenthredo hebraica* Geoffroy in Fourcroy, 1785:** 363–364. Synonymy with *T. viridis* by Lepeletier 1823: 85. Type(s) lost. Type locality: Paris.

Current status. *Species incertae sedis* within *Rhogogaster* s. str.

Original description. "T. hebraica. La Lettre hébraïque verte. Long. 5 lig. Larg. 1½ lig. T. viridis, capite thoraceque supra caracteribus nigris. Loc. Habitat flores." This short description refers to Geoffroy (1762)[7].

Discussion. The description fits with the taxa of *Rhogogaster* s. str. *Tenthredo hebraica* was treated by Taeger *et al.* (2010) as a synonym of *Rhogogaster viridis* auct. However, it cannot be associated with sufficient reliability to this or another taxon. The variety described by Geoffroy (1762) might belong to the *R. picta* group (*Cytisogaster*).

(4) Taxa excluded from *Rhogogaster*

***Rhogogaster viridis* forma *montana* Betrem, 1933:** 377–378.
(Fig. 4x)

Current status. **Syn. nov.** of *Tenthredo olivacea* Klug, 1817.

Lectotype ♀ hereby designated (RMNH, http://dx.doi.org/10.6084/m9.figshare.1299412). Type locality: Germany: Sauerland: Rehsiepen.

Discussion. The taxon was treated by Benson (1943) as a questionable synonym of *Tenthredo chlorosoma*.The lectotype, as well as the paralectotypes (4♀, 1♂ Rehsiepen, 1♀ Switzerland: Kandersteg, all RMNH) belong to *Tenthredo olivacea* Klug, 1817.

***Tenthredo* (*Eurogaster*) *virescens* (Jakowlew, 1887), comb. nov.**
(Figs 1g, 4w)

Sciapteryx virescens Jakowlew, 1887: 163–164. **Lectotype ♀ hereby designated** (ZIRAS, http://dx.doi.org/10.6084/m9.figshare.878068). Type locality: Tibet: Burchan-Budda, 14.000 ft. (= China: Qinghai: Burhan Budai Shan, N35.833° E97.167°).

Rhogogaster virescens: Konow (1905)

Discussion. The species was described based on 1♀ and 2♂ (http://dx.doi.org/10.6084/m9.figshare.1348292). The female is hereby designated as lectotype, the two males as paralectotypes. The species is morphologically similar to *Tenthredo* (*Eurogaster*) *aaliensis* (Strand, 1898), the type species of *Eurogaster* Zirngiebl, 1953. *Tenthredo aaliensis* is currently considered to be a very variable species, with paler forms in the eastern Palearctic. It is possible that *virescens* represents a very pale form of this species.

7. Geoffroy (1762 p. 271–272) "T E N T H R E D O viridis, capite thoraceque supra caracteribus nigris. La lettre hebraique verte. Longueur 5 lignes. Largeur 1 ½ ligne. Cette mouche-à-scie est toute verte en-dessous. Ses antennes & ses yeux sont noirs. Sur sa tête, entre ses yeux, il y a deux cercles noirs adossés & qui se touchent, sur lesquels sont placés les trois petits yeux lisses de pareille couleur. Le corcelet a dans son milieu en-dessus une ligne noire longitudinale irréguliere, & deux raies obliques de même couleur de chaque côté. Le dessus du ventre a une bande noire longitudinale qui règne tout du long dans son milieu. Les pattes ont quelques filets noirs & les bords des anneaux des tarses sont teints de cette même couleur. Les aîles qui font transparentes ont des veines noires, & leur bord extérieur plus épais que le reste de l'aile est vert. Cette belle mouche-à-scie n'est pas des plus communes, elle se trouve sur les fleurs. N.B. Il y en a une variété dont le ventre est tout note én-dessus, & dans laquelle les taches noires de la tête & du corcelet font plus grandes. Ses pattes sont aussi presque toutes noires & très-peu panachées de vert. Elle est un peu plus petite."

***Tenthredo interrupta* Fabricius, 1804:** 40.

Lectotype ♀ hereby designated (by S.M. Blank). Type locality: Austria, **nomen oblitum**. Lectotype labeled "interrupta"; "ZMUC-GISHym 1069". Left antenna, right flagellomeres 5–7, right middle tarsomere 5, hind tarsi missing.

Current status. Syn. nov. of *Tenthredopsis tessellata* (Klug, 1817), **nomen protectum**.

Discussion. The synonymy of *Tenthredo tessellata* and *T. interrupta* was already indicated by Klug (1819), but subsequent authors have interpreted the name differently. Dalla Torre (1894) listed *interrupta* under *Tenthredo mesomelaena* Linné, 1758 while Konow (1905) placed the name in synonymy with *Rhogogaster viridis*. The latter opinion was accepted by subsequent authors (e.g., Taeger *et al.* 2010).

Our colleague S.M. Blank (SDEI) examined the type in the course of a SYNTHESYS project (DK-TAF 4845, 2008). He confirmed: "Although the generally dirty white ground-color of the abdomen of the lectotype is faded, the excised, shallowly punctate clypeus, the absence of red on the abdomen, the basally white and distally black pterostigma, and the red hind femora distinguish this specimen as a *Tenthredopsis* species, which is known as *T. tessellata* (Klug, 1817). *Tenthredo interrupta* Fabricius, 1804 is the same as *Tenthredopsis tessellata* (Klug, 1817)".

The name *Tenthredopsis tessellata* (or the misspelling *tesselata*) is frequently used (we noted about 100 works during the last 50 years), whereas *interrupta* according to our files was never used as the name of a valid species after 1899. *Tenthredopsis tessellata* is the type species of *Tenthredopsis* Costa, 1859.

***Tenthredo Viridis* [sic!] Poda, 1761:** 103. Primary homonym of *Tenthredo viridis* Linné, 1758. Type(s) lost. Type locality: not given.

Current status. *Species incertae sedis* in Tenthredininae. Hereby excluded from synonymy with *R. viridis*.

Discussion. The description[8] fits with several *Rhogogaster* species, including *R. viridis*, but also *Tenthredo olivacea* Klug, 1817.

***Tenthredo straminea* Schrank, 1776:** 85–86. Type(s) lost. Type locality: "Oesterreich" (Austria).

Current status. *Species incertae sedis* in Tenthredininae. Hereby excluded from synonymy with *R. viridis*.

Discussion. Synonymy with *R. viridis* by Konow (1897a: 268–269) "Die *T. straminea* Schrnk. ist eine vergilbte *Rhogogastera viridis* L., da Schrank selbst sagt, dass dieselbe ebenso gezeichnet sei, wie *viridis*, mit dem Unterschiede, dass hier das paillenfarbig sei, was dort grün ist.". Konow did not consider the complete description by Schrank (1776)[9] and ignored the color of the antennae and tarsi. The placement in *Rhogogaster* is therefore very doubtful. *T. straminea* might be a *Tenthredopsis* and is to be considered as *species incertae sedis* in Tenthredininae.

