

Publishing online identification keys in the form of scholarly papers

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One of the main deficiencies in publishing and dissemination of online interactive identification keys produced through various software packages, such as DELTA, Lucid, MX and others, is the lack of a permanent scientific record and a proper citation mechanism of these keys. In two earlier papers, we have discussed some models for publishing raw data underpinning interactive keys (Penev et al. 2009; Sharkey et al. 2009). Here we propose a method to incentive authors of online keys to publishing these through the already established model of “Data Paper” (Chavan and Penev 2011, examples: Narwade et al. 2011, Van Landuyt et al. 2012, Schindel et al. 2011, Pierrat et al 2012, see also Pensoft's Data Publishing Policies and Guidelines). For clarity, we propose a new article type for this format, “Online Identification Key”, to distinguish it from the “Data Paper” in the narrow sense.

The model is demonstrated through an exemplar paper of Cerretti et al. (2012) in the current issue of ZooKeys. The paper describes the main features of an interactive key to the Palearctic genera of the family Tachinidae (Diptera) implemented as an original

web application. The authors discuss briefly the advantages of these tools for both taxonomists and general users, and point out the need of shared, standardized protocols for taxa descriptions to keep matrix-based interactive keys easily and timely updated.

The format of the “Online Identification Key” paper largely resembles the structure of Data Papers proposed by Chavan and Penev (2011) on the basis of the Ecological Metadata Language (EML) and developed further in Pensoft’s Data Publishing Policies and Guidelines. An “Online Identification Key” paper should focus on a formal description of the technical details and content of an online key that is what is often called “metadata”. For example, an “Online Identification Key” paper has a title, author(s), abstract and keywords like any other scientific paper; it should also include in the first place: the URL of an open access version of the online key and possibly also the data underpinning the key, information on the history of and participants in the project, the software used and its technical advantages and constraints, licenses for use, taxonomic and geographic coverage, lists and descriptions of the morphological characters used, and literature references.

In contrast to conventional data papers, the “Online Identification Key” papers do not require compulsory publication of raw data files underpinning a key, although such a practice is highly recommended and encouraged. There might be several obstacles in publishing raw data that can be due to copyright issues on either data or source codes. It is mandatory, however, for the online keys published in this way to be freely available for use to anyone, by just clicking the URL address published in the paper.

The publication of an online key in the form of a scholarly article is a pragmatic compromise between the dynamic structure of the internet and the static character of scientific articles. The author(s) of the key will be able to continuously update the product, to the benefit of its users. At the same time, the users will have available a citation mechanism for the online key, identical to that used for any other scientific article, to properly credit the authors of the key.

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MOSCHweb — a matrix-based interactive key to the genera of the Palaearctic Tachinidae (Insecta, Diptera)

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Abstract

We provide a general overview of features and technical specifications of an original interactive key web application for the identification of Palaearctic Tachinidae genera. The full list of terminal taxa included in the key, which is the most updated list of genera currently recorded for the Palaearctic Region, is given. We also briefly discuss the need for dealing with detailed and standardized taxa descriptions as a base to keep matrix-based interactive tools easily updated, by proposing a standardized protocol.

Keywords

Interactive key, identification tool, web application, data matrix, morphology, description protocol, Diptera, Tachinidae, Palaearctic Region

Introduction

With more than 1,500 valid genera worldwide (cf. O’Hara 2011), the Diptera family Tachinidae represents a good model to which “alternative” diagnostic tools to the traditional dichotomous keys can be applied. We here propose an original interactive/multi-entry key web application, MOSCHweb (“mosch” derives from the Ital-

ian words “mosca” meaning fly and “chiave” meaning key), for the identification of 423 terminal taxa (at generic and subgeneric rank) of Palaearctic Tachinidae (Insecta, Diptera) based on a <characters x taxa> data matrix approach (cf. Dallwitz 1980; Walter and Winterton 2007). The system adopted in MOSCHweb allows the selection of one or more states for each character, while the software discards all taxa that do not share these states; the selection process is repeated until the search is narrowed down to a single taxon.

Unlike traditional dichotomous keys where characters appear in a fixed order and possible difficulties to recognize the state of one or more characters jeopardize the identification process, in MOSCHweb characters have equal value, appear simultaneously, and can be used in any order. This approach allows the user to simply ignore characters of difficult interpretation or characters that are inapplicable due to damage to the specimen. The possibility to proceed in spite of the incompleteness of the specimen is permitted by the high redundancy of the data matrix which is based on a great amount of information about each terminal taxon. Another peculiarity of the key is the possibility for the user to express uncertainty by selecting more than one state per character or even initially selecting all states and then deselecting one state at a time for each character.

At all times, the user is able to keep all the selected characters and states under control. At the end of the identification process, the set of chosen states will form a code associated with each identified specimen.

We also provide dedicated pages for the morphological terminology adopted (including chaetotaxy), the graphic representation of main measurements, and an iconographic database for each character state used in the interactive key. Also included are images and information concerning morphological features and distributions.

Newly described taxa or nomenclatural changes will not alter the logic of the system, as new species can be added as terminal taxa just by adding a row of listed characters for the new species.

Format of the paper

This paper was prepared following the outlines for data papers provided by Penev et al. (2009, 2011).

Project description

Taxonomic coverage

The key covers 414 of the 416 genera belonging to the family Tachinidae that are currently recorded in the Palaearctic Region (cf. Herting 1984; Herting and Dely-Draskovits 1993; Tschorsnig and Richter 1998; Richter 2004; Shima 2006; Cerretti

2010; O'Hara 2011). The terminal taxa of the key are 423 because 8 subgenera and 1 species group were treated separately (see the list below). The following genera are not included in the present version of MOSCHweb because we have not yet examined any specimens: *Montuosa* Chao & Zhou, 1996, known from Palearctic China (cf. O'Hara et al. 2009); *Aesia* Richter, 2011, known from the type locality of Wrangel Island (Russia) (Richter 2011).

List of the terminal taxa included in the current version of the database (last update: April 2012)

Acemya Robineau-Desvoidy, 1830; *Actia* Robineau-Desvoidy, 1830; *Actinochaetopteryx* Townsend, 1927; *Adenia* Robineau-Desvoidy, 1863 [subgenus of *Exorista*]; *Admontia* Brauer & Bergenstamm, 1889; *Allophorocera* Hendel, 1901; *Alloprosopaea* Villeneuve, 1923; *Allophorophasia* Townsend, 1927; *Alsomyia* Brauer & Bergenstamm, 1891; *Amelibaea* Mesnil, 1955; *Amnonia* Kugler, 1971; *Amphicestonia* Villeneuve, 1939; *Anaeudora* Townsend, 1933; *Ancistrophora* Schiner, 1865; *Anechuromyia* Mesnil & Shima, 1979; *Aneogmena* Brauer & Bergenstamm, 1891; *Anthomyiopsis* Townsend, 1916; *Anurophylla* Villeneuve, 1938; *Aphantorhaphopsis* Townsend, 1926 [subgenus of *Siphona*]; *Aphria* Robineau-Desvoidy, 1830; *Aplomya* Robineau-Desvoidy, 1830; *Arama* Richter, 1972; *Arcona* Richter, 1988; *Argyrophylax* Brauer & Bergenstamm, 1889; *Athrycia* Robineau-Desvoidy, 1830; *Atylomyia* Brauer, 1898; *Atylostoma* Brauer & Bergenstamm, 1889; *Aulacephala* Macquart, 1851; *Austrophorocera* Townsend, 1916; *Bactromyia* Brauer & Bergenstamm, 1891; *Bampura* Tschorsnig, 1983; *Baumhaueria* Meigen, 1838; *Belida* Robineau-Desvoidy, 1863; *Bessa* Robineau-Desvoidy, 1863; *Besseria* Robineau-Desvoidy, 1830; *Billaea* Robineau-Desvoidy, 1830; *Biomeigenia* Mesnil, 1961; *Bithia* Robineau-Desvoidy, 1863; *Blepharella* Macquart, 1951; *Blepharipa* Rondani, 1856; *Blepharomyia* Brauer & Bergenstamm, 1889; *Blondelia* Robineau-Desvoidy, 1830; *Botria* Rondani, 1856; *Brachicheta* Rondani, 1861; *Brachymera* Brauer & Bergenstamm, 1889; *Bracteola* Richter, 1972; *Brullaea* Robineau-Desvoidy, 1863; *Buquetia* Robineau-Desvoidy, 1847; *Cadurcia* Villeneuve, 1926; *Cadurciella* Villeneuve, 1927; *Calliethilla* Shima, 1979; *Calozenillia* Townsend, 1927; *Calyptromyia* Villeneuve, 1915; *Campylocheta* Rondani, 1859; *Carbonilla* Mesnil, 1974; *Carcelia* Robineau-Desvoidy, 1830; *Carcelina* Mesnil, 1944; *Catagonia* Brauer & Bergenstamm, 1891; *Catena* Richter, 1975; *Catharosia* Rondani, 1868; *Cavalieria* Villeneuve, 1908; *Cavillatrix* Richter, 1986; *Ceracia* Rondani, 1865; *Ceranthia* Robineau-Desvoidy, 1830 [subgenus of *Siphona*]; *Ceratochaetops* Mesnil, 1954; *Ceromasia* Rondani, 1856; *Ceromya* Robineau-Desvoidy, 1830; *Cestonia* Rondani, 1861; *Cestonionerva* Villeneuve, 1929; *Cestonioptera* Villeneuve, 1939; *Chaetexorista* Brauer & Bergenstamm, 1895; *Chaetoria* Becker, 1908; *Chaetovoria* Villeneuve, 1920; *Chetina* Rondani, 1856; *Chetogena* Rondani, 1856 [except subgenus *Diplostichus*]; *Chetoptilia* Rondani, 1862; *Chrysomikia* Mesnil, 1970; *Chrys-*

osomopsis Townsend, 1916; *Ciala* Richter, 1976; *Cinochira* Zetterstedt, 1845; *Cistogaster* Latreille, 1829; *Clairvillia* Robineau-Desvoidy, 1830; *Clairvilliops* Mesnil, 1959; *Clausicella* Rondani, 1856; *Clemelis* Robineau-Desvoidy, 1863; *Cleonice* Robineau-Desvoidy, 1863; *Chytiomya* Rondani, 1861; *Cnephaotachina* Brauer & Bergenstamm, 1894 [subgenus of *Nowickia*]; *Compsilura* Bouché, 1834; *Compsiluroides* Mesnil, 1953; *Conogaster* Brauer & Bergenstamm, 1891; *Conoptina* Richter, 1995 [subgenus of *Lixophaga*]; *Corybantia* Richter, 1986; *Crapivnicia* Richter, 1995; *Crassicornia* Kugler, 1980; *Crosskeya* Shima & Chao, 1988; *Crypsina* Brauer & Bergenstamm, 1889; *Ctenophorinia* Mesnil, 1963; *Cucuba* Richter, 2008; *Cylindromyia* Meigen, 1803; *Cyrtophloebe* Rondani, 1856; *Cyzenis* Robineau-Desvoidy, 1863; *Datvia* Richter, 1972; *Demoticoides* Mesnil, 1953; *Demoticus* Macquart, 1854; *Dexia* Meigen, 1826; *Dexiomimops* Townsend, 1926; *Dexiosoma* Rondani, 1856; *Dexiotrix* Villeneuve, 1936; *Dicarca* Richter, 1993; *Dinera* Robineau-Desvoidy, 1830; *Dionaea* Robineau-Desvoidy, 1830; *Dionomelia* Kugler, 1978; *Diplostichus* Brauer & Bergenstamm, 1889 [subgenus of *Chetogena*]; *Dolichocolon* Brauer & Bergenstamm, 1889; *Dolichocoxys* Townsend, 1927; *Dolichopodomorpho* Townsend, 1927; *Drino* Robineau-Desvoidy, 1863; *Drinomyia* Mesnil, 1962; *Dufouria* Robineau-Desvoidy, 1830; *Ectophasia* Townsend, 1912; *Elfriedella* Mesnil, 1957; *Eliozeta* Rondani, 1856; *Eloceria* Robineau-Desvoidy, 1863; *Elodia* Robineau-Desvoidy, 1863; *Elomya* Robineau-Desvoidy, 1830; *Emporomyia* Brauer & Bergenstamm, 1891; *Engeddia* Kugler, 1977; *Entomophaga* Lioy, 1864; *Epicampocera* Macquart, 1849; *Erebiomima* Mesnil, 1953; *Eriothrix* Meigen, 1803; *Erycesta* Herting, 1967; *Erycia* Robineau-Desvoidy, 1830; *Erynnia* Robineau-Desvoidy, 1830; *Erynniopsis* Townsend, 1926; *Erythroceras* Robineau-Desvoidy, 1848; *Estheria* Robineau-Desvoidy, 1830; *Ethilla* Robineau-Desvoidy, 1863; *Etroga* Richter, 1995; *Eubrachymera* Townsend, 1919; *Euexorista* Townsend, 1912; *Eugymnopeza* Townsend, 1933; *Euhygia* Mesnil, 1960; *Eulabidogaster* Belanovsky, 1951; *Eulasiona* Townsend, 1892; *Eumea* Robineau-Desvoidy, 1863; *Eumeella* Mesnil, 1939; *Eurysthaea* Robineau-Desvoidy, 1863; *Euthera* Loew, 1866; *Eutrixopsis* Townsend, 1919; *Euvespivora* Baranov, 1942; *Everestiomyia* Townsend, 1933; *Exorista* Meigen, 1803 [except subgenus *Adenia*]; *Feriola* Mesnil, 1957; *Fischeria* Robineau-Desvoidy, 1830; *Flavicorniculum* Chao & Shi, 1981; *Freraea* Robineau-Desvoidy, 1830; *Frontina* Meigen, 1838; *Gaedia* Meigen, 1838; *Galsania* Richter, 1993; *Gastrolepta* Rondani, 1862; *Gastroptilops* Mesnil, 1957; *Germaria* Robineau-Desvoidy, 1830; *Germariochaeta* Villeneuve, 1937; *Glaurocara* Thomson, 1869; *Gnadochaeta* Macquart, 1851; *Gonia* Meigen, 1803; *Goniocera* Brauer & Bergenstamm, 1891; *Goniophthalmus* Villeneuve, 1910; *Graphogaster* Rondani, 1868; *Gymnocheta* Robineau-Desvoidy, 1830; *Gymnoglossa* Mik, 1898; *Gymnomacquartia* Mesnil & Shima, 1979; *Gymnophryxe* Villeneuve, 1922; *Gymnosoma* Meigen, 1803; *Halidaya* Egger, 1856; *Hamaxia* Walker, 1860; *Hamaxiella* Mesnil, 1967; *Hapalioloemus* Baranov, 1934; *Haracca* Richter, 1995; *Hasmica* Richter, 1972; *Hebia* Robineau-Desvoidy, 1830; *Hemimacquartia* Brauer & Bergenstamm, 1893; *Hemyda* Robineau-Desvoidy, 1830; *Heraultia* Villeneuve, 1920; *Hermyna* Robineau-

