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Contribution to the knowledge of Swedish Dacnusiini (Hymenoptera, Braconidae: Alysiinae): checklist and seven new species records

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ABSTRACT. A total of seven Dacnusiini (Hym., Braconidae, Alysiinae) species are recorded for the first time for Sweden: *Antrusa chrysoptegula* (Tobias, 1986), *Aristelix phaenicura* (Haliday, 1839), *Chorebus (Phaenolexis) caesariatus* Griffiths, 1967, *Chorebus (Chorebus) scabrifossa* Stelfox, 1957, *Coelinidea gracilis* (Curtis, 1829), *Eucoelinidea compressa* Tobias, 1979 and *Sarops rea* Nixon, 1942. Moreover, the genera *Aristelix* Nixon, 1943, *Eucoelinidea* Tobias, 1979 and *Sarops* Nixon, 1942 are thus recorded for the first time in Sweden. Finally, a checklist of the Swedish Dacnusiini species is provided.

Key words: parasitoids, faunistics, new records, entomological collections, Sweden

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Introduction

The poor knowledge about the biodiversity inhabitants in our landscapes aroused the attention of many countries in the beginning of year 2000. Because the lack of information in literature, the Swedish Parliament commissioned the assembling of a Swedish Species Information Centre (SSIC) in 2002, which main objectives were to increase the biodiversity knowledge through identification, analysis and dissemination of information, concerning species and their habitats occurring in Sweden (Ottosson et al., 2018).

Alysiinae with 266 known Swedish species (Yu et al., 2016) is one of the poorly studied groups among the Braconidae in Sweden. Alysiines are small braconid wasps that occur throughout the world, which can be easily identified by their exodont mandibles, foldable outwards and not touching even as 'closed' (Fig. 1A). Big mandibles need strong muscles and thus the heads are generally broad and equipped with large muscles controlling the mandibles, noticeable from the dorsal view of the head (Fig. 1B). The general

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habitus varies a great deal from large specimens to small, about 1–10 mm in size.

About 2,500 species and 106 genera have been described worldwide within Alysiinae (Yu et al., 2016), which is divided into two large and polymorphic tribes, Alysiini and Dacnusini (Shenefelt, 1974; Peris-Felipo et al., 2014). Morphologically, these two tribes are mainly distinguished by the presence (Alysiini) (Fig. 2A) or absence (Dacnusini) of the fore wing vein cuqu 2 (r-m or second radiomedial) (Fig. 2B); accordingly, Alysiini has three submarginal (radiomedial) cells, while Dacnusini have only two (Peris-Felipo et al., 2014).

Alysiini have a very wide range of hosts from 29 families of cyclorrhaphous Diptera, predominantly from families such as Agromyzidae, Anthomyiidae, Calliphoridae, Drosophilidae, Muscidae, Phoridae, Sarcophagidae, and Tephritidae. On the other hand, Dacnusini have been only

reared from 13 families of Diptera and mainly from leaf and stem miners of the families Agromyzidae, Chloropidae and Ephydriidae (Yu et al., 2016; Kostromina et al., 2016). Thanks to this biology, several species are relevant from an economic point of view due to their potential role in pest control such as *Asobara* Foerster, 1863 or *Tanycarpa* Foerster, 1863 species which are recently recorded as parasitoids of *Drosophila suzukii* (Matsumura, 1931) (Girod et al., 2018).

In the present work, dacnusini material deposited in the Swedish Museum of Natural History (NHRS) and Lund University Zoological Museum (MZLU) was revised. Based on this material, three genera: *Aristelix* Nixon, 1943, *Eucoelinidea* Tobias, 1979 and *Sarops* Nixon, 1942 are recorded for the first time in Sweden. Additionally, diagnosis about new record species is provided.