***Tenthredo annalicornis* [sic!] Gmelin, 1790:** 2667. Type(s) lost. Type locality: Europa.

Current status. *Species incertae sedis* in Tenthredinidae. Hereby excluded from synonymy with *R. viridis*.

Discussion. The reference cited by Gmelin[10] (Zschach 1788) agrees with Gmelin's description, except that "punctis conjugatis nigris" was given there as "punctis paribus nigris". Kirby (1882) listed the species as "*Nematus* (?) *annalicornis*". Konow (1897b: 314) synonymized it without explanation with *R. viridis*: "Die *T. annulicornis*

8. Poda (1761: 103) " * * * Antennis filiformibus artculis 7. s. 8. excepta basi * Viridis. 3. T. antennis septemnodiis, corpore viridi, costa alarum superiorum longitudinali concolore, abdomine supra demtis marginibus fusco. Habitat in Fraxino."
9. Schrank (1776: 85–86): "T. antennis septemnodiis, corpore flavo, abdomine supra fusco. Beschreibung. Sie ist größer, als die grüne (Tenth. viridis Lin.), aber eben so gezeichnet, mit dem Unterscheide [sic!] daß hier das paillenfarben ist, was dort grün ist. Die Füsse, welche dort grün, und die Fühlhörner welche dort schwarz sind, sind hier hell castanienbraun. Das Vaterland ist Oesterreich. Man fängt sie an Oertern, wo es viele Weiden und Erlen giebt."
10. Gmelin (1790: 2667) "T. pallida, antennarum basi nigro-annulata, vertice figura ramosa, oculis, thoracis et abdominis dorso punctis conjugatis nigris. Habitat in Europa. Mus. Lesk. p. 55. n. 117."

[sic!] Gmel. ist sicher nichts anderes als *Rhogogastera viridis* L.". There are serious doubts that this is correct, as the coloration of the antennae is different in *Rhogogaster*, the description of the remaining color pattern is very vague, and no information about the body size is given. The placement in *Rhogogaster* is therefore very doubtful, and *T. annalicornis* is better considered to be a *species incertae sedis* in Tenthredinidae.

***Tenthredo chloros* Rudow, 1871:** 387–388. Syntype(s) lost. Type locality: Germany, Unterharz.

Tenthredo chlora W.F. Kirby, 1882: 292 (emendation of *T. chloros*)

Current status. *Species incertae sedis* within Tenthredinidae. Hereby excluded from synonymy with *R. viridis*.

Discussion. Synonymy with *T. viridis* by Cameron (1882: 135). Treated as a doubtful synonym of *T. chlorosoma* Benson, 1943 by Benson (1943). Rudow's descriptions are known to be frequently unreliable, and many of his taxa are hard to interpret. The types are lost (Rudow 1883). These facts apply also to *chloros*. The described imago could be an extremely small male (7 mm, might be a result of suboptimal rearing) of *chlorosoma.* The usual size of the species in Central Europe is about 9–11 mm. Furthermore, Rudow (1871)[11] described the larva of *chloros*, reared on *Salix fragilis*. The larva should be 16–17 mm, and does not fit with the description given by Lorenz & Kraus (1957). Therefore it seems to be possible that the small imago and the rather big larva belong to different taxa. Consequently, *Tenthredo chloros* Rudow, 1871 is considered to be a *species incertae sedis* within Tenthredinidae.

Key to the European *Rhogogaster* s. str. with special emphasis on Fennoscandia

Character assessment

Male genitalia. The penis valves (Figs 6 a–n) of the species seem to be rather characteristic. There is some variation, and at present minimal differences between these forms are considered to be infraspecific variation. In *R. chlorosoma* and *scalaris* the ventral margin of the valviceps is rather membranous. The loss or damage of these parts during the preparation process, or simply a different fixation of this part apparently lead to rather different images given by Benson (1943, 1952, 1965) and Ross (1943) (Figs 6j–n). Frequently, preparations of the two valves of the same specimen are not mirrored symmetrically (Figs 6b, d, i). This might be a result of a different arrangement (angle) on the slide, unequal drying of the valves, or a different original morphology. The club like penis valves of *R. polaris* look variable as well, most likely partly because of their three-dimensional structure, which causes different (two-dimensional) images if the angle of view is changed (Fig. 6o).

The relations of the dorsal and apical margins seem to be sufficiently characteristic to distinguish *R. scalaris* (Fig. 6a) and *R. chlorosoma* (Fig. 6c).

In some non-European species the valviceps has a very characteristic filament, e.g., *R. naias* Benson, 1965 (Fig. 6i) and *R. auctor* Weiffenbach, 1967 (Fig. 6d).

Ovipositor. The shape of the serrulae of the lancet (valvula 1, saw) shows two different types that may be distinguished by the angle of the cypsella (incision behind the postcalcar). In the "*scalaris* type" this angle is broader than 45° (Figs 5a, b), whereas in the "*viridis* type" this angle is clearly less than 45° (Figs 5c–f). Furthermore, the distal margins of the serrulae (i.e., the denticles) are more or less concave in the *scalaris* type, but convex in the *viridis* type. Benson (1952, fig. 331) gave in the widely used "Handbooks..." a rather

11. Rudow (1871: 387–388) 22. T[enthredo]. chloros. T. flavo-virens, fronte, thorace, femorum, tibiarum, tarsorum, antennarumque superiore parte nigris, oculis coeruleus, carpo viridi. Long. corp. 7 mill. Larva flavo-virens, duabus lineis dorsalibus albidis, lateribus albo-striatis, segmentis punctatis, capite viridi, temporibus brunneis, pedibus anterioribus longiusculis. In Salice fragili invenitur. Long. 16–17 mill. Folliculus flavo-virens, foliis contortis construitur. Der T. viridis L. ähnlich, aber mit grünem Flügelmal und fast ganz gelbgrünem Körper. Auf dem Kopfe ist die Stirn mit einem herzförmigen schwarzen Fleck versehen, der wiederum mit gelbgrünen Zeichnungen geziert ist. Die Fühler sind von der Länge des Abdomens und so wie die Füsse an der obern Seite schwarz gezeichnet. Die Wespe findet sich mit T. viridis und andern grünen Arten auf Weidenarten vom Mai ab bis August, ihr Flug ist schwirrend, schwerfällig. Im Freien wird das Gespinnst wohl versteckt am Erdboden liegen."

misleading picture of the serrulae of *dryas* (= *viridis*), as their distance from each other is much too short. Later Benson (1963) discussed the problem of more or less damaged saws and gave a better picture of a complete lancet. The current study also supports the opinion, that minute differences in the shape of the serrulae are very likely not sufficient to distinguish the taxa. Apart from damage caused by the use of the ovipositor, variability of the shape of the serrulae is also to be expected. Even in strongly damaged saws, the shape of the cypsella is still visible (Fig. 5f). Our colleague S.M. Blank drew our attention on the sawlike dorsal margin of the lance of *R. magniserrula* (Fig. 7e). A more or less serrate dorsal margin of the lance is present also in the remaining species treated here (Figs 6h, k). Obviously the degree of serration of the lance is correlated with the degree of the serration of the lancet. The serration of the lance may be also worn (compare the saw of the paratype of *magniserrula* at http://dx.doi.org/10.6084/m9.figshare.1375774).