Desvoidy, 1830; *Hubneria* Robineau-Desvoidy, 1847; *Hyalurgus* Brauer & Bergenstamm, 1893; *Hyleorus* Aldrich, 1926; *Hyperaea* Robineau-Desvoidy, 1863; *Hypovoria* Villeneuve, 1912; *Hystriomyia* Portshinsky, 1881; *Imitomyia* Townsend, 1912; *Isafarus* Richter, 1976; *Isosturmia* Townsend, 1927; *Istocheta* Rondani, 1859; *Janthinomyia* Brauer & Bergenstamm, 1893; *Kallisomyia* Borisova-Zinov'eva, 1964; *Kirbya* Robineau-Desvoidy, 1830; *Klugia* Robineau-Desvoidy, 1863; *Kuwanimyia* Townsend, 1916; *Labigastera* Macquart, 1834; *Lambrusca* Richter, 1998; *Lasiopales* Villeneuve, 1922; *Laufferiella* Villeneuve, 1929; *Lecanipa* Rondani, 1859; *Leiophora* Robineau-Desvoidy, 1863; *Leptothelaira* Mesnil & Shima, 1979; *Leskia* Robineau-Desvoidy, 1830; *Leucostoma* Meigen, 1803; *Ligeria* Robineau-Desvoidy, 1863; *Ligeriella* Mesnil, 1961; *Linnaemya* Robineau-Desvoidy, 1830; *Lissoglossa* Villeneuve, 1912; *Litophasia* Girschner, 1887; *Lixophaga* Townsend, 1908 [*sensu stricto*]; *Loewia* Egger, 1856; *Lomachantha* Rondani, 1859; *Lophosia* Meigen, 1824; *Lydella* Robineau-Desvoidy, 1830; *Lydina* Robineau-Desvoidy, 1830; *Lypha* Robineau-Desvoidy, 1830; *Lyphosia* Mesnil, 1957; *Macquartia* Robineau-Desvoidy, 1830; *Macroprosopa* Brauer & Bergenstamm, 1889; *Maculosalia* Mesnil, 1946; *Madremyia* Townsend, 1916; *Magripa* Richter, 1988; *Manola* Richter, 1982; *Masicera* Macquart, 1834; *Masistylodes* Mesnil, 1963; *Masistylum* Brauer & Bergenstamm, 1893; *Medina* Robineau-Desvoidy, 1830; *Meigenia* Robineau-Desvoidy, 1830; *Melisoneura* Rondani, 1861; *Mendelssohnia* Kugler, 1971; *Mesnilisca* Zimin, 1974; *Metacemyia* Herting, 1969; *Metadrinomyia* Shima, 1980; *Microcerophina* Kugler, 1977; *Microphthalma* Macquart, 1843; *Microsoma* Macquart, 1855; *Mikia* Kowarz, 1885; *Milada* Richter, 1973; *Mintho* Robineau-Desvoidy, 1830; *Minthodes* Brauer & Bergenstamm, 1889; *Mitannia* Herting, 1987; *Mongolomintho* Richter, 1976; *Munira* Richter, 1974; *Mycteromyiella* Mesnil, 1966; *Myxexoristops* Townsend, 1911; *Naira* Richter, 1970; *Nanoplagia* Villeneuve, 1929 [removed from synonymy with *Plagiomima* Brauer & Bergenstamm, 1891] (cf. Cerretti 2009); *Neaera* Robineau-Desvoidy, 1830; *Nealsomyia* Mesnil, 1939; *Nemoraea* Robineau-Desvoidy, 1830; *Nemorilla* Rondani, 1856; *Neoemdenia* Mesnil, 1953; *Neophryxe* Townsend, 1916; *Neoplectops* Malloch, 1930; *Nigara* Richter, 1999; *Nilea* Robineau-Desvoidy, 1863; *Nipponoceromyia* Mesnil & Shima, 1978; *Nowickia* Wachtl, 1894 [*sensu stricto*]; *Oblitoneura* Mesnil, 1975; *Ocytata* Gistel, 1848; *Onychogonia* Brauer & Bergenstamm, 1889; *Opesia* Robineau-Desvoidy, 1863; *Oswaldia* Robineau-Desvoidy, 1863; *Oxyphyllomyia* Villeneuve, 1937; *Pachycheta* Portschinsky, 1881; *Pachystylum* Macquart, 1848; *Pales* Robineau-Desvoidy, 1830; *Palesisa* Villeneuve, 1929; *Palmonia* Kugler, 1972; *Pandelleia* Villeneuve, 1907; *Panzeria* Robineau-Desvoidy, 1830 [including the species formerly ascribed to *Ernestia* Robineau-Desvoidy, 1830, *Fausta* Robineau-Desvoidy, 1830, *Eurithia* Robineau-Desvoidy, 1844 and *Appendicia* Stein, 1924 by Herting (1984), Herting and Dely-Draskovits (1993), Tschorsnig et al. 2004] (cf. Cerretti 2010); *Paracraspedothrix* Villeneuve, 1919; *Paradrino* Mesnil, 1949; *Paralypha* Mesnil, 1963; *Parapexopsis* Mesnil, 1953; *Parasetigena* Brauer & Bergenstamm, 1891; *Paratrixa* Brauer & Bergenstamm, 1891; *Paratryphera* Brauer & Bergenstamm, 1891; *Parerigone*

Brauer, 1898; *Parhamaxia* Mesnil, 1967; *Pelamera* Herting, 1969; *Pelatachina* Meade, 1894; *Peleteria* Robineau-Desvoidy, 1830; *Pentatomophaga* de Meijere, 1917; *Periarchiclops* Villeneuve, 1924; *Peribaea* Robineau-Desvoidy, 1863; *Perigymnosoma* Villeneuve, 1929; *Periscepsia* Gistel, 1848 [*sensu stricto*]; *Petagnia* Rondani, 1856; *Peteina* Meigen, 1838; *Petinarctia* Villeneuve, 1928 [subgenus of *Periscepsia*]; *Pexopsis* Brauer & Bergenstamm, 1889; *Phania* Meigen, 1824; *Phasia* Latreille, 1804; *Phebellia* Robineau-Desvoidy, 1846; *Phenicellia* Robineau-Desvoidy, 1863; *Phonomyia* Brauer & Bergenstamm, 1893; *Phorinia* Robineau-Desvoidy, 1830; *Phorocera* Robineau-Desvoidy, 1830; *Phorocerosoma* Townsend, 1927; *Phryno* Robineau-Desvoidy, 1830; *Phryxe* Robineau-Desvoidy, 1830; *Phyllomyia* Robineau-Desvoidy, 1830; *Phytomyptera* [*partim*] [= *Gwenda* Richter, 1977]; *Phytomyptera* Rondani, 1845 [except the species formerly included in *Gwenda* Richter]; *Phytorophaga* Bezzi, 1923; *Picconia* Robineau-Desvoidy, 1863; *Platymya* Robineau-Desvoidy, 1830; *Plesina* Meigen, 1838; *Policheta* Rondani, 1856; *Pradocania* Tschorsnig, 1997; *Proceromyia* Mesnil, 1957; *Prodegeeria* Brauer & Bergenstamm, 1894; *Prodemoticus* Villeneuve, 1919; *Prooppia* Townsend, 1926; *Prosenia* Le Peletier & Serville, 1828; *Prosethilla* Herting, 1984; *Prosopea* Rondani, 1861; *Psalidoxena* Villeneuve, 1941; *Pseudalsomyia* Mesnil, 1968; *Pseudebenia* Shima, Han & Tachi, 2010; *Pseudogonia* Brauer & Bergenstamm, 1889; *Pseudomintho* Brauer & Bergenstamm, 1889; *Pseudopachystylum* Mik, 1891; *Pseudoperichaeta* Brauer & Bergenstamm, 1889; *Ptesiomyia* Brauer & Bergenstamm, 1893; *Ramonda* Robineau-Desvoidy, 1863 [subgenus of *Periscepsia*]; *Ramonella* Kugler, 1980; *Redtenbacheria* Schiner, 1861; *Rhacodinella* Mesnil, 1968; *Rhamphina* Macquart, 1835; *Rhaphiochaeta* Brauer & Bergenstamm, 1889; *Rhinaplomyia* Mesnil, 1953; *Rhinomyodes* Townsend, 1933; *Rhynchogonia* Brauer & Bergenstamm, 1893; *Richteriola* Mesnil, 1963; *Riedelia* Mesnil, 1942; *Rioteria* Herting, 1973; *Robinaldia* Herting, 1983; *Rondania* Robineau-Desvoidy, 1850; *Rossimiops* Mesnil, 1953 [= *Mesnilomyia* Kugler, 1972; = *Persedeia* Richter 2001] (cf. Cerretti et al. 2009); *Sarromyia* Pokorný, 1893; *Scaphimyia* Mesnil, 1953; *Schembria* Rondani, 1861; *Schineeria* Rondani, 1857; *Scomma* Richter, 1972; *Senometopia* Macquart, 1834; *Sepseocara* Richter, 1986; *Sericozenillia* Mesnil, 1957; *Setalunula* Chao & Yang 1990; *Simoma* Aldrich, 1926; *Siphona* Meigen, 1803 [*sensu stricto*]; *Sisyropa* Brauer & Bergenstamm, 1889; *Smidtia* Robineau-Desvoidy, 1830; *Solieria* Robineau-Desvoidy, 1848; *Sonaca* Richter, 1981; *Spallanzania* Robineau-Desvoidy, 1830; *Stackelbergomyia* Rohdendorf, 1948; *Staurochaeta* Brauer & Bergenstamm, 1889; *Ste Leoneura* Stein, 1924; *Stomina* Robineau-Desvoidy, 1830; *Strongygaster* Macquart, 1834; *Sturmia* Robineau-Desvoidy, 1830; *Sturmiopsis* Townsend, 1916; *Subclytia* Pandellé, 1894; *Suensonomyia* Mesnil, 1953; *Sumpigaster* Macquart, 1955; *Symmorphomyia* Mesnil & Shima, 1977; *Synactia* Villeneuve, 1916; *Synamphichaeta* Villeneuve, 1936; *Tachina* Meigen, 1803; *Tachinoestrus* Portshinsky, 1887; *Takanoella* Baranov, 1935; *Takanomyia* Mesnil, 1957; *Tetrigimyia* Shima & Takahashi, 2011; *Thecocarcelia* Townsend, 1933; *Thelaira* Robineau-Desvoidy, 1830; *Thelyconychia* Brauer & Bergenstamm, 1889; *Thelymorphia* Brauer & Bergenstamm, 1889;

Thelymyia Brauer & Bergenstamm, 1891; *Therobia* Brauer, 1862; *Thrixion* Brauer & Bergenstamm, 1889; *Tlephusa* Robineau-Desvoidy, 1863; *Torocca* Walker, 1859; *Townsendiellomyia* Baranov, 1932; *Trafoia* Brauer & Bergenstamm, 1893; *Triarthria* Stephens, 1829; *Trichactia* Stein, 1924; *Trichoformosomyia* Baranov, 1934; *Trichopoda* Berthold, 1827; *Trigonospila* Pokorny, 1886; *Tritaxys* Macquart, 1847; *Trixa* Meigen, 1824; *Trixella* Mesnil, 1980; *Trixiceps* Villeneuve, 1936; *Tryphera* Meigen, 1838; *Uclesia* Girschner, 1901; *Urodexia* Osten-Sacken, 1882; *Uromedina* Townsend, 1926; *Ventoplagia* Richter, 2009; *Vibrissina* Rondani, 1861; *Villanovia* Strobl, 1910; *Voria* Robineau-Desvoidy, 1830; *Wagneria* Robineau-Desvoidy, 1830; *Wardarina* Mesnil, 1953; *Weberia* Robineau-Desvoidy, 1830; *Weingaertneriella* Baranov, 1932; *Winthemia* Robineau-Desvoidy, 1830; *Xylotachina* Brauer & Bergenstamm, 1891; *Xysta* Meigen, 1824; *Zaira* Robineau-Desvoidy, 1830; *Zambesomima* Mesnil, 1967; *Zenillia* Robineau-Desvoidy, 1830; *Zeuxia* Meigen, 1826; *Ziminia* Mesnil, 1963; *Zophomyia* Macquart, 1835.

Characters used in the key

General features

The key matrix is based on 98 morphological characters of the adult fly. These are encoded into a variable number of character states from 2 to 9, for a total of 374 states. The characters were chosen on externally visible features, accessible even to non-expert users without dissecting the specimens. Male and female terminalia (with the exception of peculiar piercing structures present in females of some genera, clearly visible without special preparation of the specimen) were excluded from this version. The characters used are divided into seven sections (head, antenna, mouthparts, thorax, wing, legs, abdomen), with the easiest and most selective characters being highlighted in green. The user can also enter the length of the specimen in a dedicated box to exclude genera outside the length of the specimen under examination. Moreover, the key allows the user to sort out genera by their subfamily placement or by their parasitized host group affiliation.