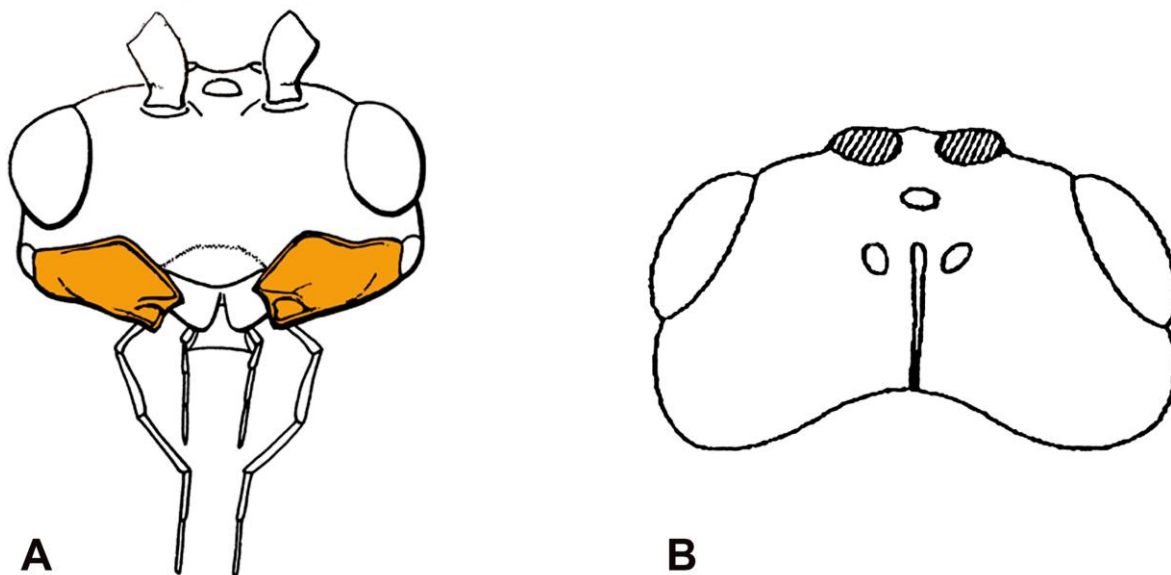


Figure 1. Head of Alysiinae. **A.** Frontal view with mandibles coloured, showing the exodont features. **B.** Dorsal view, showing the wide head indicating big mandibles.

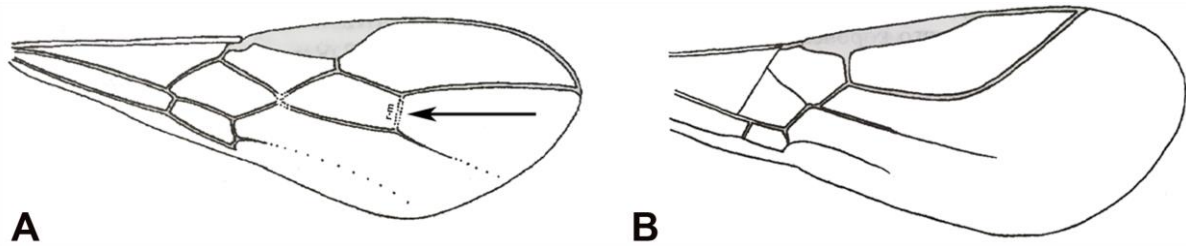


Figure 2. Fore wing. **A.** Tribe Alysini with the vein r-m arrowed; **B.** Tribe Dacnini with the vein r-m absent.

Material and methods

Studied material was selected from the entomological collections of the Swedish Museum of Natural History (NRM) and Lund University Zoological Museum (MZLU). Specimens from NRM were collected using Malaise traps among 2014–2015. Traps were placed in several localities in southern Sweden, from the mainland but also from the Baltic island Öland. Materials were prepared with 70% ethyl alcohol, kept dark and cool until sorting and mounting.

For terminology of morphological features and sculpture as well as for measurements see Peris-Felipo et al. (2014); for wing venation nomenclature see van Achterberg (1993). Species identification was carried out using Tobias' keys (1986) except the *Aristelix* species, which were identified using Peris-Felipo et al. (2015). Regarding *Sarops*, the original description by Nixon (1942) was used for identification. DNA sequences of the specimens are also provided except for the *Sarops rea* specimen. DNA extraction, PCRs, sequencing protocols followed Stigenberg et al. (2015). The sequences were deposited in GenBank with their accession numbers. Distribution data were collected from Yu et al. (2016), Dyntaxa (2019) and Fauna Europea (2019).