Plantar lobes. The range of the size of the plantar lobes ("pulvilli") of the hind tarsus was measured for *R. scalaris, polaris*, *punctulata*, and *chlorosoma* (based on 10 specimens of each sex of each species), and all specimens of *R. viridis* available at that time to AT (3 ♂, 9 ♀). The distance between the first and second lobe of the hind tarsus was compared with the length of the first lobe (Figs 3g–n). The following conclusions are drawn:

1. The relative size of the plantar lobes of the hind tarsus is clearly different (smaller) from the lobes of the middle or front legs. Only the relations found on the hind tarsus are used here.

2. The relative size of the lobes is different between the sexes, and may be on average larger in the males (*chlorosoma,* Figs 3h–i) or in the females (all other species, Figs 3l, 3m).

3. *Rhogogaster chlorosoma* is usually well separated by rather large plantar lobes (Figs 3h–i), *R. punctulata* by its small plantar lobes (Fig. 3g), whereas the other species (with medium sized lobes) strongly overlap in this character.

Geographic variation. Northern Fennoscandian *R. chlorosoma, punctulata,* and *scalaris* are on average clearly smaller and darker than specimens from Central Europe.

Coloration. There are tendencies in the color pattern of the taxa that are useful for identification. Local populations are frequently more or less stable in color pattern, but more distant populations may be different.

Sculpture. The sculpture seems to be very variable in *R. scalaris*, which might be a mixture of species. In some cases the sculpture seems to be rather reliable for distinguishing the taxa, but also these characters are to be considered in connection with other characters.

Structure. The structure of the frontal field was used by Benson (1965) to separate his *dryas* group. The variability of this structure is rather high, and clearly overlaps with *scalaris,* even if the stuctures are sometimes very distinct (especially in the males). However, in females this is often less distinct, and in connection with the misleading picture of the serrulae for *dryas* by Benson (1952), especially the females of *viridis* are frequently misidentified. The convex shape of the scutellum in *viridis* is usually a good character for this species (Figs 3o, p), but sometimes this is less distinct, and the character overlaps especially with *polaris* (Figs 3q, r).

Consequently, single characters (except for the male genitalia) are usually not sufficient for definite identification of the species. The following key therefore provides character sets, that are to be considered as a unit, and the user has to evaluate the complete character set for his decision. Even if the key was designed mainly for specimens from Fennoscandia, it should also work for the other parts of Europe. However, the occurrence of other, perhaps rather stable forms of the species, is to be expected in these areas. The key is based on the material examined by AT.

Key

1. (**a**) Terga mainly green, usually on both sides with (sometimes fused) two black spots (rarely without these spots); anterior margins of the terga narrowly black, these margins usually visible through the translucent hind margin of the previous tergite (Figs 3a, b) (in Fennoscandian specimens this is more distinct than in more southern specimens; in Fennoscandian specimens frequently also sternites with distinct black marked anterior margins).
   (**b**) Postocellar area green, only the surrounding furrows mainly black (Fig. 4a) (in eastern European specimens sometimes lateral furrows completely green).
   (**c**) Black color of the upper head forming a 'ω': frontal ridges green, frontal field and frons between antennal furrow and inner eye margin largely black, the black parts not fused above the antennal sockets (Fig. 4a).

(**d**) Upper head usually with distinct, rather mat microsculpture

(**e**) Plantar lobes ("pulvilli") small, distance between 1st and 2nd in ♂ 2.6–3.2 ×, in ♀ 1.6–2.0 × as long as its own length (Fig. 3g).

(**f**) Penis valve as in Figs 6e, l.

(**g**) Saw similar to *scalaris*, but serrulae somewhat smaller (Fig. 5h).

(**h**) Median mesoscutal lobes mainly green, only median groove and notaulus more or less black (Figs 3a, b).

Additional notes. Morphology: Body size in Fennoscandia ♂ 6.5–8 mm, ♀ 7–9 mm, specimens from other parts of Europe up to 12 mm. Meso- and metascutellum with very weak microsculpture, shiny, mesocutellar appendage smooth and shiny. Mesoscutellum flat or slightly convex. Temples with microsculpture, usually rather mat. Postocellar area variable in size, about 2.2–2.8 times as broad as long, convex, laterally with deep, converging furrows; anteriorly blunt triangular, with sharp, but less deep furrow. Color pattern of head and thorax varies little. Postocellar area always green with black furrows. Occiput mainly black, only green close to the occipital carina. Distribution: Europe (not recorded from Portugal), also eastern Palaearctic. Material: AT: 340 specimens (48 ♂♂ 65 ♀♀ from Fennoscandia), MV: about 600 specimens . . . . . ***R. punctulata*** (Klug, 1817) ♂♀ (see p. 10)

– (**aa**) Terga more or less green, dorsally largely black and often forming a more or less broad median black stripe on the abdomen (Figs 3c–f); if terga nearly completely green, without lateral black spots; anterior margins of the terga not narrowly black, not different from the posterior parts of the tergum.

(**bb**) Postocellar area and surrounding furrows mainly black, even in very pale specimens at least the anterior part of the postocellar area black (Figs 4b–l, n–p).

(**cc**) Black color of the head usually more extensive and forming a '∞' (Figs 4b–l): only upper parts of frontal ridges green, frontal field and frons between antennal furrow and inner eye margin largely black, the black parts fused above the antennal sockets, or face mainly black with small green spots on the upper frontal ridges (rarely completely black without green spots), exceptionally in very pale specimens the black mark above the antennae dissolved in small black spots; if exceptionally as in (c) (Figs 4n–p), then (a) and (b) do not fit.

(**dd**) Upper head usually shiny, without or only with weak microsculpture.

(**ee**) Plantar lobes usually larger, distance between 1st and 2nd in ♂ 0.6–2.0 ×, in ♀ 0.7–1.4 × as long as its own length (Figs 3h–n).

(**ff**) Penis valve different (Figs 6a–c, f, h, j, k, m, n).

(**gg**) Saw of *viridis* or *scalaris* type (Figs 5g, i–n).

(**hh**) Median mesoscutal lobes usually mainly black, each with a more or less large lateral green spot, rarely completely black (Figs 2c–g, 3c–f, s, t, 7a–c, n, o).

Note. Sometimes *Tenthredo olivacea* Klug, 1817, is mistaken for a *Rhogogaster* species because of its similar coloration. It would run in the key here. Apart from different mandibles, the clypeus has a different shape, the inner margins of the eyes are more strongly convergent, the tarsi in female are not ringed green black; postocellar area green, but temples beside the postocellar area black (Fig. 4x) 2

2(1). (**a**) Female only, male unknown.