List of the characters used in the key

HEAD: eye pubescence; ocelli; width of frons (male); width of frons (female); outer vertical setae (male); outer vertical setae (female); length of ocellar setae; inclination of ocellar setae; frontal setae; fronto-orbital plate; upper reclinate orbital setae; proclinate orbital setae (male); proclinate orbital setae (female); parafacial setae; width of parafacial; parafacial ratio; shape of facial ridge (head in lateral view); setae of facial ridge; type of setae on facial ridge; vibrissa; face; lower facial margin; genal dilation; ventral part of occiput; dorsal part of occiput; height of gena.

ANTENNAE: colour of antennal pedicel; length of antenna; length of first flagellomere; apex of first flagellomere; pubescence of arista; thickness of arista; length of first aristomere; length of second aristomere.

MOUTHPARTS: length of prementum; labella; colour of palpus; size and shape of palpus.

THORAX: presutural dark vittae of scutum; prosternal setulae; shape of prosternum; proepisternum; postpronotum; presutural acrostichal setae; presutural dorsocentral setae; postsutural dorsocentral setae; postsutural intra-alar setae; supra-alar setae; katepisternal setae; katepimeron; anepimeral seta; colour of scutellum; number of marginal setae of scutellum; lateral setae of scutellum; length of subapical setae of scutellum; apical scutellar setae; preapical scutellar setae; anatergite; posterior spiracle; postmetacoxal area.

WING: position of lower calypter; marginal shape of lower calypter; setulae on lower calypter surface; wing colour; tegula colour; basicosta colour; second costal segment; costal spine; vein R_1 ; basal seta on vein R_{4+5} ; setae on vein R_{4+5} ; vein CuA_1 ; bend of vein M; stub and prolongation of vein M; fourth costal sector (CS_4); ratios of sections of vein M; crossvein DM-Cu; petiole.

LEGS: colour of legs; fore coxa; fore tibia; mid tibia; number of preapical setae on hind tibia; length of preapical setae on hind tibia; anterodorsal setae on hind tibia; hind coxa.

ABDOMEN: ground colour of abdomen; abdominal microtomentum (pattern); fusion of abdominal tergites; mid-dorsal depression on syntergite 1+2; marginal setae on syntergite 1+2; median marginal setae on tergites 3 and 4; median discal setae on tergites 3 and 4; tergite 5 length; sternite 4; male abdominal patches of setulae (pattern); female ovipositor.

COLOUR: general body ground colour.

Software technical specification

Platform: Framework.Net

Web Server: Microsoft Internet Information Service 6.0

Programming language: C#

Application version: MOSCHweb 1.0

Data base: Microsoft SQL Server

Data: 1.0beta

Language: English

License for use of the key: Creative Commons Attribution License 3.0 (CC-BY), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Use of the primary data: Primary data are available from the authors by agreement.

Web Location: www.tachinidae.eu

Software technical features (Fig. 1)

1. *Genera window*: an updating real-time box containing all the genera that share selected character states. The name of the genus is followed by the author name, the year and page of the original description paper. Clicking on the genus name, a new window opens to show the general distribution, body length range and general remarks of the genus, the name of the subfamily it belongs to and the images available for it.
2. *Specimen length box*: a small box in which user can insert an approximate specimen length as an integer number expressed in millimeters.
3. *Subfamilies menu*: a menu giving the possibility to reduce the query to the taxa belonging to just one of the four subfamilies or, by default, to work with the entire data set.
4. *Morphology—Chaetotaxy—Terminology button*: a button that refers to a dedicated window (Fig. 2), illustrating the characters used in the key, with the help of interactive images of the body parts, obtainable just by moving the mouse over the list of terms.
5. *Host menu*: a menu that allows data on host relationships to be used as a selection criterion, e.g. with reared specimens. It is possible to include also genera for which host relationships are still unknown. A “refresh” button clears the checkboxes for host (without refreshing the character or subfamily selection).

The screenshot shows the MOSCHweb interactive key main page. The interface is divided into several sections:

- Top Bar:** Includes a search bar and a "Found: 1" indicator.
- Genera window (1):** Displays "Crypina Brauer & Bergenstamm, 1889: 97".
- Specimen length box (2):** A text input field for "specimen length (mm)" with a "send" button.
- Subfamilies menu (3):** A list of subfamilies with radio buttons: Exoristinae, Tachininae, Dexiinae, Phasiinae, and All subfam.
- Morphology—Chaetotaxy—Terminology button (4):** A button for accessing detailed character information.
- Hosts (5):** A section for host relationships with checkboxes for various insect orders (Lepidoptera, Coleoptera, Hymenoptera, etc.) and a "refresh" button.
- HEAD (6):** A tab for the head section.
- REFRESH (7):** A button to refresh the selection.
- 1 EYE PUBESCENCE (8):** A section for eye pubescence with checkboxes for "Eye pubescent" and "Eye bare or nearly bare".
- 2 OCELLI (9):** A section for ocelli with checkboxes for "ocelli present" and "ocelli missing".
- 3 [MALE] WIDTH OF FRONS (10):** A section for male frons width with checkboxes for various width ranges.
- 4 [FEMALE] WIDTH OF FRONS (11):** A section for female frons width with checkboxes for various width ranges.
- EXPORT DATA (12):** A section for exporting data with checkboxes for "Eye pubescent", "Ocelli", and "Frons width".

Figure 1. Interactive key main page.

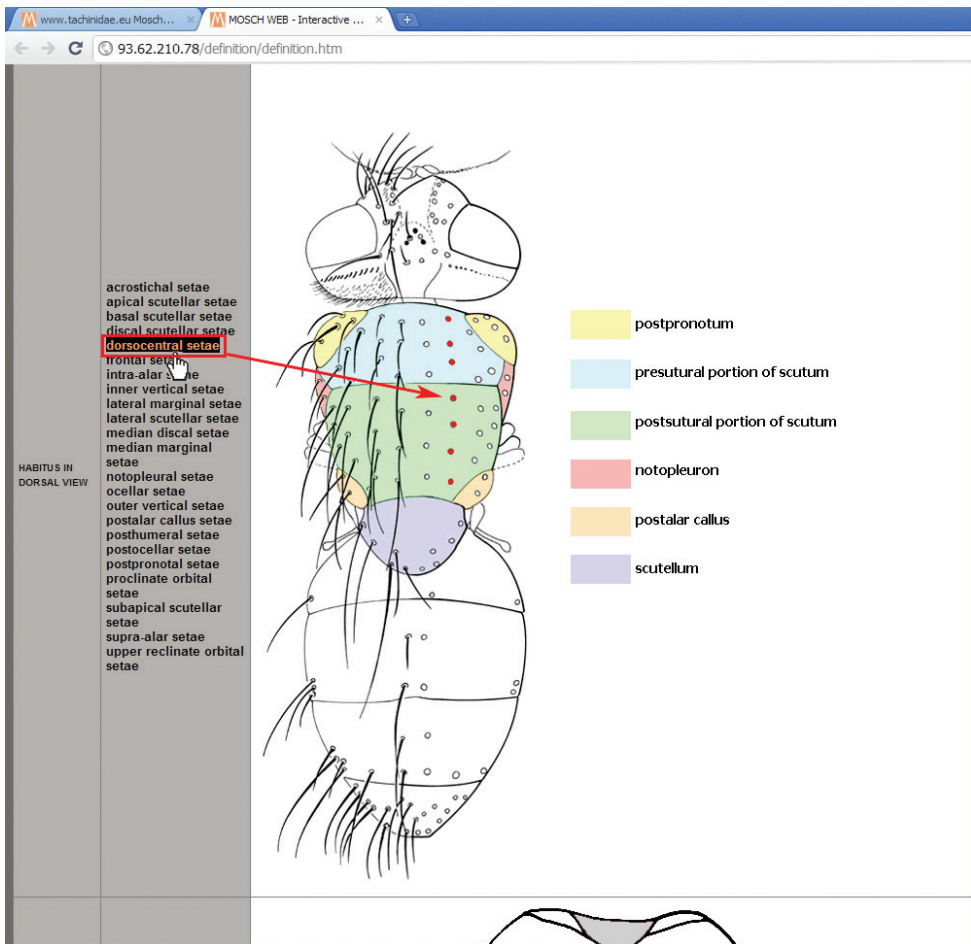


Figure 2. Interactive image window for morphology, chaetotaxy and terminology.

6. *Body parts bar*: a bar with buttons referring to the body sections where used characters are divided. A “refresh” button clears the checkboxes for characters (without refreshing the host or subfamily selection).
7. *Character window*: a window with all the characters used in the key. Each character has from two to nine states; for every state the user can see the pictures in the archive that refer to that state just by clicking on the camera icon to the left of the checkboxes. The characters can be used in any order; easiest and more selective characters are highlighted in green. MOSCHweb allows also for “uncertainty” to be expressed by the selection of more than one state for each character, as is useful for qualitative or morphometric characters. Taking into account that morphometric ratios are often continuous, we chose to subdivide arbitrarily such characters in more or less regular intervals. For specimens showing values at the extremes of the intervals, it is possible and suggested to select both the states with contiguous values.

8. *Selected choice box*: an updating real-time box showing the chosen characters and states selected by the user, ordered as they appear in the Character window; this represents an ID code which is linked to the specimen under examination.
9. *Export data*: a button allowing the user to export in TXT format the terminal taxon/taxa name (depending upon the accuracy of the inquiry) followed by the list of selected states (point 8) in the form of a code (Fig. 3). This “code” serves as a record of the character states used to achieve a specimen identification. This functionality may be useful to check previous identifications in the light of nomenclatorial changes, group revisions or new taxon descriptions.

MOSCHweb is a user friendly application based on an intuitive graphical interface and very simple dynamics, designed to meet the needs of both specialist and less experienced users. MOSCHweb does not constrain nor address the user to a path in character choice except for highlighting in green those characters that allow a nearly

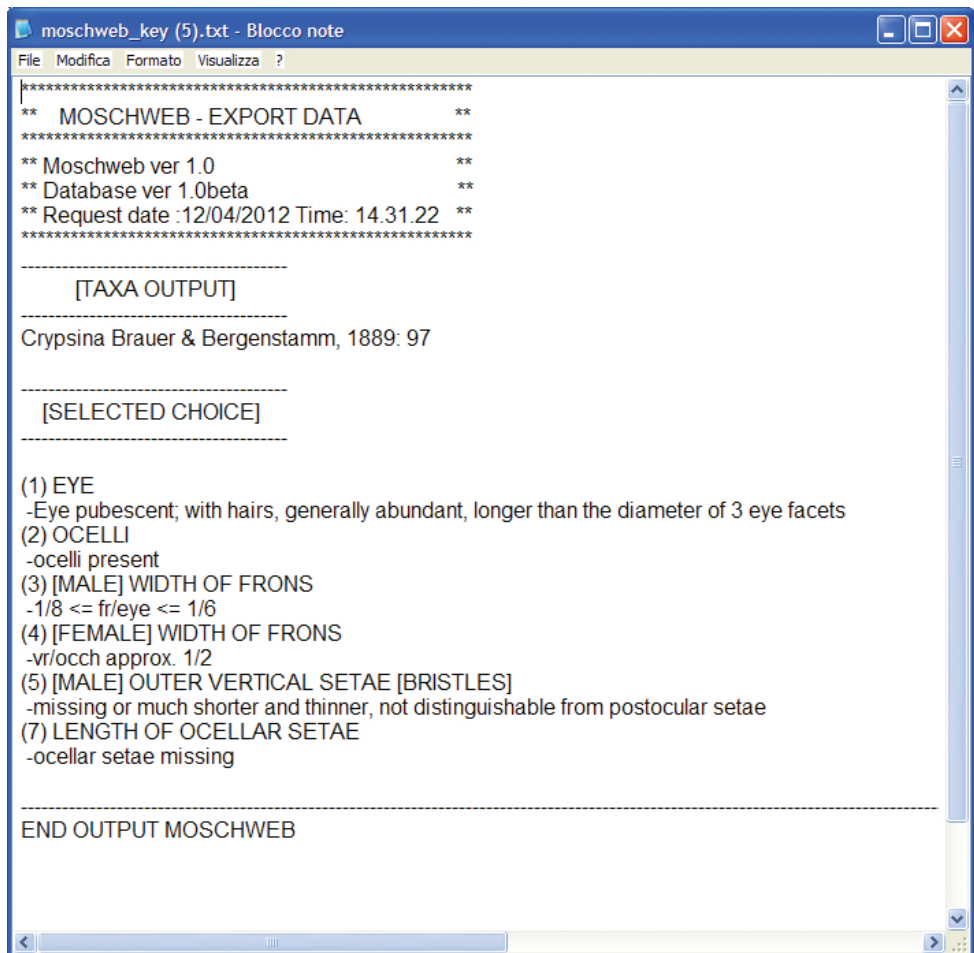


Figure 3. Example of TXT export data file.

linear reduction of terminal taxa. We think this is a strength of our application. As a consequence, we deliberately excluded both the possibility of removing automatically the redundant characters or states during the identification process and resorting to a probabilistic identification by implementing error tolerance in chosen character states, as it is present in other widely used software packages (cf. Dallwitz 2000 onwards).

Software implementation and data matrix updating

MOSCHweb is an open-access web application, it is not open-source. The application can be augmented/updated only by, or in agreement with, the corresponding authors of this paper.

Instead, the author of a new taxon is encouraged to download the form of the encoded description from www.tachinidae.eu, fill it out, and send it to the corresponding authors of this paper along with the PDF version of the original description. The author/s of the new taxon/taxa can also attach, to the e-mail, all relevant digital images (e.g., habitus, body parts) to be uploaded to the web application, along with a statement declaring that the images are original or copyright free.

Corresponding authors (PC, HPT) keep updated both the web application, by implementing new functions, and the data matrix, by improving encoded descriptions of terminal taxa. Every change can be monitored on the homepage and reported in the TXT export data file, by updating the number of the application version and by changing the date of the last modification to the data matrix. A short message on the homepage may describe differences from the previous version, if needed.

Conclusions

It is well known how the high rate of description of new taxa and the many nomenclatural changes (especially among insects) quickly make conventional dichotomous keys obsolete. It is not always easy to update a dichotomous key especially when one or more taxa are split and new “couplets” are needed. Generally, taxonomic and nomenclatorial changes are not a big problem for specialists, but for beginners or general users the only solution is to wait (often in vain) for the publication of a new updated key. In MOSCHweb this problem can be easily solved by augmenting the database (taxa x characters) with the new taxon/taxa. In this way the newly inserted entities will not alter the logic of the system, and automatically become part of the interactive key.