Results

Seven species have been recorded for the first time for Sweden: *Antrusa chrysotegula* (Tobias, 1986), *Aristelix phaenicura* (Haliday, 1839), *Chorebus* (*Phaenolexis*) *caesariatus*

Griffiths, 1967, *Chorebus* (*Chorebus*) *scabrifossa* Stelfox, 1957, *Coelinidea gracilis* (Curtis, 1829), *Eucoelinidea compressa* Tobias, 1979, and *Sarops rea* Nixon, 1942. Moreover, the genera *Aristelix* Nixon, 1943, *Eucoelinidea* Tobias, 1979 and *Sarops* Nixon, 1942 are recorded for the first time in Sweden.

Subfamily Alysinae Leach, 1815

Tribe Dacnini Foerster, 1863

1. *Antrusa chrysotegula* (Tobias, 1986)

(Fig. 3)

Material examined: 1♀, Swe. Sm, Torsås kmn, Söderåkra, Påboda 2015.05.31–06.26. WGS84 N56.4347232, E16.0708442. (P. Magnusson leg.). [Voucher ID: ALY_0004; GenBank-ID: MK450350] (NHRS).

Diagnosis: Mandibles widened apically and with only three teeth; notauli shallow on horizontal surface of mesoscutum; vein 2-M usually merging with the submarginal cell, vein m-cu antefurcal; first metasomal tergite rugose-punctate.; second metasomal tergite in basal half pubescent and finely longitudinally rugose; apical metasomal tergites each with a single transverse line of setae; hind femur 4.5 times as long as its maximum width; antennae 30-segmented.

Distribution: Hungary, Korea, Russia and Sweden (**new record**).

2. *Aristelix phaenicura* (Haliday, 1839)

(Fig. 4)

Material examined: 1♂, Sweden, Sm, Torsås kmn, Söderåkra, Påboda 2015.05.31–06.26. WGS84 N56.4347232, E16.0708442.

(P. Magnusson leg.). [Voucher ID: ALY_0010; GenBank-ID: MK450351] (NHRS).

Diagnosis: Radial cell usually reaching the wing apex; metasoma with numerous hairs; clypeus, temples, mesosoma and hind femur granulose sculpture; antennae shorter than body; 27-segmented.

Distribution: It is found almost in all Western Palaearctic region; Sweden (**new record**).

3. *Chorebus (Phaenolexis) caesariatus* Griffiths, 1967 (Fig. 5)

Material examined: 1♂, Sweden, Sm, Torsås kmn, Söderåkra, Påboda 2015.05.31–06.26. WGS84 N56.4347232, E16.0708442. (P. Magnusson leg.). [Voucher ID: ALY_0006; GenBank-ID: MK450352] (NHRS).

Diagnosis: Eyes not converging below; occiput with numerous hairs; genae not projecting angularly; mandibles not broadened; upper tooth slightly developed; mesonotum with dense whitish hairs; precoxal suture smooth; radial vein not uniformly curved but in apical half with S-shaped bend or straightened; hind coxae with distinct tuft of hairs; first metasomal tergite twice as long as its apical width; antennae 23–24-segmented.

Distribution: Azerbaijan, Hungary, Italy, Sweden (**new record**) and Ukraine.

4. *Chorebus (Chorebus) scabrifossa* Stelfox, 1957 (Fig. 6)

Material examined: 1♀, Sweden, Öl, Mörbylånga, Kalkstad NR, mixed deciduous forest. 1–27 May 2014. Malaise trap, M. & C. Jaschhof. Jaschhof catalog #7/2014. [Voucher ID: ALY_0016; GenBank-ID: MK450353] (NHRS).