(**b**) Black color of the upper head forming a 'ω': frontal ridges green, frontal field and frons between antennal furrow and inner eye margin largely black, the black parts not fused above the antennal sockets (Figs 4n–p).

(**c**) Saw of *viridis* type, serrulae very large (Figs 5e,f, n).

Additional notes. Morphology very similar to *R. viridis*. Body size 10.0 (specimens from Finland) to 12.0 mm (specimen from Kirov). Frontal field with deep frontal groove and antennal furrows deep, thus frontal ridges well defined, antennal crests somewhat bent up. Upper head polished, microsculpture only weakly indicated. Mesoscutellum slightly convex, appendage densely sculptured and medially carinate, both without distinct pits. Saw with 19–21 large serrulae, distances between the elavated parts (praecalcar) are mostly shorter than the lower parts (postcalcar) of the serrulae. Plantar lobes medium sized, distance between 1st and 2nd (in ♀) about 1.0–1.2 × as long as its own length. Color similar to *R. viridis*, but black pattern of the head different as described in (b) above. Distribution: Finland, Russia (Kirov) Fig. 6p. Material: 4♀ (see data of the types) . . . . . ***R. magniserrula*** Viitasaari **spec. nov.** ♀ (see p. 8)

– (**aa**) Female or male.

(**bb**) Black color of the head usually more extensive and forming a '∞'(Figs 4b–l): only upper parts of frontal ridges green, frontal field and frons between antennal furrow and inner eye margin largely black, the black parts fused above the antennal sockets, or face mainly black with small green spots on the upper frontal ridges (rarely completely black without green spots), exceptionally in very pale specimens the black mark above the antennae dissolved in small black spots.

(**cc**) Saw of *scalaris* type (Figs 5a, b, j, l), or *viridis* type with less prominent serrulae (Figs 5c, d, g, i, k, m) . . 3

3(2). (**a**) Occiput green, only black close to the foramen magnum and on the lower part of the back of the occipital area (Fig. 4b, c).

(**b**) Vertex beside postocellar area green, the black marks on the frons only reach the anterior parts of postocellar area (Fig. 4b, c).

(**c**) Mesoscutellum and its appendage green, without black line between them (Fig. 3s).

(**d**) Abdomen in ♂ dorsally without a complete median black stripe, in Fennoscandian ♂ terga 1–6(–7) with basal ± triangular median black spot, getting smaller and narrower toward the apex of abdomen, usually at least 8th tergite completely green (Fig. 3d), exceptionally also 8th tergite with narrow black mark; in Fennoscandian ♀ abdomen usually with a complete median black stripe that covers about 40–60 % of the dorsal surface (compare Fig. 3e); in specimens from other parts of Europe abdomen frequently less black to nearly completely green (Fig. 3c).

(**e**) Plantar lobes very large, distance between 1st and 2nd in ♂ 0.6–0.8 (Fig. 3h), in ♀ 0.7–1.0 (Fig. 3i) × as long as its own length.

(**f**) Penis valve Figs 6c, k.

(**g**) Saw Figs 5a, b, j, l.

Additional notes. Morphology: Body size in Fennoscandia ♂ 7.0–9.5, ♀ 9.0–11.0 mm (outside Fennoscandia ♂ up to 11, ♀ up to 13 mm). In Fennoscandia usually represented by a rather dark form. Mesoscutellum with weak microsculpture, often with distinct pits in the apical half, shiny; mesoscutellar appendage smooth and shiny, or with some pits. Mesoscutellum flat or slightly convex. Temples nearly without microsculpture, smooth and shiny. Postocellar area variable in size, about 2.0–2.8 × as broad as long, slightly convex, laterally with moderately deep, converging furrows; anteriorly blunt triangular or nearly straight, with rather shallow furrow. Color: Occiput green, sometimes with few black markings connected with the black of the posterior area of the occipital area. Color pattern of head and thorax varies little. The green spots on median mesoscutal lobe large, about same size as the spots on the lateral lobes. The latter are fused anteriorly of the scutellum. Scutellar groove sometimes only narrowly black, in darker specimens anteriorly (lateral mesocutal lobes) black and posteriorly (mesoscutellum) green. Distribution: Europe (not recorded from Portugal and Greece), also eastern Palaearctic. Obviously rare in the subarctic region (only 1♀ from Narvik examined), more common in southern parts. In Central and Eastern Europe often more common than *scalaris.* Material: AT: 360 specimens (21 ♂♂ 46 ♀♀ from Fennoscandia), MV: about 500 specimens . . . . . ***R. chlorosoma*** (Benson, 1943) ♂♀ (see p. 7)

– (**aa**) Occiput largely black, near the occipital carina ± pale (Figs 4e–h); only exceptionally occiput mainly pale (Fig. 4d), but then the other characters do not fit.

(**bb**) Vertex beside postocellar area black, the black marks of the frons reach to the occipital carina (Figs 4e–l, n–p)(this applies to the available northern European specimens; in more southern specimens the black frequently reaching only about to the middle of postocellar area, or rarely it has the same pattern as in *R. chlorosoma* as described above).

(**cc**) Mesoscutellum and its appendage variably colored, more or less marked with green, somtimes mainly or even completely black(Figs 2d–e, 3t); if both mainly green, usually at least a narrow black line between them remains.

(**dd**) Abdomen in ♂ dorsally usually with complete median black stripe, getting smaller and narrower toward the apex of abdomen, usually also 8th tergite broadly black (compare Fig. 3e); in Fennoscandian ♀ abdomen usually with a complete median black stripe that covers about 70–80 % of the dorsal surface (Fig. 3f) (rarely abdomen pale as in *chlorosoma,* exceptionally nearly completely green, but then occiput darker, and plantar lobes smaller).

(**ee**) Plantar lobes smaller, distance between 1st and 2nd in ♂ 1.3–2.2 (Figs 3l, n), in ♀ (0.9–)1.0–1.4 (Figs 3k, m)× as long as its own length.

(**ff**) Penis valve different (Figs 6a, b, f, h, j, n, 3w) (for reliable identification of the following species, examination is strongly recommended).

(**gg**) Saw as previous (Figs 5a, b, j, l), or as Figs 5c, d, g, i, k, m (unknown for *R. gayuboi*) 4

4(3). (**a**) Male only, female unknown.

(**b**) Coloration pale, similar to *chlorosoma* with pale abdomen (Fig. 3y) and occiput, but black color of the vertex reaches the occipital carina (Fig. 3v).

(**c**) Penis valve Fig. 3w.

Additional notes. Plantar lobe of the 1st tarsomere about one third the length of the 2nd tarsomere. Distribution: Spain. Material: Species not seen . . . . . [***R. gayuboi*** Llorente, 1988 ♂] (see p. 8)

– (**aa**) Male or female.