An online open-access resource like MOSCHweb may enhance taxonomic reliability in two ways:

- i) By being easily updated once a new genus (or subgenus) is described and published. To do this, taxonomists may simply follow the same strict protocol for taxa description as used in MOSCHweb as a base. The mandatory fields of the

description protocol would represent the minimum amount of information recommended for describing a new taxon.

- ii) By allowing the recording of the character states selected to identify a given specimen in the form of a TXT file, as a record for the user of the key and for the recipient of the identification.

MOSCHweb, although originally conceived for the identification of a difficult group of parasitoids like the Tachinidae, is to be considered a platform to use also with other taxonomic groups. Those interested in testing MOSCHweb with other groups can send us a list of terminal taxa, a list of characters and character states and the resulting <characters x taxa> matrix. Moreover, we strongly encourage to provide images of treated taxa and pictures referring to the character states present in the key, as well as images illustrating morphological terminology adopted.

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A review of North American Recent *Radiolucina* (Bivalvia, Lucinidae) with the description of a new species

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Abstract

North American members in the genus *Radiolucina* are reviewed. A lectotype for the type species, *Radiolucina amianta*, is designated and descriptions and illustrations are provided. A description of a new species, *Radiolucina jessicae*, from the west coast of Mexico is presented. Key diagnostic species characteristics are outlined and compared among members of the genus.

Keywords

Lucinidae, Panamic Province, neotype, lectotype, new species

Introduction

Members of Lucinidae have been grouped and identified incorrectly in the past because of variable shell and anatomical characteristics. Since the discovery of chemosymbiosis with sulphide-oxidizing bacteria in the early 1980's, the systematics of Lucinidae has attracted more attention and many new genera and species have been described (Bouchet and Cosel 2004; Glover and Taylor 2007; Hickman 1994; Taylor and Glover 2006). Small species (less than 10 mm) have received less attention than their larger

counterparts. There are currently over 400 Lucinidae species living in a variety of different habitats (Barnes and Hickman 1999; Roeselers and Newton 2012).

Dall (1901) placed *Phacoides amiantus* Dall, 1901 and *Lucina cancellaris* Philippi, 1846 with the Indo Pacific subgenus *Bellucina* (now known as *Cardiolucina* Sacco, 1901). Later, Britton (1972) described *Radiolucina* as a new subgenus of *Parvilucina*, and included *Phacoides amiantus* Dall, 1901, *Lucina cancellaris* (Philippi 1846), and the fossil species *Phacoides waccamawensis* (Dall, 1903). Recent DNA results (Taylor et al. 2011) show that *Radiolucina amianta* and *Radiolucina cancellaris* are related to *Lucinisica*, not *Parvilucina* or *Cardiolucina* as was thought in the past.

While reviewing the Lucinidae of the Panamic Province, morphological differences among specimens identified as *Radiolucina cancellaris* were discovered. After further research on the genus and examination of pertinent type specimens, a new species of *Radiolucina* was recognized herein named *Radiolucina jessicae*. The three Recent members of North American *Radiolucina* are described and illustrated.

Materials, methods, and abbreviations

One hundred *Radiolucina* specimens from Mexico and Florida were examined. Of the 100, 20 were determined to be *Radiolucina jessicae*, two were *Radiolucina amianta*, and 78 were *Radiolucina cancellaris*. Six *Radiolucina jessicae* specimens were rehydrated in water and dish soap, and reconstituted anatomy was examined.

LACM- Natural History Museum of Los Angeles, Los Angeles, USA; NHMUK- The Natural History Museum, London, UK; SBMNH- Santa Barbara Museum of Natural History, Santa Barbara, USA; USNM- Smithsonian National Museum of Natural History, Smithsonian Institution, Washington DC, USA.

In the descriptions below, morphological characteristics outlined in Britton (1972), Taylor and Glover (2000), Cosel (2006), Glover and Taylor (2007), Taylor and Glover (2009), and Coan and Valentich-Scott (2012) have been used.

Data resources

The data underpinning the analyses reported in this paper are deposited at GBIF, the Global Biodiversity Information Facility, <http://ipt.pensoft.net/ipt/resource.do?r=radiolucina>

Taxonomy

Genus *Radiolucina* Britton, 1972

<http://species-id.net/wiki/Radiolucina>

Radiolucina Britton, 1972. Type species (original designation): *Phacoides (Bellucina) amiantus* Dall, 1901.

Description. Shell shape subovate; maximum length: 9.0 mm, maximum height: 8.0 mm; with an average of 13 heavy radial ribs, overlain by thin commarginal lamellae that continue through interspaces, producing a reticulate pattern; posterior end thickened, posterior dorsal area often with low spines; pallial line often discontinuous broken into large and small segments; right valve hinge with two cardinal teeth, left valve hinge with one wide cardinal tooth, one anterior lateral tooth, one posterior lateral tooth.

Comparisons. *Parvilucina* Dall, 1901 (type species: *Lucina tenuisculpta* P.P. Carpenter, 1864) attains a larger size and has fine radial ribs, and a short, broad anterior adductor muscle scars compared to *Radiolucina*, which has strong radial ribs and a long, narrow anterior adductor muscle scar.

Pleurolucina Dall, 1901 (type species: *Lucina leucocyma* Dall, 1886) has heavy commarginal lamellae with few broad, weak radial ribs compared to *Radiolucina*. It is similar to *Radiolucina* in that they both have a long, narrow anterior adductor muscle scar.

Liralucina Glover & Taylor, 2007 (type species: *Phacoides sperabilis* Hedley, 1909) has an average of 35 flat, radial ribs compared to *Radiolucina*, which has average 13 strong, radial ribs.

There is evidence (Coan and Valentich-Scott 2012) that *Radiolucina* dates back to the Miocene.

Literature. Britton (1972), Hickman (1994), Taylor and Glover (2000), Glover and Taylor (2007), Taylor and Glover (2009), Coan and Valentich-Scott (2012).

Radiolucina amianta (Dall, 1901)

http://species-id.net/wiki/Radiolucina_amianta

Figures 1, 4, 5a

Phacoides (Bellucina) amiantus Dall, 1901: 826-827.

Parvilucina (Radiolucina) amianta. — Britton, 1972: 9-10

Lucina (Bellucina) amiantus Bretsky. — 1976: 273

Shell shape. Subovate, extended anteriorly and posteriorly, length longer than height, slightly inflated; maximum length: 6.0 mm, maximum height: 6.0 mm.

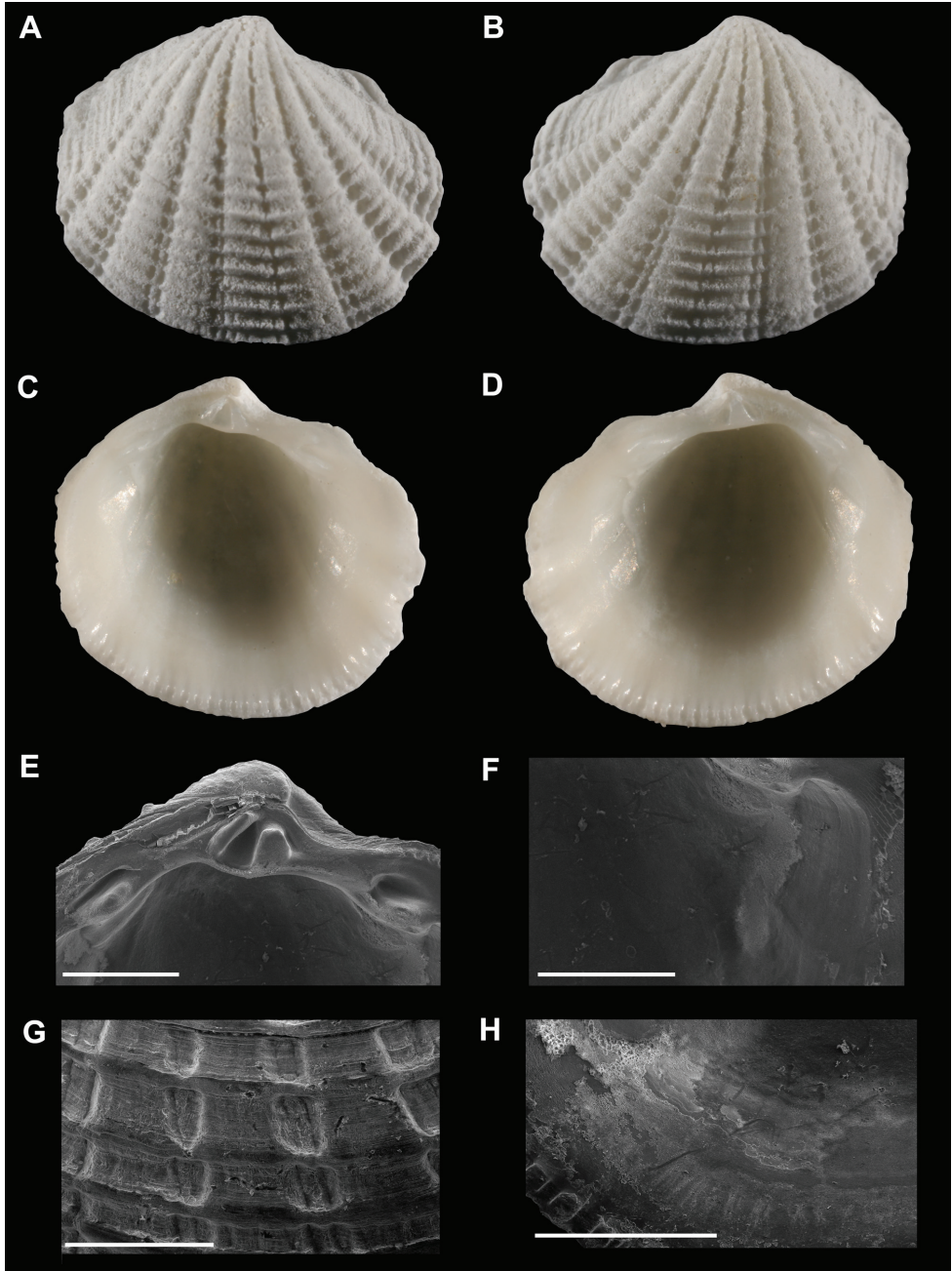


Figure 1. **A–D** *Radiolucina amianta* (SBMNH 357639, USA, Florida, Santa Petersburg, Tampa Bay) length = 5.4 mm **A** Exterior of right valve **B** Exterior of left valve **C** Interior of left valve **D** Interior of right valve **E** Close up of hinge of left valve **F** Close up of anterior adductor muscle scar of left valve **G** Close up of ribs of right valve **H** Close up of pallial line of left valve. **E–H** scale bar = 1 mm.

Sculpture and color. About 11 (n=2) non-bifurcating radial ribs, overlain by thin commarginal lamellae that continue through interspaces, producing a reticulate pattern; occasional intercalary ribs present; interspaces shallow, thin towards beak and progressively widening ventrally; anterior and posterior ends smooth with fine commarginal striae, posterior sometimes with spines of varying heights protruding from shell; inner shell margin finely crenulate; interior color tan, shiny.

Hinge. Hinge plate thick, curved on either side of cardinal teeth; beaks prosogyrate; cardinal teeth small, right valve posterior tooth thin, anterior tooth thick, left valve middle tooth wide; lateral teeth large, posterior tooth vertical, anterior tooth horizontal; ligament sunken above cardinal teeth.

Adductor scars and pallial line. Pallial line continuous; anterior adductor scar long, narrow, diverging from pallial line for about a quarter of its length; posterior adductor scar small, wide, pallial line joins at most ventral point.

Type specimens and type locality. Dall did not designate a single specimen as the holotype. To stabilize nomenclature, I herein designate the lectotype to be the right valve (USNM 64276), which is the same specimen as figured by Dall 1901, plate XXXIX fig. 10, with the type locality of Yucatan Strait, North Atlantic Ocean (approximately 21.3°N, 86.2°W), 1170 m (Fig. 4). An additional right valve (USNM 1183662) in the original lot is a paralectotype.

Distribution. Western Atlantic from North Carolina to Florida, West Indies, Gulf of Mexico, Caribbean Central America, South America south to Uruguay (Mikkelsen and Bieler 2007).

Remarks. In describing *Phacoides (Bellucina) amiantus*, Dall noted that it seemed to be the same species that Tuomey and Holmes (1857) had described as *Lucina costata* from the Pleistocene of South Carolina (non *Lucina costata* d'Orbigny, 1846). Boss et al. (1968: 25) misinterpreted Dall's proposal as a new name, but it is expressly a new species. Moreover, it is not at all clear that these represent the same species.

Literature. Dall (1901), Bretsky (1976), Mikkelsen and Bieler (2007), Tunnell et al. (2010).

***Radiolucina cancellaris* (Philippi, 1846)**

http://species-id.net/wiki/Radiolucina_cancellaris

Figure 2, 5b

Lucina cancellaris Philippi, 1846: 21.

Radiolucina cancellaris — Olsson 1961: 547.

Radiolucina cancellaris — Keen 1971: 1064.

Radiolucina cancellaris neotype — Coan and Valentich-Scott 2012: 359.

Shell shape. Subovate, inflated; maximum length: 7.2 mm, maximum height: 8.0 mm; beaks prosogyrate.