Diagnosis: Eyes not converging below; mandibles not broadened; upper tooth

slightly developed; antennae 25–29-segmented; mesonotum with dense whitish hairs; precoxal suture rugose; radial vein rather uniformly curved; hind coxae with distinct tuft of hairs; second metasomal tergite sculptured.

Distribution: Ireland, Romania, Russia and Sweden (**new record**).

5. *Coelinidea gracilis* (Curtis, 1829) (Fig. 7)

Material examined: 1♀, Sweden, Sm, Torsås kmn, Söderåkra, Påboda 2015.05.31–06.26. WGS84 N56.4347232, E16.0708442. (P. Magnusson leg.) [Voucher ID: ALY_0003; GenBank-ID: MK450354] (NRM); 1♀, Sweden, Öl, Mörbylånga, Lilla Vickleby Lunds NR, old oak forest, Malaise trap, 27.June–30.July 2014, M. & C. Jaschhof. Jaschhof catalog #115/2014. [Voucher ID: ALY_0021; GenBank-ID: MK450355] (NHRS).

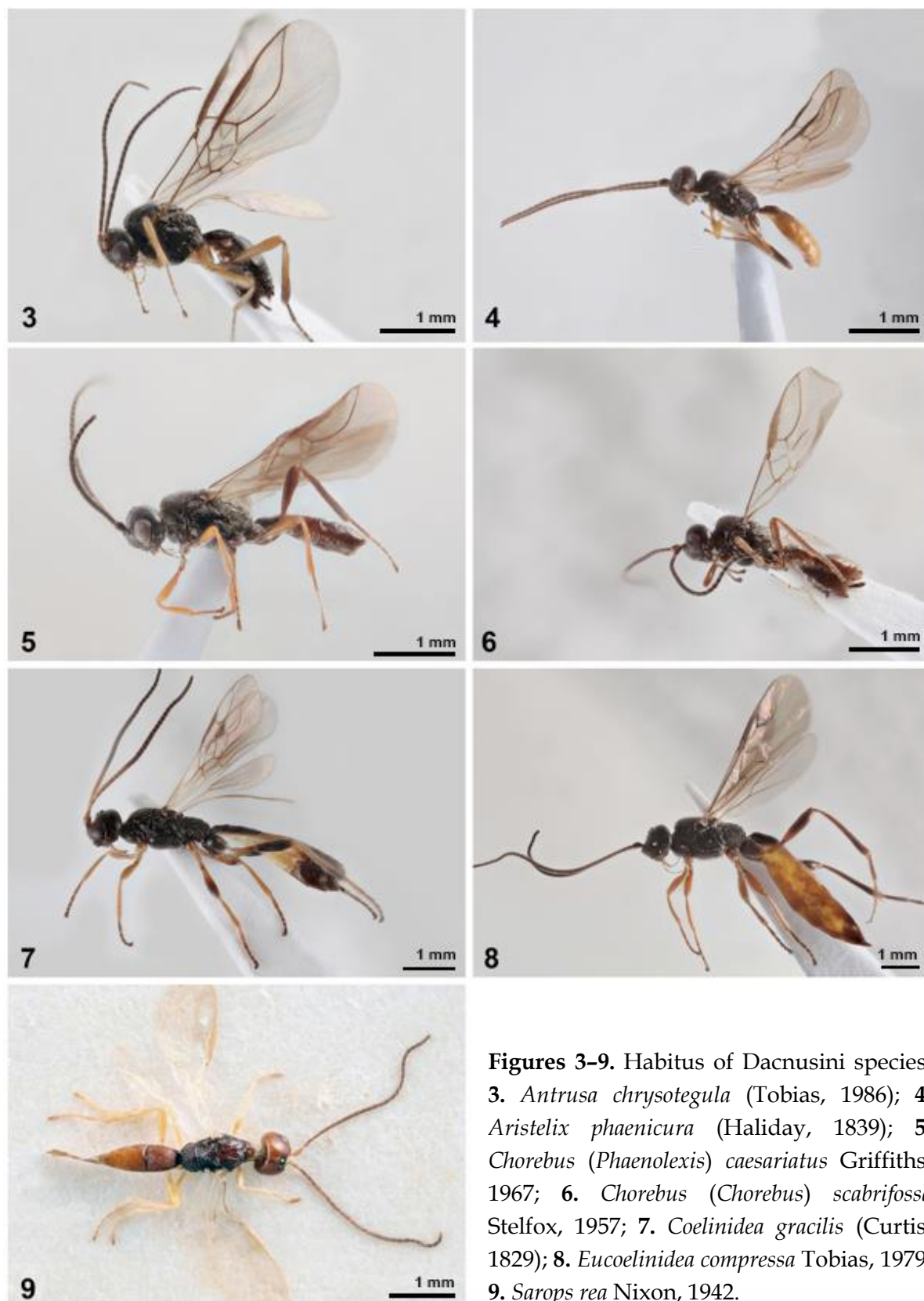
Diagnosis: Head in dorsal view cubic and black; metasoma entirely black; second and third metasomal tergites dark brownish yellow; radial cell reduced; vein 3-RS uniformly curved.