(**bb**) Coloration usually not pale as in *chlorosoma*, occiput usually largely black (Figs 4e–h).

(**cc**) Penis valve different (Figs 6a, b, f, h, j, n, o) 5

5(4). (**a**) Mesoscutellar appendage usually with few pits or without pits, frequently without distinct microsculpture and shiny (Figs 2d–g, 3t), but sometimes with distinct microsculpture and rather mat.

(**b**) Carina of the postocellar area in subarctic specimens mainly black, or green only laterally (Figs 2e–g, 4f–h), exceptionally completely green (Fig. 2d); in specimens from other parts of Europe completely green (Figs 4d, e) or more or less black in the middle.

(**c**) Frontal field with shallow frontal groove or flat, thus frontal ridges often only weakly defined, antennal crests usually not bent up.

(**d**) Penis valve Figs 6a, b, j.

(**e**) Saw Figs 5a, b, j, l.

Additional notes. The specimens from northern Fennoscandia show a high variability both in color and sculpture. Morphology: Body size ♂ 6.0–8.5, ♀ 7.5–10.0 mm in Fennoscandian specimens, up to about 12 mm in other parts of Europe. Upper head and thorax usually shiny with more or less dense pits. Density of microsculpture variable, sometimes nearly missing, sometimes very dense and nearly mat, usually more or less distinct between the pits, but shiny. Mesoscutellar appendage outside Fennoscandia usually smooth and shiny, or with few pits. Frontal field nearly flat or with more or less distinct furrow. Plantar lobes medium sized, distance between 1st and 2nd in ♂ 1.2–1.6, in ♀ 0.9–1.3 × as long as its own length. Color. Northern forms seem to be usually much darker than specimens from Central Europe. In the darkest specimens the thorax is dorsally completely black (pronotum and tegula still green) and the upper head nearly completely black (without green spots on the frontal ridge).The palest form from Lapland has 2 large green spots on the median mesoscutellar lobes, 4 green spots on the lateral mesoscutellar lobes, and mesoscutellum, mesoscutellar appendage and metascutellum largely green. From outside Fennoscandia very pale specimens are known that are nearly completely green and very similar to *R. chlorosoma.* Distribution: Europe, also eastern Palaearctic. Occurrence in the Nearctic realm needs confirmation. It may be, that more than one species is involved here. Material: AT: 450 specimens (96 ♂♂ 157 ♀♀ from Fennoscandia), MV: about 600 specimens. (*R. viridis* auct.) . . . . . ***R. scalaris*** (Klug, 1817) ♂♀ (see p.10)

– (**aa**) Mesoscutellar appendage densely pitted with microsculpture between the pits (Figs 3o–r).

(**bb**) Carina of the postocellar area completely green (Figs 4i–l).

(**cc**) Especially in ♂ frontal field frequently with deep frontal groove and antennal furrows deep, thus frontal ridges well defined, antennal crests usually somewhat bent up.

(**dd**) Penis valve Figs 6f, h, m, n, o.

(**ee**) Saw Figs 5c–g, i, k, m. 6

6(5). (**a**) Penis valve Fig. 6f, o.

(**b**) Mesoscutellum slightly convex to nearly flat, anterior part with more or less dense microsculpture, shiny (Figs 3q, r).

(**c**) Black color of the frontal patch not reaching the upper margins of the compound eyes, the green margin of the eyes usually not becoming narrower than half diameter of the anterior ocellus (Fig. 3l).

(**d**) Northern species (confirmed records are all located north of 60° latitude).

Additional notes. Morphology: Body size ♂ 6.5–9.0, ♀ 9.0–10.0 mm. Upper head and thorax usually shiny with more or less dense pits, usually with microsculpture but shiny, sometimes microsculpture nearly missing. Frontal field with more or less deep (sometimes rather flat) furrow. Plantar lobes medium sized, distance between 1st and 2nd in ♂ 1.6–1.9, in ♀ 1.1–1.3 × as long as its own length. Color rather stable compared with northern *R. scalaris*: similar to the pale forms of *scalaris*: usually 2 green spots on the median mesoscutellar lobes, 4 green spots on the lateral mesoscutellar lobes and mesoscutellum and mesoscutellar appendage green marked, the latter now and then completely black; metascutellum usually black, sometimes green spotted or completely green. In one ♂ the median mesoscutellar lobes only with very small green spots; in the palest specimen there is no black line between the green mesoscutellum and its appendix. The black spot on the upper head does not reach the margins of the compound eyes. Distribution: Northern Europe (Finland, Norway, Sweden, Russia: Karelia) and eastern Palearctic (Russia: Magadan). Material: AT: 60 specimens (38 ♂♂ 22♀♀ from Fennoscandia). MV: 4♂♂ 1♀ . . . . . ***R. polaris*** Lindqvist, 1964 ♂♀ (see p. 9)

– (**aa**) Penis valve Figs 6h, n.

(**bb**) Mesoscutellum distinctly convex (exceptionally only slightly convex), anterior part with pits and ± dense microsculpture, rather mat, Figs 3o, p.

(**cc**) Black color of the frontal patch usually reaching the upper margins of the compound eyes, if a green margin remains, it is narrower than half diameter of the anterior ocellus, Figs 3i–k.

(**dd**) Widely distributed species (also in the North).

Additional notes. The characters given above to distinguish the females of *polaris* and *viridis* are very weak and still need to be confirmed. Morphology: Body size ♂ 8.5–10.0, ♀ 9.0–12.0 mm. Plantar lobes medium sized, distance between 1st and 2nd in ♂ 1.8–2.2, in ♀ 1.2–1.4 × as long as its own length. Distribution: The species is widely distributed. Except for the Iberian Peninsula, it is recorded from all parts of Europe, and in Asia eastwards to the Baikal region. During the current study it was noted that a large number of specimens have been misidentified (especially females). Material: AT: 16 specimens (4 ♀♀ from Fennoscandia), MV: 191 specimens . . . . . ***R. viridis*** (Linné, 1758) ♂♀ (see p. 11)