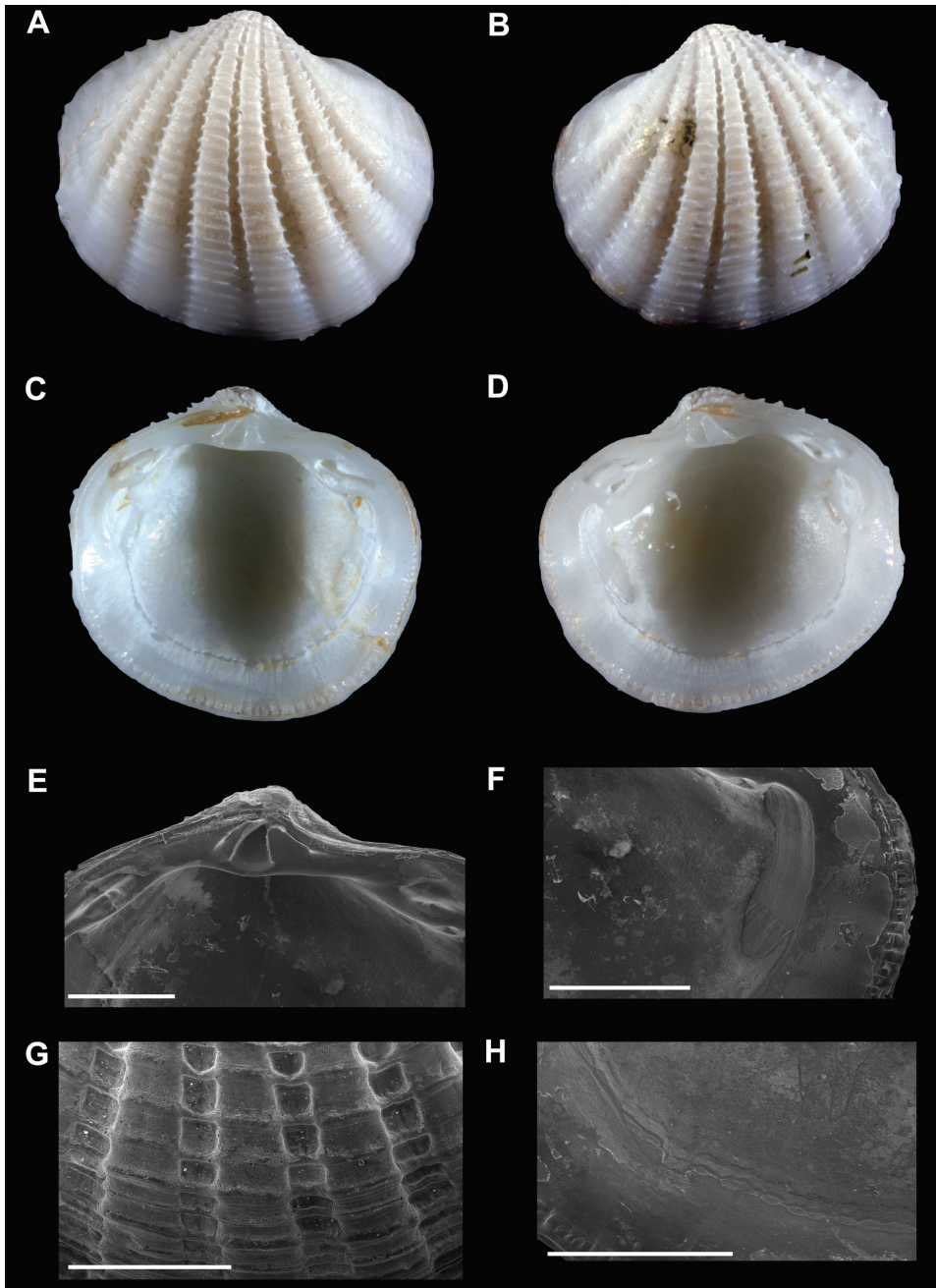


Figure 2. **A–D.** *Radiolucina cancellaris* neotype (SBMNH 149738, Mexico, Sonora, Cabo Haro) length = 5.5 mm **A** Exterior of right valve **B** Exterior of left valve **C** Interior of left valve **D** Interior of right valve **E–F, H** *Radiolucina cancellaris* (SBMNH 20044, Mexico, Sonora, Cabo Haro) **E** Close up of hinge of left valve **F** Close up of anterior adductor muscle scar of left valve **G** *Radiolucina cancellaris* (SBMNH 129044, Mexico, Sinaloa, Teacapan) Close up of ribs of right valve **H** Close up of pallial line of left valve. **E–H** scale bar = 1 mm.

Sculpture and color. Average 12 (10–15 n=76) non-bifurcating radial ribs, overlain by thin commarginal lamellae that continue through interspaces, producing a reticulate pattern; interspaces sunken, thin towards beak, progressively widening ventrally; anterior end smooth, with fine commarginal striae; posterior end with a series of average 13 (12–15 n=20) thick spines of varying heights protruding from shell; inner ventral margin crenulations thin, closely spaced; interior color white to cream, shiny.

Hinge. Hinge plate thick, straight with slight curve; cardinal teeth small, right valve posterior thin, anterior thick, left valve middle tooth wide; lateral teeth large, posterior vertical, anterior horizontal; ligament sunken above the cardinal teeth.

Adductor scars and pallial line. Pallial line discontinuous, broken into small and large segments, with one small circular indentation directed ventrally; anterior adductor scar large, narrow, diverging from pallial line for about a quarter of its length; posterior adductor scar small, wide, pallial line joins at most ventral point.

Type specimens and type locality. Neotype, SBMNH 149738 (Coan and Valentich-Scott 2012), length 6 mm, height 6 mm. Cabo Haro, Sonora, Mexico, 37–73 m.

Distribution. Known from Isla Cedros, Pacific coast of Baja California (28.2°N) [Keen, 1971], into the Golfo de California as far north as near its head at Puerto Peñasco, Sonora (31.3°N) [LACM], México, to Isla San Lorenzo, Lima, Perú (12.1°S) [LACM]; intertidal zone to 212 m [LACM]. Also in the Pliocene of Ecuador and the Pleistocene of Baja California.

Literature. Britton (1972), Coan and Valentich-Scott (2012), Dall (1901), Keen (1971), Olsson (1961).

Remarks. Shell shape and ribs vary at different stages of growth. Due to this, it can be difficult to distinguish variants of *Radiolucina cancellaris*. The number of ribs is consistent during growth (average 12); however sometimes they were thinner or thicker, and inconsistently extended to the ventral margin. Bifurcation and/or intercalary ribs are sometimes present depending on the stage of growth.

***Radiolucina jessicae* Garfinkle, sp. n.**

urn:lsid:zoobank.org:act:6EA53845-C2D9-4376-B460-7729CDDD3D60

http://species-id.net/wiki/Radiolucina_jessicae

Figure 3, 5c

Radiolucina cf. *cancellaris* Coan and Valentich-Scott, 2012: 360

Diagnosis. Subovate, extended anteriorly and posteriorly, slightly inflated; with about 11 primary radial ribs, excluding intercalary ribs; commarginal ribs continuing through interspaces creating a rectangular pattern; posterior end with fine commarginal striae and spines of varying heights protruding from shell; pallial line discontinuous, broken into a series of short and long sections with one large segment directed ventrally.

Shell shape. Subovate, long, extended anteriorly and posteriorly, length longer than height; slightly inflated; maximum length: 6.0 mm, maximum height: 5.3 mm; beaks pointed, prosogyrate.

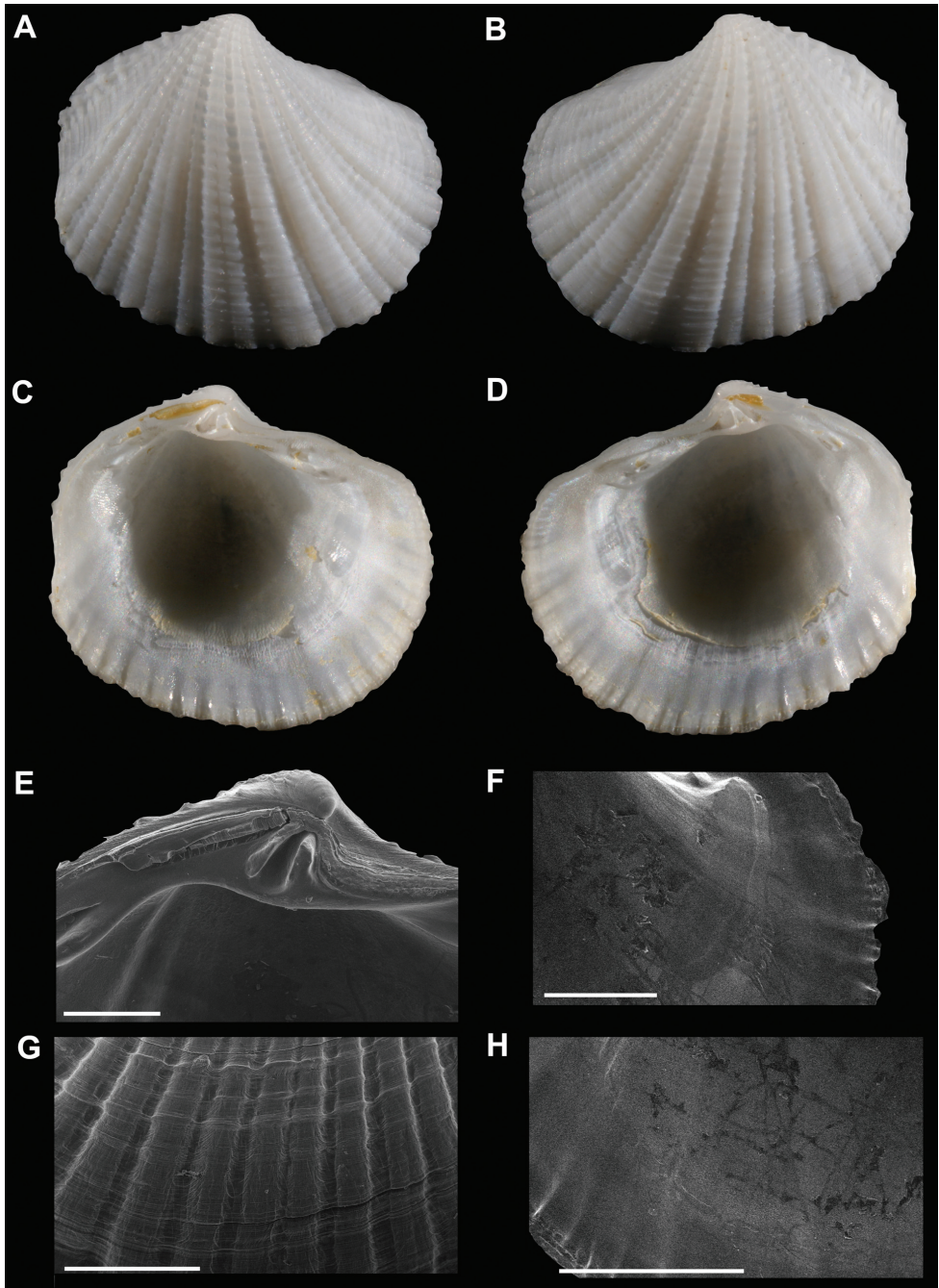


Figure 3. **A–D** *Radiolucina jessicae* sp. n., holotype (SBMNH 353469, Mexico, Baja California Sur, Bahía Concepción) length = 4.5 mm **A** Exterior of right valve **B** Exterior of left valve **C** Interior of left valve **D** Interior of right valve **E–H** *Radiolucina jessicae* new species, paratype (SBMNH 149936) **E** Close up of hinge of left valve **F** Close up of anterior adductor muscle scar of left valve **G** Close up of ribs of right valve **H** Close up of pallial line of left valve. **E–H** scale bar = 1 mm.

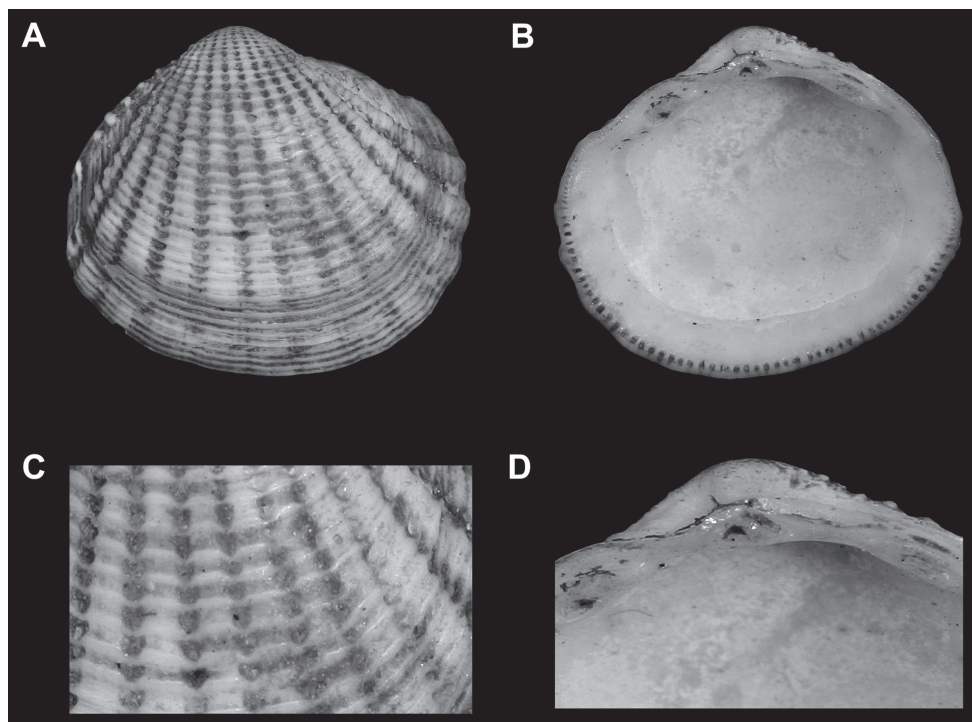


Figure 4. A–D *Phacoides* (*Bellucina*) *amiantus* Dall, 1901 lectotype herein (USNM 64276, Mexico, Yucatan Strait) length = 6 mm **A** Exterior of right valve **B** Interior of right valve **C** Close up of ribs of right valve **D** Close up of hinge of right valve.

Sculpture and color. Average 13 (9–16 $n=20$) radial ribs, occasional bifurcate usually on larger specimens; commarginal ribs continuing through interspaces, with 6–10 thick intercalary ribs extending to ventral edge of valve, present in most specimens, more pronounced in larger specimens; interspaces shallow and thin towards beak, progressively widening ventrally; anterior side smooth with fine commarginal striae; posterior side also smooth with fine commarginal striae, with a series of average nine (4–15 $n=20$) thick spines of varying heights protruding from shell; exterior color tan to white, also with brown along ribs; interior color tan, white to cream, shiny; inner shell margin crenulations thin, closely spaced.