Distribution: It is found almost all Eastern and Western Palaearctic regions; Sweden (**new record**).

6. *Eucoelinidea compressa* Tobias, 1979

(Fig. 8)

Material examined: 1♀, Sweden, Öl, Mörbylånga, Kalkstad NR, mixed deciduous forest. 1–27 May 2014. Malaise trap, M. & C. Jaschhof. Jaschhof catalog #7/2014 [Voucher ID: ALY_0019; GenBank-ID: MK450357] (NHRS); 1♀, Sweden, Öl, Mörbylånga, Lilla Vickleby Lunds NR, old oak forest. Malaise trap, 31 July–29 August 2014. M. & C. Jaschhof. Jaschhof catalog #137/2014 [Voucher ID: ALY_0022; GenBank-ID: MK450356] (NHRS).



Figures 3-9. Habitus of Dacnusiini species. 3. *Antrusa chrysotegula* (Tobias, 1986); 4. *Aristelix phaenicura* (Haliday, 1839); 5. *Chorebus (Phaenolexis) caesariatus* Griffiths, 1967; 6. *Chorebus (Chorebus) scabrifossa* Stelfox, 1957; 7. *Coelinidea gracilis* (Curtis, 1829); 8. *Eucoelinidea compressa* Tobias, 1979; 9. *Sarops rea* Nixon, 1942.

Diagnosis: Metasoma very long, compressed, slightly pubescent; first metasomal tergite 2.0 times as long as its apical width; radial cell reduced; vein 3-RS fairly uniformly curved.

Distribution: Armenia and Sweden (**new record**).

7. *Sarops rea* Nixon, 1942 (Fig. 9)

Material examined: 1♀, Sweden, Bl, Listerby, Gö. 5.vi.1963, coll. A. Sundholm [Voucher ID: MZLU 2018_919] (MZLU).

Diagnosis: Metasoma longer than mesosoma; first metasomal tergite slightly longer than its apical width; radial cell on forewing narrower; brachial cell closed; mandibles with slight upper tooth; antennae 30–32-segmented.

Distribution: Former Czechoslovakia, Germany, Hungary, Japan, Korea, Moldova, The Netherlands, Russia, Sweden (**new record**) and United Kingdom.

Checklist of Swedish Dacnusiini Foerster, 1963 species (* First records for Sweden)

Amyras clandestina (Haliday, 1839)
Antrusa chrysolegula (Tobias, 1986)*
Antrusa flavicoxa (Thomson, 1895)
Antrusa interstitialis (Thomson, 1895)
Antrusa melanocera (Thomson, 1895)
Aristelix phaenicura (Haliday, 1839)*
Chaenusa conjungens (Nees, 1811)
Chaenusa nereidum (Haliday, 1839)
Chorebus (Chorebus) abnormiceps (Nixon, 1946)
Chorebus (Chorebus) affinis (Nees, 1812)
Chorebus (Stiphrocera) albipes (Haliday, 1839)
Chorebus (Stiphrocera) alecto (Morley, 1924)
Chorebus (Stiphrocera) amasis (Nixon, 1945)
Chorebus (Stiphrocera) ampliator (Nees, 1834)
Chorebus (Stiphrocera) angelicae (Nixon, 1945)
Chorebus (Stiphrocera) anitus (Nixon, 1943)
Chorebus (Stiphrocera) aphantus (Marshall, 1895)
Chorebus (Chorebus) armida (Nixon, 1945)