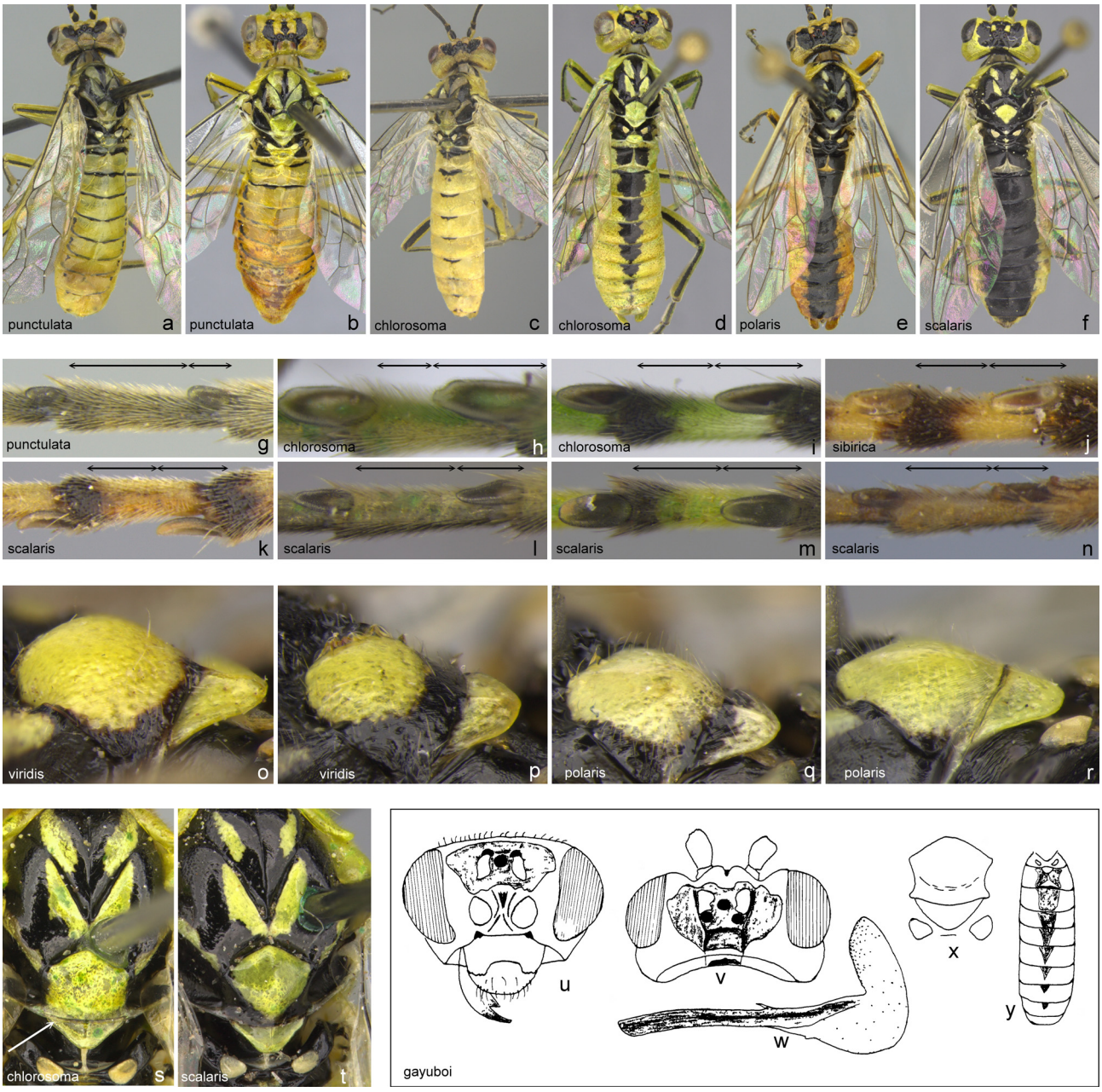

FIGURE 3. a–f: color pattern in dorsal view—**a** *Rhogogaster punctulata* ♂, **b** *R. punctulata* ♀, **c–d** *R. chlorosoma* ♂, **e** *R. polaris* ♂, **f** *R. scalaris* ♀. **g–n:** 1st and 2nd plantar lobe of hind tarsus—**g** *R. punctulata* ♂, **h** *R. chlorosoma* ♂, **i** *R. chlorosoma* ♀, **j** *R. sibirica* ♀ (lectotype), **k** *R. scalaris* ♀ (lectotype), **l** *R. scalaris* ♂, **m** *R. scalaris* ♀, **n** *R. scalaris* ♂ (lectotype *R. chlorosoma podkumokensis*). **o–r:** mesoscutellum and appendage in dorsolateral view—**o–p** *R. viridis*, **q–r** *R. polaris*. **s–t:** thorax in dorsal view—**s** *R. chlorosoma*, **t** *R. scalaris*. **u–y:** figures of *R. gayuboi* (from Llorente Vigil, 1988)—**u** face, **v** head dorsal, **w** penis valve, **x** mesoscutellum and appendage dorsal, **y** abdomen.