Hinge. Hinge plate thin, slightly curved on either side of cardinal teeth; right valve posterior and anterior cardinal teeth about equal in size, left valve middle tooth wide; lateral teeth large, posterior vertical and anterior horizontal; ligament long, sunken above cardinal teeth.

Adductor muscle and pallial scars. Pallial line discontinuous, broken into series of large, small segments, with one large segment directed ventrally; anterior adductor scar is large, narrow, diverging from pallial line for about half its length; posterior adductor scar small, wide, pallial line joins anteriorly to most ventral point.

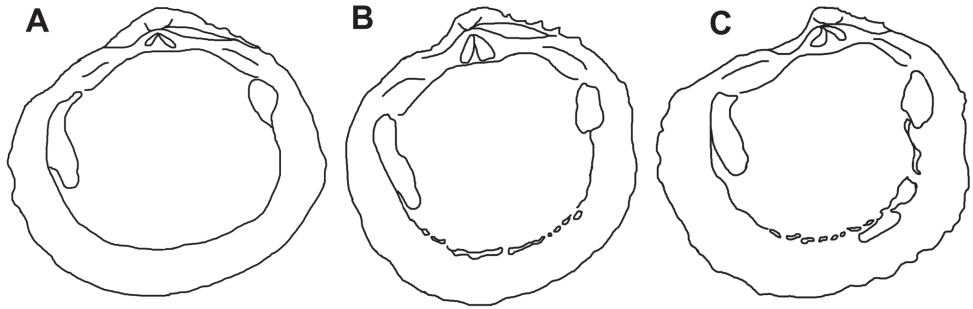


Figure 5. Outline drawings of interior of right valves **A** *Phacoides (Bellucina) amiantus* lectotype **B** *Radiolucina cancellaris* neotype **C** *Radiolucina jessicae* new species holotype – Not to scale.

Anatomy from rehydrated dried specimens. Inhalant aperture usually smaller than exhalant, elongate, often narrow; tissue bridge between apertures usually narrow; ventral mantle fusion thin, narrow; mantle fusion variable, usually not fused below anterior adductor muscle; rectum curves dorsally around posterior adductor muscle and ends at exhalant aperture.

Type locality and type specimens. North America, Mexico, Baja California Sur, Bahía Concepción, Bahía Coyote; 26°43'50"N, 111°53'30"W; 12 m.

Holotype. SBMNH 353469, length: 4.5 mm. **Paratypes.** SBMNH 149936, 6 unpaired valves; LACM 3231, 4 unpaired valves; NHMUK 20120066, 2 unpaired valves; USNM 1179317, 2 unpaired valves.

Distribution. East Pacific, W side of Isla El Muerto, Baja California, Mexico (30°4.00'N, 114°33.00'W) to Bahía Concepción, Baja California Sur, Mexico (26°39.00'N, 111°48.00'N). Also known from Sonora, Guaymas, Bahía San Carlos, Sonora, Mexico (27°56.1.00'N, 111°5.00'W) to San Carlos, Gulf of Panama (8°29.00'N, 79°56.00'W). Usually collected among gravel and shells; known from 13–27 m deep.

Etymology. Named in honor of Jessica Sanford from Santa Barbara, California for being an inspiring scientist, meaningful mentor, and wonderful friend.

Comparisons. See comparisons of *Radiolucina amianta*, *Radiolucina cancellaris*, and *Radiolucina jessicae* in Table 1.

Radiolucina waccamawensis (Dall 1903), from the Pliocene of the Waccamaw district, South Carolina, has about 10 strong radial ribs with deep interspaces, compared to *Radiolucina jessicae* which has about 13 radial ribs with shallow interspaces, and about eight intercalary ribs. The morphologic characters of *Radiolucina waccamawensis* are closer to *Radiolucina cancellaris*.

Discussion. Different morphologic characters among different ages of *Radiolucina cancellaris* are common, specifically ontogenetic changes in shape, rib number, and hinge teeth. Further research and use of additional characters, specifically DNA studies, (Taylor et al. 2011) could present more details and explanation for the variable characters observed, and could possibly reveal more new species within the *Radiolucina cancellaris* complex.

Table 1. Comparisons of key characteristics of North American *Radiolucina* species.

<i>Radiolucina</i> species	Radial ribs/ interspaces	Hinge plate	Pallial line	Adductor muscle scars
<i>amianta</i>	About 11 radial, non-bifurcating with occasional small intercalary ribs; interspaces shallow	Thick, curved on either side of cardinal teeth	Continuous	Anterior long, narrow, diverging from pallial line for about a quarter of its length; posterior small, wide, pallial line joins at most ventral point
<i>cancellaris</i>	About 12 radial, non-bifurcating; interspaces sunken	Thick, straight with slight curve over entire length	Discontinuous, broken into a series of large and small segments with 1 small circular indentation directed ventrally	Anterior large, narrow, diverging from pallial line for about a quarter of its length; posterior small, wide, pallial line joins at most ventral point
<i>jessicae</i>	About 13 radial, with occasional bifurcation and thick intercalary ribs; interspaces shallow	Thin, slightly curved on either side of cardinal teeth	Discontinuous, broken into a series of large and small segments with 1 large segment directed ventrally	Anterior large, narrow, diverging from pallial line for about half its length; posterior wide, pallial line joins anterodorsally to most ventral point

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Three new species of *Lathrobium* Gravenhorst (Coleoptera, Staphylinidae, Paederinae) from Sichuan, Southwest China

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Abstract

Three new species of the genus *Lathrobium* Gravenhorst, 1802 from Sichuan Province, Southwest China are described and illustrated: *L. acutissimum* sp. n., *L. hailuogouense* sp. n. and *L. labahense* sp. n. A checklist of Chinese *Lathrobium* is provided.

Keywords

Coleoptera, Staphylinidae, taxonomy, *Lathrobium*, new species, key to species, checklist, Sichuan, China

Introduction

Up to today, 57 species of the genus *Lathrobium* Gravenhorst, 1802 have been reported from China. The records of four species are doubtful and the presence of the remaining 53 species has been confirmed in the past (Assing 2009, 2010a, b; Chen et al. 2005a, b; Hua 2002; Li 1992; Li and Chen 1990, 1993; Peng and Zhao 2012a, b;

Ryvkin 2011; Schülke 2002; Smetana 2004; Watanabe 1997, 1998, 1999a, b, 2005, 2011; Watanabe and Xiao 1994, 1996, 1997, 2000).

Only one species, *Lathrobium watanabei* Schülke, 2002, had been known from the vast Sichuan Province, China. In the neighbouring provinces, seventeen species have been recorded from Yunnan Province (Bernhauer, 1938; Hua, 2002; Watanabe & Xiao, 1994, 1996, 1997, 2000), one from Guizhou Province (Chen et al. 2005a) and two from Shaanxi Province (Chen et al. 2005b).

In 2006, Hu and Tang made a collecting trip to the Hailuoguo and the Labahe natural reserves and collected a number of *Lathrobium* specimens. Among them, three new species are recognized and reported herein and a checklist of Chinese *Lathrobium* is provided.

Material and methods

All specimens were collected from the leaf litter of in broad-leaved forests by sifting. The following abbreviations are used in the text, with all measurements in millimeters:

body length (BL): length of body from the labral anterior margin to the anal apex;
forebody length (FL): length of the clypeal anterior margin to the elytral apex;
head length (HL): length of head from the clypeal anterior margin to the posterior margin of the head;
head width (HW): maximum width of head;
pronotum length (PL): length of pronotum along midline;
pronotum width (PW): maximum width of pronotum;
elytra length (EL): length of elytra from the apex of the scutellum to the elytral posterior margin.

The type material is deposited in the Insect Collection of Shanghai Normal University, Shanghai, China. (SNUC).

Descriptions

***Lathrobium (Lathrobium) acutissimum* Peng, Li & Zhao, sp. n.**

urn:lsid:zoobank.org:act:F4955AB5-B251-496B-9802-D3D26E6D39AE

http://species-id.net/wiki/Lathrobium_acutissimum

Figs 1A, 2

Type locality. Labahe Natural Reserve, Sichuan Province, Southwest China

Type material (5 ♂♂, 4 ♀♀). Holotype: ♂, labeled ‘**CHINA:** Sichuan Prov. / Tianquan County / Labahe N. R. / 30°09'N, 102°26'E / 30.vii.2006, alt. 2,000 m /

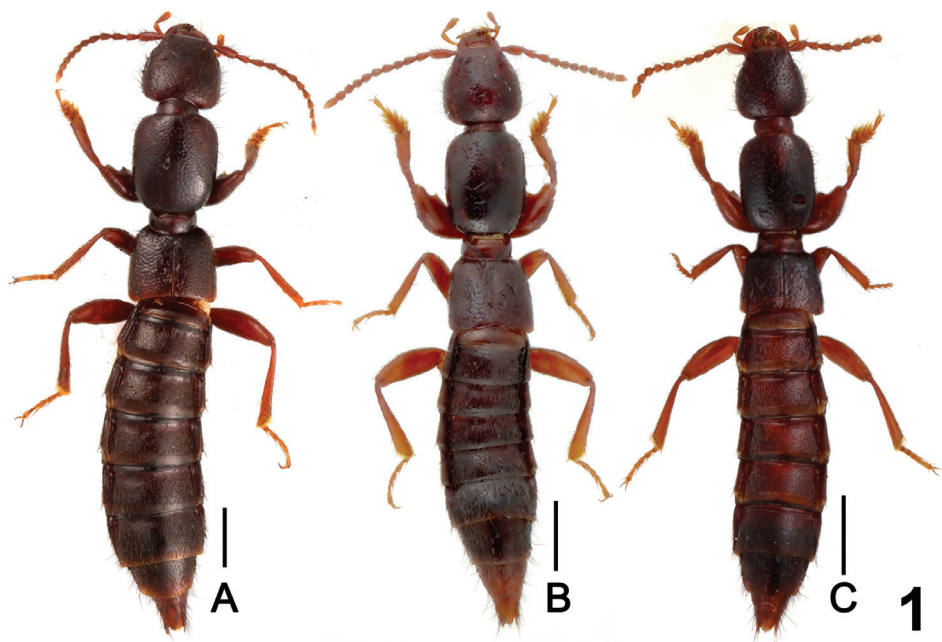


Figure 1. Male habitus of *Lathrobium* spp., **A** *L. acutissimum* **B** *L. hailuogouense* **C** *L. labahense*. Scales: 1.0 mm.

Hu & Tang leg.'. Paratypes: 4 ♂♂, 2 ♀♀, same label data as holotype; 2 ♀♀, same label data, except '29.v.2006'.

Description. Measurements and ratios: BL 8.12–10.00, FL 3.78–4.11, HL 1.18–1.26, HW 1.26–1.31, PL 1.52–1.63, PW 1.30–1.41, EL 0.98–1.05, HL/HW 0.93–0.96, HW/PW 0.94–0.97, HL/PL 0.76–0.79, PL/PW 1.16–1.17, EL/PL 0.64–0.67.

Habitus as in Fig. 1A. Body brown with paler apex, legs brown to light brown, antennae brown to reddish brown.

Head subquadrate (HL/HW 0.93–0.96); punctation coarse and dense; interstices with shallow and netlike microsculpture; eyes small, approximately 1/5–1/4 of length of postocular region in dorsal view.

Pronotum nearly parallel-sided; punctation sparser than that of head; impunctate midline narrow; interstices shining without microsculpture.

Elytra with punctation denser than that of pronotum and well defined; hind wings reduced.

Abdomen with dense punctation; interstices with very shallow, transversely striate microsculpture.

Male. Sternite VII (Fig. 2A) with short, darkish setae in U-shaped postero-median impression; sternite VIII (Fig. 2B) with triangular, symmetrical emargination and short, darkish setae in shallow impression; sternite IX (Fig. 2C) long and nearly symmetrical; aedeagus (Fig. 2D, 2E) with very slender, ventral process.

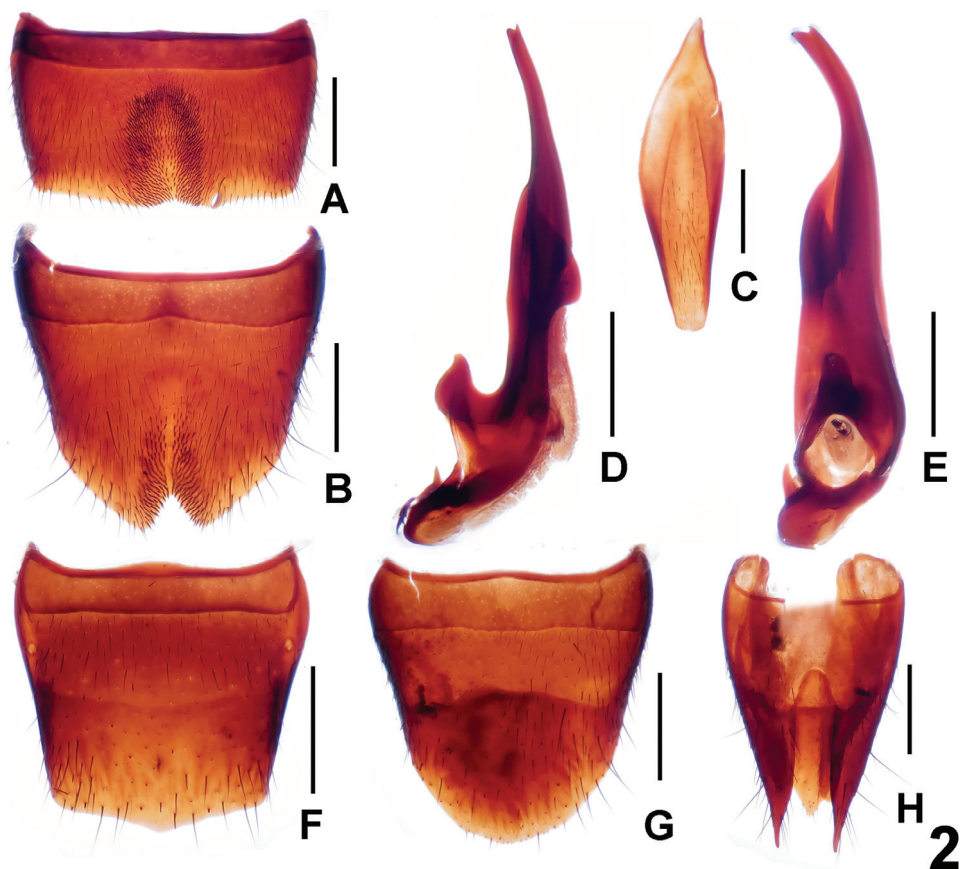


Figure 2. *Lathrobium acutissimum*. **A** male sternite VII **B** male sternite VIII **C** male sternite IX **D** aedeagus in lateral view **E** aedeagus in ventral view **F** female tergite VIII **G** female sternite VIII **H** female tergites IX–X. Scales: 0.5 mm.