Chorebus (Stiphrocera) asramenes (Nixon, 1945)
Chorebus (Stiphrocera) avestus (Nixon, 1944)
Chorebus (Phaenolexis) bathyzonus (Marshall, 1895)
Chorebus (Stiphrocera) bres (Nixon, 1944)
Chorebus (Phaenolexis) brevicornis (Thomson, 1895)
Chorebus (Phaenolexis) caesariatus Griffiths, 1967*
Chorebus (Stiphrocera) catta (Nixon, 1945)
Chorebus (Stiphrocera) cinctus (Haliday, 1839)
Chorebus (Stiphrocera) coxator (Thomson, 1895)
Chorebus (Stiphrocera) credne (Nixon, 1944)
Chorebus (Stiphrocera) crenulatus (Thomson, 1895)
Chorebus (Stiphrocera) cubocephalus (Telenga, 1935)
Chorebus (Stiphrocera) cylindricus (Telenga, 1935)
Chorebus (Phaenolexis) cytherea (Nixon, 1937)
Chorebus (Stiphrocera) daimenes (Nixon, 1945)
Chorebus (Stiphrocera) deione (Nixon, 1944)
Chorebus (Chorebus) dentifer (Thomson, 1895)
Chorebus (Stiphrocera) diremtus (Nees, 1834)
Chorebus (Stiphrocera) enephes (Nixon, 1945)
Chorebus (Stiphrocera) ergias (Nixon, 1945)
Chorebus (Stiphrocera) eros (Nixon, 1937)
Chorebus (Stiphrocera) fallax (Nixon, 1937)
Chorebus (Stiphrocera) freya (Nixon, 1943)
Chorebus (Phaenolexis) fuscipennis (Nixon, 1937)
Chorebus (Stiphrocera) ganesus (Nixon, 1945)
Chorebus (Phaenolexis) gedanensis (Ratzeburg, 1852)
Chorebus (Chorebus) glabriculus (Thomson, 1895)
Chorebus (Chorebus) gracilipes (Thomson, 1895)
Chorebus (Stiphrocera) lar (Morley, 1924)
Chorebus (Chorebus) larides (Nixon, 1944)
Chorebus (Stiphrocera) lateralis (Haliday, 1839)
Chorebus (Phaenolexis) leptogaster (Haliday, 1839)
Chorebus (Stiphrocera) lugubris (Nixon, 1937)
Chorebus (Stiphrocera) merellus (Nixon, 1937)
Chorebus (Stiphrocera) misellus (Marshall, 1895)
Chorebus (Chorebus) mitrus (Nixon, 1945)
Chorebus (Chorebus) navicularis (Nees, 1812)
Chorebus (Phaenolexis) nerissus (Nixon, 1937)
Chorebus (Stiphrocera) ninella (Nixon, 1945)