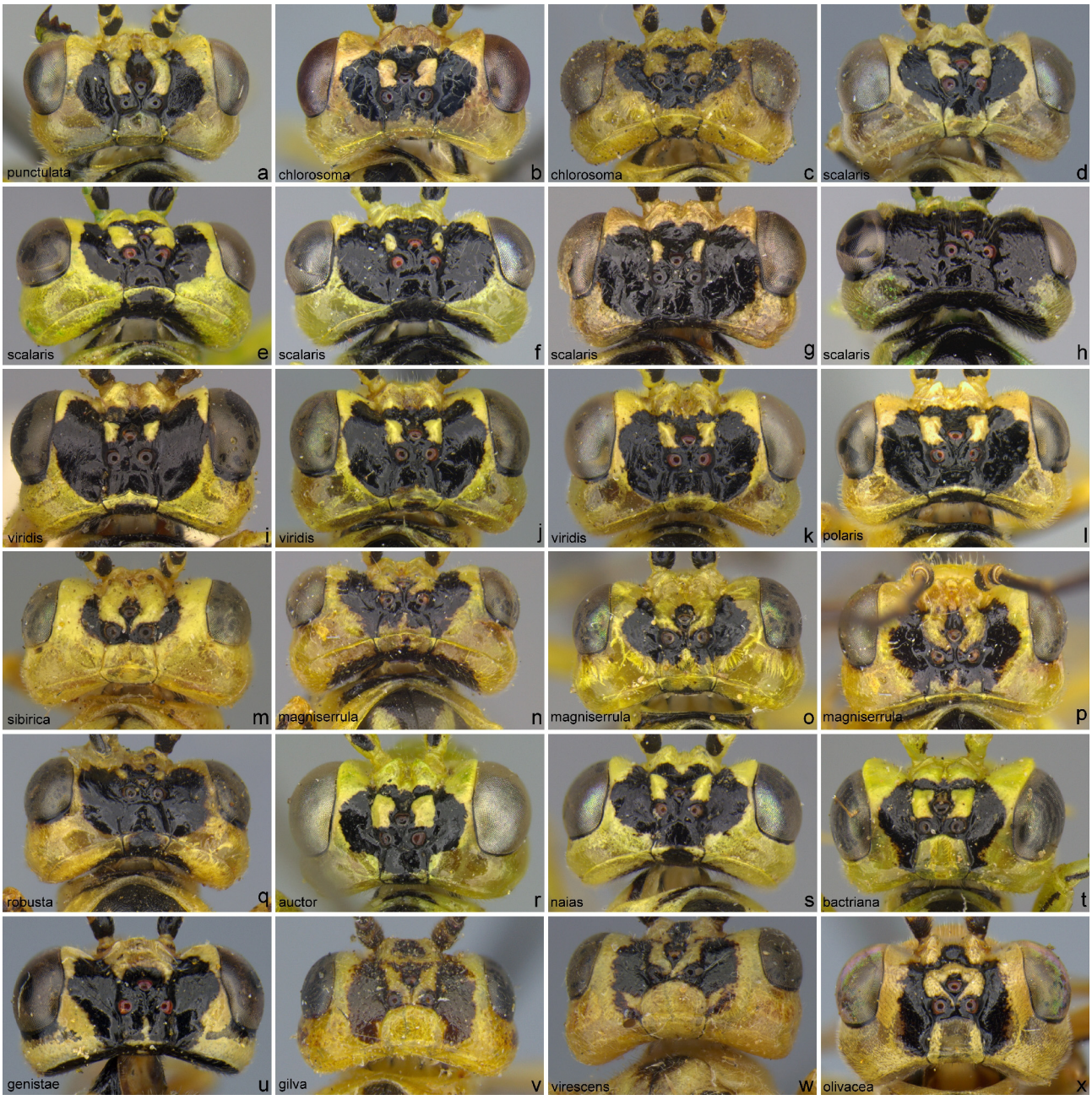

FIGURE 4. a–x: head in dorsal view—**a** *Rhogogaster punctulata*, **b** *R. chlorosoma*, **c** *R. chlorosoma* (paratype), **d** *R. scalaris* (*R. chlorosoma podkumokensis* lectotype), **e** *R. scalaris,* **f** *R. scalaris,* **g** *R. scalaris* (*R. carpatica* lectotype), **h** *R. scalaris,* **i** *R. viridis*, **j** *R. viridis* (*R. dryas* paratype), **k** *R. viridis*, **l** *R. polaris*, **m** *R. sibirica* (lectotype), **n** *R. magniserrula* (holotype), **o** *R. magniserrula* (paratype from Russia), **p** *R. magniserrula* (holotype, oblique view), **q** *R. robusta* (holotype), **r** *R. auctor* (holotype), **s** *R. naias* (paratype), **t** *R. bactriana* (*R. bactriana lindti* paratype), **u** *R. genistae* (*R. genistae viridifrons* lectotype), **v** *R. gilva* (lectotype), **w** *Tenthredo virescens* (lectotype), **x** *T. olivacea* (*R. viridis* var. *montana* lectotype).

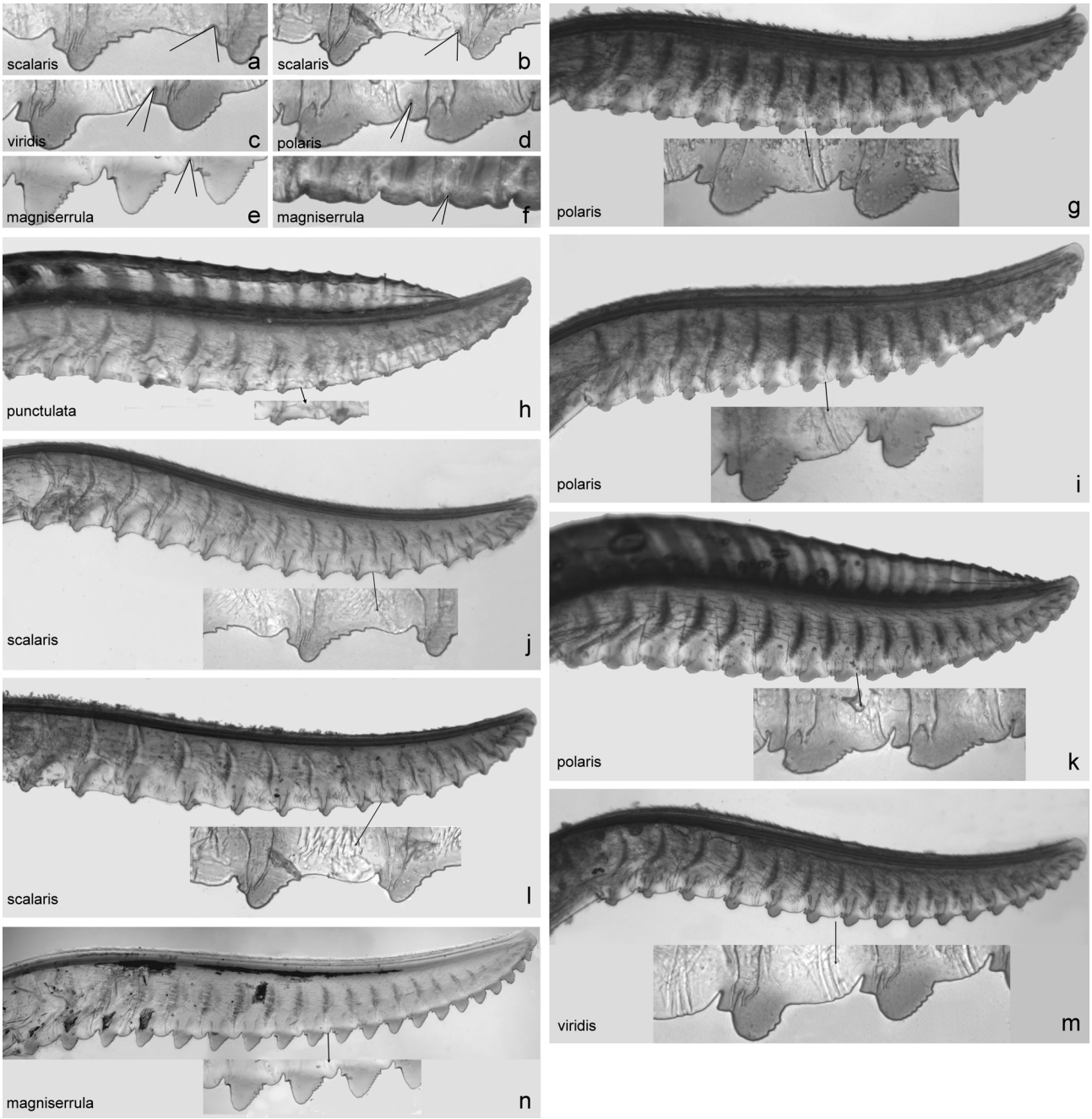

FIGURE 5. a–f: serrulae from the middle of the saw, with marked angle of cypsella—**a**–**b** *Rhogogaster scalaris*, **c** *R. viridis*, **d** *R. polaris*, **e** *R. magniserrula*, **f** *R. magniserrula* (worn). **g–n:** lancet (in **h** and **k** also lance) with details of serrulae—**g, i, k** *R. polaris*, **h** *R. punctulata*, **j, l** *R. scalaris*, **m** *R. viridis*, **n** *R. magniserrula.*