Female. Posterior margin of tergite VIII (Fig. 2F) somewhat convex; sternite VIII (Fig. 2G) slightly longer than that of male, posterior margin broadly convex; tergite X (Fig. 2H) not acute basally and not reaching anterior margin of tergite IX (Fig. 2H).

Distribution. Southwest China: Sichuan.

Etymology. The specific epithet (Latin, adjective: sharp) alludes to the apical margin of the male sternite IX.

Remarks. It resembles *Lathrobium lijiangense* Watanabe & Xiao, 1997 from Yunnan in having a similar shape of the male sternite VII. The new species can be readily distinguished from these species by the male sternite VIII with a triangular emargination at the apical margin and by the aedeagus with a much longer ventral process. In *L. lijiangense*, the male sternite VIII has a semi-elliptical emargination at the apical margin and the ventral process of the aedeagus is short.

***Lathrobium (Lathrobium) hailuogouense* Peng, Li & Zhao, sp. n.**

urn:lsid:zoobank.org:act:9D0986A3-9EFF-43D6-9414-3CD35F1F17FC

http://species-id.net/wiki/Lathrobium_hailuogouense

Figs 1B, 3

Type locality. Hailuogou, Sichuan Province, Southwest China**Type material** (10 ♂♂, 13 ♀♀). Holotype: ♂, labeled 'CHINA: Sichuan Prov. / Luding County / Hailuogou / 29°41'N, 102°06'E / 23.vii.2006, alt. 2,200–2,300 m / Hu & Tang leg.'. Paratypes: 4 ♂♂, 4 ♀♀, same label data as holotype; 3 ♂♂, 4 ♀♀, same data, except '29°41'N, 102°07'E / 24.vii.2006, alt. 2,800–3,000 m'; 2 ♂♂, 4 ♀♀, same data, except '27.vii.2006'; 1 ♀, same data, except '28.vii.2006'.**Description.** Measurements and ratios: BL 7.23–8.34, FL 3.34–3.72, HL 1.04–1.11, HW 1.05–1.15, PL 1.39–1.48, PW 1.07–1.20, EL 0.93–1.02, HL/HW 0.94–0.99, HW/PW 0.96–0.99, HL/PL 0.75–0.79, PL/PW 1.23–1.30, EL/PL 0.67–0.69.Habitus as in Fig. 1B. General appearance similar to *L. acutissimum*, except for somewhat smaller body size and sparser punctuation on head and pronotum.

Male. Posterior margin of sternite VII (Fig. 3A) weakly concave; sternite VIII (Fig. 3B) with symmetrical, subtriangular emargination and darkish setae in large, shallow impression; sternite IX (Fig. 3C) asymmetrical; aedeagus (Fig. 3D, 3E) with slender, ventral process and short, dorsal sclerites.

Female. Posterior margin of tergite VIII (Fig. 3F) nearly truncate; sternite VIII (Fig. 3G) much longer than that of male, posterior margin strongly convex; tergite X (Fig. 3H) slender and not reaching anterior margin of tergite IX (Fig. 3H).

Distribution. Southwest China: Sichuan.**Etymology.** The specific epithet of this new species is derived from the type locality "Hailuogou".**Remarks.** The new species resembles *Lathrobium zhangii* Watanabe & Xiao, 1997 from Yunnan in having the posterior margin of the male sternite VII weakly concave and a similar shape of the male sternite VIII. The new species can be readily distinguished from these species by the broad ventral process of the aedeagus in lateral view. In *L. zhangii*, the ventral process of the aedeagus is much narrower in lateral view.***Lathrobium (Lathrobium) labahense* Peng, Li & Zhao, sp. n.**

urn:lsid:zoobank.org:act:06462E31-EB5D-4F33-849E-E224427D4CC6

http://species-id.net/wiki/Lathrobium_labahense

Figs 1C, 4

Type locality. Labahe Natural Reserve, Sichuan Province, Southwest China**Type material** (1 ♂, 1 ♀). Holotype: ♂, labeled 'CHINA: Sichuan Prov. / Tianquan County / Labahe N. R. / 30°09'N, 102°28'E / 31.vii.2006, alt. 2,400–2,600 m / Hu & Tang leg.'. Paratypes: 1 ♀, same label data as holotype.

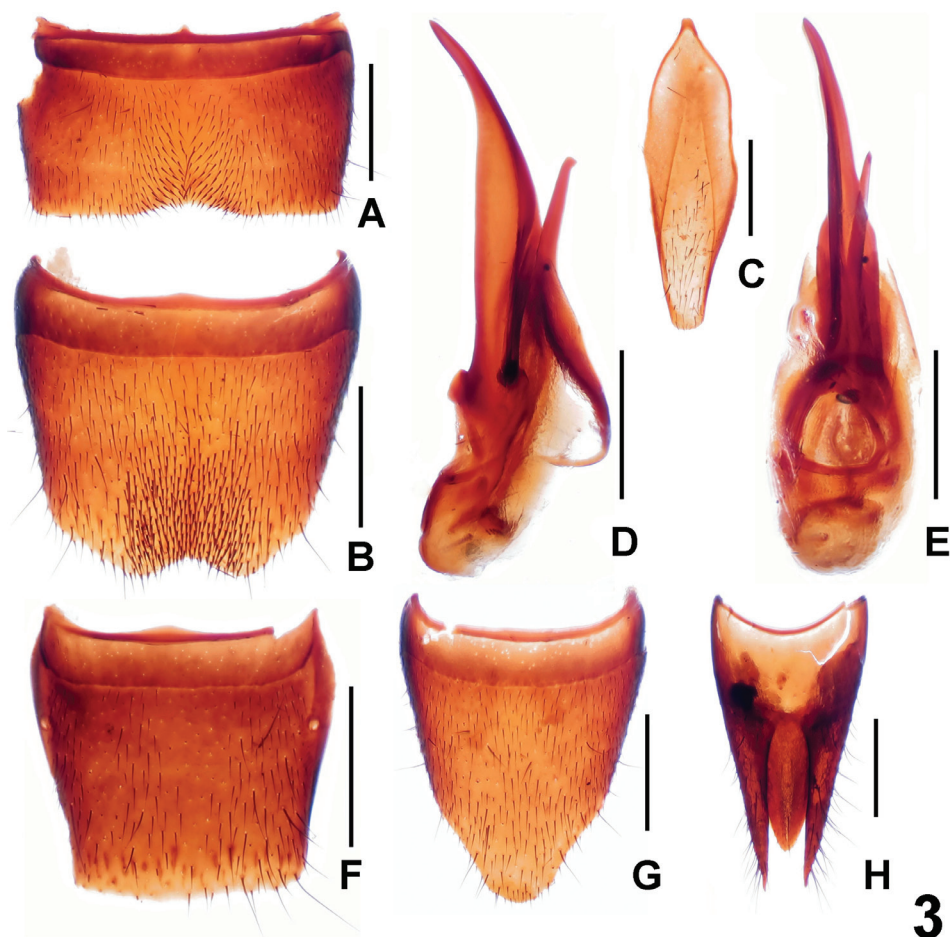


Figure 3. *Lathrobium hailuogouense*. **A** male sternite VII **B** male sternite VIII **C** male sternite IX **D** aedeagus in lateral view **E** aedeagus in ventral view **F** female tergite VIII **G** female sternite VIII **H** female tergites IX–X. Scales: 0.5 mm.

Description. Measurements and ratios: BL 7.02–7.54, FL 2.95–3.06, HL 0.85–0.94, HW 0.88–0.92, PL 1.22–1.25, PW 0.91–0.93, EL 0.78–0.81, HL/HW 0.97–1.02, HW/PW 0.97–0.99, HL/PL 0.70–0.75, PL/PW 1.34, EL/PL 0.64–0.65.

Habitus as in Fig. 1C. Generally similar to *L. acutissimum* except for lighter coloration of legs, smaller body size, and somewhat sparser punctation on head and pronotum.

Male. Posterior margin of sternite VII (Fig. 4A) concave and with short, darkish setae; sternite VIII (Fig. 4B) with semicircular, symmetrical emargination and dense, long setae in shallow impression; sternite IX (Fig. 4C) nearly symmetrical; aedeagus (Fig. 4D, 4E) with long, ventral process and thin, dorsal sclerite.

Female. Posterior margin of tergite VIII (Fig. 4F) weakly convex; sternite VIII (Fig. 4G) much longer than that of male, posterior margin strongly convex; tergite IX (Fig. 4H) not separated from tergite X (Fig. 4H).

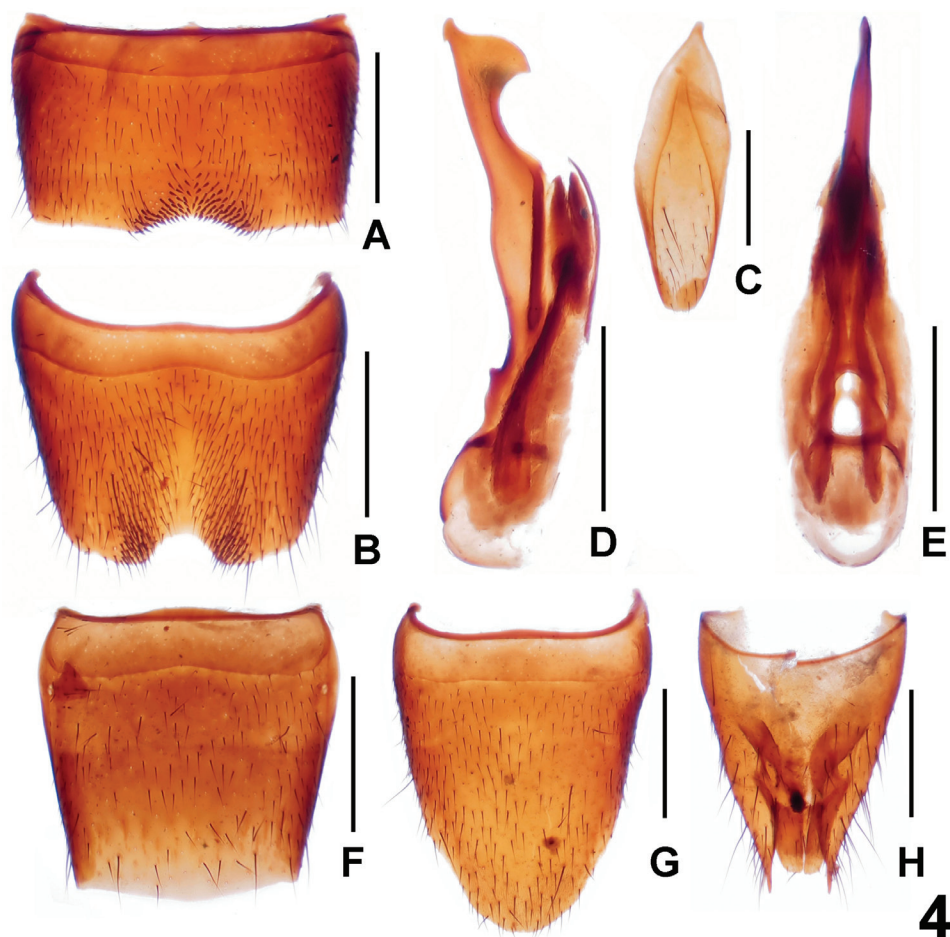


Figure 4. *Lathrobium labahense*. **A** male sternite VII **B** male sternite VIII **C** male sternite IX **D** aedeagus in lateral view **E** aedeagus in ventral view **F** female tergite VIII **G** female sternite VIII **H** female tergites IX–X. Scales: 0.5 mm.

Distribution. Southwest China: Sichuan.

Etymology. The specific epithet of this new species is derived from the type locality “Labahe”.

Remarks. *Lathrobium labahense* resembles *L. watanabei* Schülke, 2002 in having a similar shape of the male sternite VIII, but can be readily separated by the aedeagus with a much longer ventral process.

A checklist of Chinese *Lathrobium*

The checklist is presented in Table 1. The species are arranged alphabetically, and all of them belong to the nominate subgenus. For synonymies see Smetana (2004).

Lathrobium nomurai Nakane, 1955 was listed for the China in Smetana (2004). However, this species is apterous and was originally described from Tsuruoka-Do Cave, Kyushu, Japan. Since it is most unlikely that it could be also found in China, we exclude *L. nomurai* from the list.

The literature references are abbreviated as follows:

A09	Assing (2009)
A10a	Assing (2010a)
A10b	Assing (2010b)
Aip	Assing (in press)
B38	Bernhauer (1938)
C05a	Chen et al. (2005a)
C05b	Chen et al. (2005b)
HE03	Herman (2003)
HU02	Hua (2002)
K46	Kolenati (1846)
L92	Li (1992)
LC90	Li and Chen (1990)
LC93	Li and Chen (1993)
P12a	Peng et al. (2012a)
P12b	Peng et al. (2012b)
Ppp	Peng et al. (present paper)
R11	Ryvkin (2011)
S62	Scheerpeltz (1962)
SCH02	Schülke (2002)
SCR59	Scriba (1859)
SH74	Sharp (1874)
SH89	Sharp (1889)
SM04	Smetana (2004)
W97	Watanabe (1997)
W98	Watanabe (1998)
W99a	Watanabe (1999a)
W99b	Watanabe (1999b)
W05	Watanabe (2005)
W11	Watanabe (2011)
WL92	Watanabe and Luo (1992)
WX94	Watanabe and Xiao (1994)
WX96	Watanabe and Xiao (1996)
WX97	Watanabe and Xiao (1997)
WX00	Watanabe and Xiao (2000)

Table 1. Checklist of Chinese *Lathrobium*. Footnotes: 1: doubtful record (likely misidentification); 2: communicated by Assing (personal communication).