- Chorebus (Phaenolexis) nomia* (Nixon, 1937)
Chorebus (Chorebus) nydia (Nixon, 1937)
Chorebus (Chorebus) obliquus (Thomson, 1895)
Chorebus (Stiphrocera) orissa (Nixon, 1944)
Chorebus (Stiphrocera) oritias (Nixon, 1945)
Chorebus (Stiphrocera) ovalis (Marshall, 1896)
Chorebus (Chorebus) parvungula (Thomson, 1895)
Chorebus (Stiphrocera) pelion (Nixon, 1944)
Chorebus (Stiphrocera) perkinsi (Nixon, 1944)
Chorebus (Stiphrocera) petiolatus (Nees, 1834)
Chorebus (Stiphrocera) phaedra (Nixon, 1937)
Chorebus (Stiphrocera) pione (Nixon, 1944)
Chorebus (Stiphrocera) polygoni Griffiths, 1967
Chorebus (Phaenolexis) posticus (Haliday, 1839)
Chorebus (Stiphrocera) prosper (Nixon, 1945)
Chorebus (Chorebus) pulverosus (Haliday, 1839)
Chorebus (Stiphrocera) resus (Nixon, 1937)
Chorebus (Stiphrocera) rotundiventris (Thomson, 1895)
Chorebus (Chorebus) rufipes (Nees, 1812)
Chorebus (Chorebus) scabrifossa Stelfox, 1957*
Chorebus (Phaenolexis) senilis (Nees, 1812)
Chorebus (Phaenolexis) stenocentrus (Thomson, 1895)
Chorebus (Phaenolexis) stenocerus (Thomson, 1895)
Chorebus (Chorebus) sylvestris Griffiths, 1967
Chorebus (Etriptes) talaris (Haliday, 1839)
Chorebus (Chorebus) tamiris (Nixon, 1943)
Chorebus (Chorebus) tanis (Nixon, 1945)
Chorebus (Chorebus) thomsoni (Roman, 1917)
Chorebus (Chorebus) thusa (Nixon, 1937)
Chorebus (Stiphrocera) trilobomyzae Griffiths, 1968
Chorebus (Chorebus) uliginosus (Haliday, 1839)
Chorebus (Stiphrocera) uma (Nixon, 1944)
Chorebus (Stiphrocera) varunus (Nixon, 1945)
Chorebus (Chorebus) vitripennis Griffiths, 1968
Chorebus (Stiphrocera) xylostellus Griffiths, 1967
Coelinidea gracilis (Curtis, 1829)*
Coelinidea nigra (Nees, 1811)
Coelinidea parvipennis (Thomson, 1895)
Coelinidea ruficollis (Herrich-Schäffer, 1838)
Coelinidea vidua (Curtis, 1829)
Coelinus parvipennis (Thomson, 1895)
Coelinus parvulus (Nees, 1811)
Coloneura arestor (Nixon, 1954)
Coloneura ate (Nixon, 1943)
Coloneura dice (Nixon, 1943)
Coloneura pygmaeator (Zetterstedt, 1838)
Dacnusa (Agonia) adducta (Haliday, 1839)
Dacnusa (Dacnusa) arctica Griffiths, 1984
Dacnusa (Dacnusa) areolaris (Nees, 1811)
Dacnusa (Dacnusa) cerpheres (Nixon, 1948)
Dacnusa (Dacnusa) cingulator (Nees, 1834)
Dacnusa (Dacnusa) confinis Ruthe, 1859
Dacnusa (Dacnusa) dryas (Nixon, 1948)
Dacnusa (Dacnusa) faeroensis (Roman, 1917)
Dacnusa (Dacnusa) laevipectus Thomson, 1895
Dacnusa (Dacnusa) longiradialis Nixon, 1937
Dacnusa (Dacnusa) maculipes Thomson, 1895
Dacnusa (Dacnusa) ocyroe Nixon, 1937
Dacnusa (Dacnusa) pubescens (Curtis, 1826)
Dacnusa (Dacnusa) soma (Nixon, 1948)
Dacnusa (Dacnusa) stramineipes (Haliday, 1839)
Dacnusa (Dacnusa) tarsalis Thomson, 1895
Dacnusa (Dacnusa) temula (Haliday, 1839)
Dacnusa (Pachysema) abdita (Haliday, 1839)
Dacnusa (Pachysema) aquilegiae Marshall, 1896
Dacnusa (Pachysema) aterrima Thomson, 1895
Dacnusa (Pachysema) austriaca (Fischer, 1961)
Dacnusa (Pachysema) discolor (Foerster, 1862)
Dacnusa (Pachysema) eoadne Nixon, 1937
Dacnusa (Pachysema) laeta (Nixon, 1954)
Dacnusa (Pachysema) liopleuris Thomson, 1895
Dacnusa (Pachysema) lissos (Nixon, 1954)
Dacnusa (Pachysema) macrospila (Haliday, 1839)
Dacnusa (Pachysema) melicerta (Nixon, 1954)
Dacnusa (Pachysema) metula (Nixon, 1954)
Dacnusa (Pachysema) monticola (Foerster, 1862)
Dacnusa (Pachysema) prisca Griffiths, 1967
Dacnusa (Pachysema) sibirica Telenga, 1935