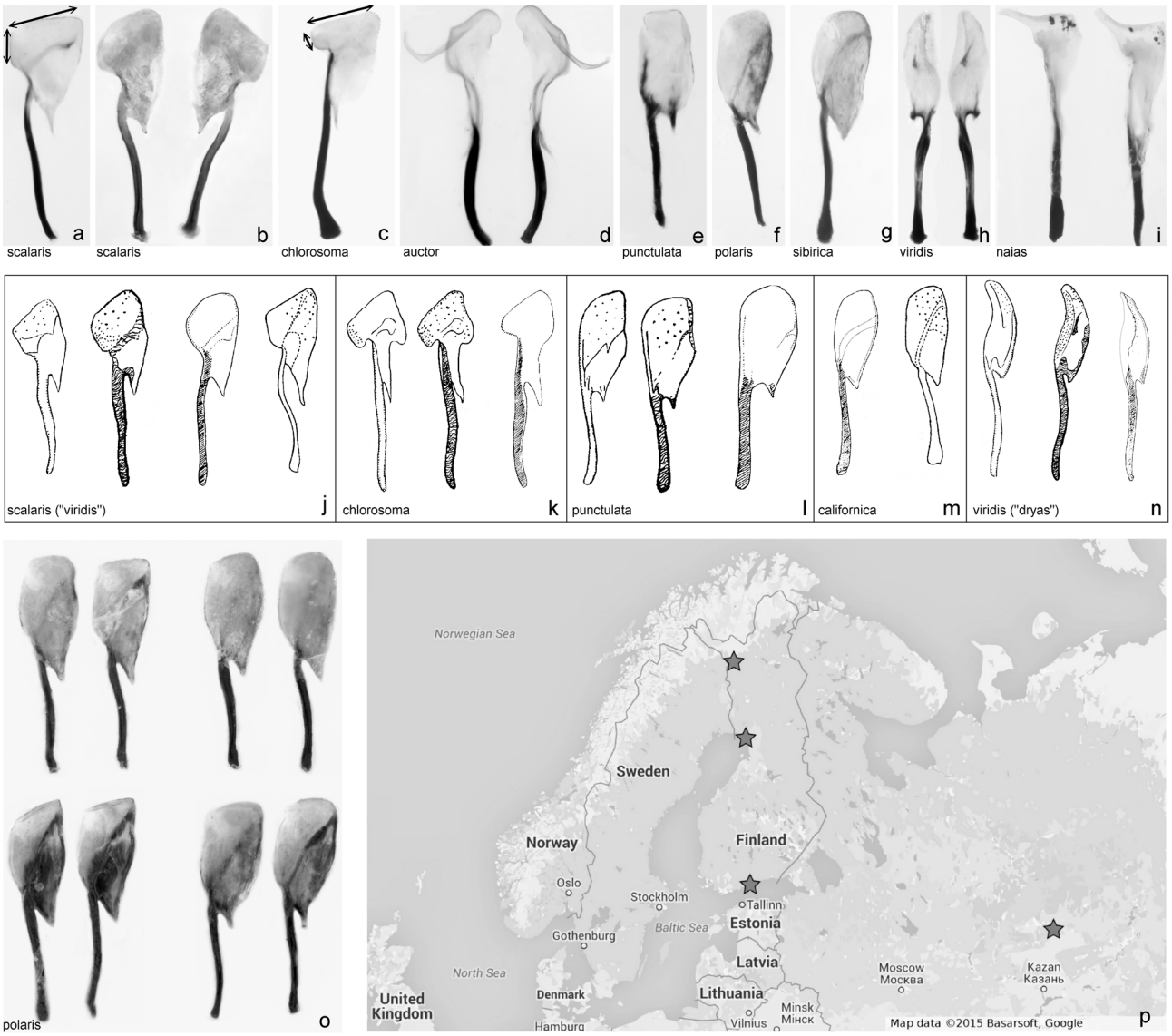

FIGURE 6. a–j: penis valves—**a–b** *Rhogogaster scalaris*, **c** *R. chlorosoma*, **d** *R. auctor* (holotype), **e** *R. punctulata*, **f** *R. polaris*, **g** *R. sibirica* (paralectotype), **h** *R. viridis*, **i** *R. naias* (paratype). **j–n:** drawings of penis valves by Benson (1943, 1952, 1965) and Ross (1943)—**j** *R. scalaris* (as *R. viridis*), **k** *R. chlorosoma*, **l** *R. punctulata*, **m** *R. californica*, **n** *R. viridis* (as *R. dryas*). **o:** variability of penis valves in *R. polaris* (all from Sweden, Abisko area). **p:** records of *R. magniserrula* (displayed with Map data, © Basarsoft, Google).

FIGURE 7. a–m: *Rhogogaster magniserrula* (holotype)—**a** dorsal view, **b–c** head and thorax dorsal view, **d** head and thorax laterally, **e** lance and lancet, **f** serrulae from the middle of the saw, **g** claw of hind leg, **h** hind tarsus, **i** 1st – 3rd plantar lobe, **j** face, **k** mesoscutellum and appendage in dorsolateral view, **l** labels, **m** antenna. **n–r:** *R. magniserrula* (paratype from Kirov)—**n** dorsal view, **o** head and thorax dorsolateral view **p** face oblique, **q** head dorsally, **r** labels.

Acknowledgments

We want to thank the following colleagues who supported this work by helpful discussions, checking the key with their own material, or by the loan of type specimens and other material: Cornelis van Achterberg (Leiden, RMNH), Alexander V. Antropov (Moscow, ZMUM), Frédérique Bakker (Leiden, RMNH), Trond Elling Barstad (Tromsø, Universitetsmuseet), Peter-René Becker (Oldenburg, LNMO), Sergej Belokobyskij (St Petersburg, ZIRAS), Stephan Blank (Müncheberg, SDEI), Henri Goulet (Ottawa, Canadian National Collection of Insects), Erik Heibo (Lierskogen), Frank Koch (Berlin, MFNB), Katja Kramp (Müncheberg, SDEI), Manfred Kraus (Nürnberg), Arkady Lelej (Vladivostok), Andrew Liston (Müncheberg, SDEI), Ole Jørgen Lønnve (Oslo, Biofokus), Pekka Malinen (Helsinki, FMHEL), Ad Mol (Rosmalen), Silke Mosel (Oldenburg, LNMO), Mercedes París (Madrid, Museo Nacional de Ciencias Naturales), Juho Paukkunen (Helsinki, FMHEL), Bruno Peter (Unterägeri), Stefan Schmidt (München, ZSM), Thomas Schmitt (Müncheberg, SDEI), Akihiko Shinohara (Tsukuba, National Museum of Nature and Science), David R. Smith (Washington, USNM), Yurii Sundukov (Yuzhno-Kurilsk, State Nature Reserve "Kurilskiy"), Anssi Teräs (Turku, ZMUT), Meicai Wei (Changsha, Central South University of Forestry and Technology), Lajos Zombori (Budapest, HNHM). Our thanks furthermore to A. Liston who checked the English of the paper, A. Lelej for his editiorial work, and A. Shinohara, S. Schmidt and an anonymous reviewer who improved the manuscript with their comments.

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