Eucoelinidea compressa Tobias, 1979*
Epimicta marginalis (Haliday, 1839)
Exotela cyclogaster Foerster, 1862
Exotela dives (Nixon, 1954)
Exotela facialis (Thomson, 1895)
Exotela gilvipes (Haliday, 1839)
Exotela hera (Nixon, 1937)
Exotela obscura Griffiths, 1967
Exotela sonchina Griffiths, 1967
Exotela umbellina (Nixon, 1954)
Laotris striatula (Haliday, 1839)
Lodbrokia hirta Hedqvist, 1962
Polemochartus liparæ (Giraud, 1863)
Protodacnusa aridula (Thomson, 1895)
Protodacnusa tristis (Nees, 1834)
Sarops rea Nixon, 1942*
Synelix (Synelix) semirugosa (Haliday, 1839)
Tates heterocera (Thomson, 1895)

Discussion

Recently, several studies of Alysiinae from the Scandinavian countries such as Denmark (Peris-Felipo et al., 2016) and Finland (Koponen & Vikberg, 2014; Riedel & Hansen, 2014; Koponen et al., 2016) have been carried out. The current study emphasis on the the checklist of the Swedish Alysiinae, through which, seven dacnusiini species have been recorded for the first time for Sweden: *Antrusa chrysotegula* (Tobias, 1986), *Aristelix phaenicura* (Haliday, 1839), *Chorebus (Phaenolexis) caesariatus* Griffiths, 1967, *Chorebus (Chorebus) scabrifossa* Stelfox, 1957, *Coelinidea gracilis* (Curtis, 1829), *Eucoelinidea compressa* Tobias, 1979, and *Sarops rea* Nixon, 1942. These new records establish the total number of known Dacnusiini species to 153 species. Despite the poor knowledge about this tribe, the number of species is higher than other Scandinavian countries such as Denmark (45 species), Norway (16) and Finland (13). However,

the number is still far from other Northern European countries such as Germany (211 species) or United Kingdom (196). This number of known Dacnusiini species from Sweden reflects the paucity of research on this group. Further investigations are necessary to increase the knowledge of this group.

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Conflict of Interests

The author declares that there is no conflict of interest regarding the publication of this paper.

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شناسایی زنبورهای قبیله *Dacnusi* (Hymenoptera, Braconidae: Alysiinae) در سوئد:
فهرست گونه‌ها و هفت گزارش جدیدگونه

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چکیده: هفت گونه از قبیله *Dacnusi* (Hym., Braconidae, Alysiinae) برای اولین بار از سوئد گزارش گردید. این گونه‌ها شامل موارد ذیل بودند: *Antrusa chrysotegula* (Tobias, 1986)، *Aristelix phaenicura* (Haliday, 1839)، *Chorebus (Chorebus) caesariatus* Griffiths, 1967، *Chorebus (Phaenolexis) caesariatus* Griffiths, 1967، *Eucoelinidea scabrifossa* Stelfox, 1957، *Eucoelinidea Coelinidea gracilis* (Curtis, 1829)، *Sarops rea* Nixon, 1942 و *compressa* Tobias, 1979. همچنین جنس‌های *Sarops* Nixon, 1942 و *Eucoelinidea* Tobias, 1979، *Aristelix* Nixon, 1943 برای اولین بار از سوئد گزارش شد. فهرست کل گونه‌های زیرخانواده Alysiinae در سوئد نیز ارائه شد.

واژگان کلیدی: پارازیتوئید، مطالعه فونستیک، گزارش‌های جدید، موزه حشرات، سوئد