Species	Distribution in China	References
<i>acutissimum</i> sp. n.	Sichuan: Jiajin Shan	Ppp
<i>ailaoshanense</i> Watanabe & Xiao, 1997	Yunnan: Ailao Shan	SM04, WX97
<i>alesi</i> Assing, 2010	Taiwan: Hsuehshan	A10b
<i>alishanum</i> Assing, 2010	Taiwan: Alishan	A10b
<i>anmaicum</i> Assing, 2010	Taiwan: Anmashan	A10b
<i>aokii</i> Watanabe & Xiao, 2000	Yunnan: Diancang Shan	SM04, WX00
<i>baihualingense</i> Watanabe & Xiao, 2000	Yunnan: Gaoligong Shan	SM04, WX00
<i>baizurum</i> Watanabe & Xiao, 2000	Yunnan: Diancang Shan	SM04, WX00
<i>cooteri</i> Watanabe, 1999	Zhejiang: Linglong Shan	SM04, W99b
<i>cylindricum</i> Bernhauer, 1938	Jiangsu: Chinkiang	HU02, B38, SM04
<i>dabeienne</i> Watanabe & Xiao, 1997	Yunnan: Gaoligong Shan	SM04, WX97
<i>daliense</i> Watanabe & Xiao, 1994	Yunnan: Diancang Shan	SM04, WX94
<i>dignum</i> Sharp, 1874	Hubei, Jiangsu ² , Liaoning	HU02, L92, LC93, R11, SH74, SM04
<i>extraculum</i> Assing, 2010	Taiwan: Peitawushan	A10b
<i>follitum</i> Assing, 2010	Taiwan: Peitawushan	A10b
<i>fulvipenne</i> Gravenhorst, 1806	Heilongjiang	SM04
<i>guizhouensis</i> Chen, Li & Zhao, 2005	Guizhou: Fanjing Shan	C05a
<i>hailuogouense</i> sp. n.	Sichuan: Gongga Shan	Ppp
<i>heteromorphum</i> Chen, Li & Zhao, 2005	Shaanxi: Taibai Shan	C05b
<i>houhuanicum</i> Assing, 2010	Taiwan: Houhuanshan	A10b
<i>hunanense</i> Watanabe, 2011	Hunan: Zhangjiacao	W11
<i>imadatei</i> Watanabe, 1992	Zhejiang: Wuyanling	SM04, W92
<i>involutum</i> Assing, 2010	Taiwan: Hsuehshan	A10b
<i>ishiiianum</i> Watanabe & Xiao, 2000	Yunnan: Gaoligong Shan	SM04, WX00
<i>itohi</i> Watanabe & Xiao, 2000	Yunnan: Gaoligong Shan	SM04, WX00
<i>jingyueticum</i> Li & Chen, 1990	Jilin: Jingyuetao	L92, LC90, LC93
<i>jiulongshanense</i> Peng & Li, 2012	Zhejiang: Jiulongshan	P12b
<i>jizushanense</i> Watanabe & Xiao, 1997	Yunnan: Jizu Shan	SM04, WX97
<i>kishimotoi</i> Watanabe, 2011	Hunan: Zhangjiacao	W11
<i>kobense</i> Sharp, 1874 ¹	Jilin?, Hubei?	HU02, LC93, SM04
<i>labahense</i> sp. n.	Sichuan: Labahe	Ppp
<i>lijiangense</i> Watanabe & Xiao, 1997	Yunnan: Yulongxue Shan	SM04, WX97
<i>lingae</i> Peng, Li & Zhao, 2012	Zhejiang: Longwangshan	P12a
<i>lineatocolle</i> Scriba, 1859 ¹	Jilin?	A09, A10a, K46, LC93, SCR59, SM04
<i>lobrathiforme</i> Assing, in press	Yunnan: Gaoligong Shan	Aip
<i>lobrathioides</i> Assing, in press	Sichuan: Jinpo Shan	Aip
<i>longwangshanense</i> Peng, Li & Zhao, 2012	Zhejiang: Longwangshan	P12a
<i>miaoershanum</i> Watanabe, 2011	Guangxi: Maoershan	W11
<i>monilicorne</i> Sharp, 1889 ¹	Jilin?	L92, LC93, SH89, SM04
<i>naxii</i> Watanabe & Xiao, 1996	Yunnan: Yulongxue Shan	SM04, WX96

Species	Distribution in China	References
<i>nenkaoicum</i> Assing, 2010	Taiwan: Nenkaoshan	A10b
<i>pollens</i> Sharp, 1889 ¹	Jilin?	L92, LC93, SM04
<i>rougemonti</i> Watanabe, 1999	Zhejiang: West Tianmu Shan	SM04, W99
<i>semistriatum</i> Scheerpeltz, 1962	Shandong: Taishan	HU02, S62, SM04
<i>shaanxiensis</i> Chen, Li & Zhao, 2005	Shaanxi: Taibai Shan	C05b
<i>shaolaiense</i> Watanabe, 1998	Taiwan: Ta-hsüeh Shan	SM04, W98
<i>sheni</i> Peng & Li, 2012	Zhejiang: Jiulongshan	P12b
<i>shubeii</i> Watanabe & Xiao, 2000	Yunnan: Gaoligong Shan	SM04, WX00
<i>sinense</i> Herman, 2003	Jiangsu: Chinkiang, Yunnan?	B38, HE03, HU02, SM04,
<i>tamurai</i> Watanabe, 1992	Zhejiang: Wuyanling	SM04, W92
<i>tarokoense</i> Assing, 2010	Taiwan: Taroko N. R.	A10b
<i>tianmushanense</i> Watanabe, 1999	Zhejiang: West Tianmu Shan	SM04, W99
<i>tsuifengense</i> Watanabe, 2005	Taiwan: Tsuifeng	W05
<i>uncum</i> Peng, Li & Zhao, 2012	Zhejiang: Longwangshan	P12a
<i>utriculatum</i> Assing, 2010	Taiwan: Peinantashan	A10b
<i>watanabei</i> Schülke, 2002	Sichuan: Daxue Shan	SCH02
<i>xiei</i> Watanabe & Xiao, 2000	Yunnan: Gaoligong Shan	SM04, WX00
<i>yasutoshii</i> Watanabe, 2005	Taiwan: Lishan	W05
<i>yinae</i> Watanabe & Xiao, 1997	Yunnan: Yulongxue Shan	SM04, WX97
<i>yunnanum</i> Watanabe & Xiao, 1994	Yunnan: Laohu Shan	SM04, WX94
<i>zhangii</i> Watanabe & Xiao, 1997	Yunnan: Jizu Shan	SM04, WX97
<i>zhaotixiongii</i> Peng, Li & Zhao, 2012	Zhejiang: Jiulongshan, Majian	P12b

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A taxonomic revision of the genus *Sinotrisus* Yin & Li (Coleoptera, Staphylinidae, Pselaphinae)

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Abstract

The genus *Sinotrisus* Yin & Li, comprising four species, is redefined and revised. Members of *Sinotrisus* are often found with ants of the subfamily Formicinae, or in humid forest habitats. The type species and three new species are (re-)described and illustrated: *S. kishimotoi* Yin & Nomura, **sp. n.** (China: Sichuan), *S. nomurai* Yin, Li & Zhao (type species) (China: Zhejiang), *S. sinensis* Yin & Nomura, **sp. n.** (China: Sichuan) and *S. vietnamensis* Yin & Nomura, **sp. n.** (Vietnam: Lai Chau). A key is included as an aid to distinguishing these species.

Keywords

Coleoptera, Staphylinidae, Pselaphinae, *Sinotrisus*, China, Vietnam, revision

Introduction

Batrissitae (Newton & Thayer, 1995) comprises more than 220 genera distributed in all zoogeographical regions except for New Zealand, and about one-third of them are known from Asia (Newton and Chandler 1989 and subsequent papers). The recently established genus *Sinotrisus* Yin & Li currently contains a single species, *S. nomurai*

Yin, Li & Zhao, from East China (Yin et al. 2010), which is known from two males collected in a nest of the ant genus *Lasius*. A recent examination of the junior author's pselaphine collection revealed three new *Sinotrisus* species from the Oriental region. The need of a generic redefinition of *Sinotrisus* arose immediately after the discovery of the new species. Thus, in this paper we redefine the genus, redescribe the type species, describe the new species and provide illustrations of major diagnostic features of all species. A key is provided to assist in the identification of these species.

The terminology used here is the same as that used by Chandler (2001) in his revision of the genera of Australian Pselaphinae, except we use 'ventrite' instead of 'sternite' when concerning the meso- and metathoracic structures.

A slash (/) is used to separate lines on the same label, and a double slash (//) is used to separate different labels on the same pin.

Measurements are in millimeters; the following acronyms are used in the text: AL—length of the abdomen along the midline; AW—maximum width of the abdomen; BL—length of the body (= HL+PL+EL+AL); EL—length of the elytra along the suture; EW—maximum width of the elytra; HL—length of the head from the anterior clypeal margin to the occipital constriction; HW—width of the head across eyes; PL—length of the pronotum along the midline; PW—maximum width of the pronotum.

Material treated in this study is housed in the following public institutions:

- SNUC** Insect Collection of Shanghai Normal University, Shanghai, P. R. China (Zi-Wei Yin);
NSMT National Museum of Nature and Science, Tokyo, Japan (Shûhei Nomura).

Taxonomy

Sinotrisus Yin & Li, 2010

<http://species-id.net/wiki/Sinotrisus>

Sinotrisus Yin & Li, 2010: 249.

Type species. *Sinotrisus nomurai* Yin, Li & Zhao, 2010 (by original monotypy).

Diagnosis. Head trapezoidal; frontal rostrum low, antennal tubercles moderately raised. Pronotum with median and lateral longitudinal sulci; small antebasal spines present, lacking lateral spines; median longitudinal sulcus broadened posteriorly to form longitudinal impression, usually lacking median antebasal fovea in impression. Elytra with three basal fovea, discal striae shallow, extending to half elytral length. Tergite IV longest, with thick triangular ridge formed by inner and outer marginal carinae.

Redescription. Length 3.0–3.3. Reddish brown. Head trapezoidal; with frontal rostrum low, antennal tubercles moderately prominent; with nude, deep vertexal foveae; occipital margins usually carinate; postocular margins narrowing toward head base; with eleven antennomeres, clubs weakly to distinctly indicated by apical three

antennomeres, ocular-mandibular carinae present; eyes roundly prominent; maxillary palpomeres III triangular, IV narrowed to base in basal half; gular carina present; foveae close in large pit.

Pronotum with distinct lateral longitudinal sulci, median longitudinal sulcus ending posteriorly as broader longitudinal antebasal impression, then followed by short median carina; lateral antebasal foveae distinct; antebasal spines minute or absent, small spines variably present along discal ridges; lateral margins lacking spines; with both inner and outer pair of basolateral foveae present; paranotal carinae at least extending anteriorly to half prosternal length; lateral procoxal foveae present.

Each elytron with three distinct basal foveae, shallow discal stria extending to half elytral length; with complete sutural and marginal striae. Thorax with lateral mesoventral foveae forked, median mesoventral foveae with openings touching, into shared transverse cavity; with large mesocoxal foveae; lateral metaventral foveae present; metaventrite with narrow posteromedian notch. Legs with second and third tarsomeres subsequent in length.

Tergite IV longer than subsequent one, with inner marginal carinae extending entire tergal length, together with outer marginal carinae forming thick triangular ridge; mediobasal sulcus deep between mediobasal foveae, sulcus bracketed by short, tuberculate discal carinae; lateral foveae at mesal and lateral margins of short, deep basolateral sulci; tergite V with thin marginal carinae, punctiform mediobasal and basolateral foveae present; VI with marginal carinae indistinct, mediobasal and inner pair of basolateral foveae as shallow trace; VII with one pair of basolateral foveae and minute lateral tubercles. Sternite IV about twice length of V at midline, with large mediobasal and two pairs of small basolateral foveae; sternites V–VII each with one pair of basolateral foveae. Foveae of abdominal segments V–VII often overlapped by previous segment.

Males with vertex, apices of mesotibiae and metatrochanters modified. Aedeagus with basal bulb greatly constricted basally; paramere fused to median lobe to form ventral lobe; articulated dorsal lobe offset to right side.

Comparative notes. The genus is morphologically similar to *Batrisodes* Reitter of the *Batrisus* genus-group, but does not fit any subgeneric concept *sensu* Park (1951). *Sinotrisus* is here placed as a member of *Tribasodes* group by the males having protuberant metatrochanters and the aedeagus with an articulated dorsal lobe (genus-groups *sensu* Nomura and Idris 2003). The large genus *Batrisodes* holds many Asian species described by Raffray (1894) and Jeannel (1958), but at least some of these need to be re-examined and likely will be moved to other genera of the *Tribasodes* group (Nomura and Idris 2003; Nomura 2007). *Sinotrisus* shares with *Intestinarius* Kurbatov, *Dendrolasiophilus* Nomura and *Majappia* Nomura of the *Tribasodes* group the lack of the pronotal lateral spines. *Intestinarius* was included in the genus *Batrisodes*, but was later treated as a separate genus (Kurbatov 2007). Members of this genus have the head bearing three longitudinal sulci and the pronotum bearing five similar sulci, and have the aedeagus with numerous hairs at the apex of the ventral lobe. *Dendrolasiophilus* and *Majappia* seem to form a smaller group by the derived loss of characters, specifi-

cally the absence of sulci on the pronotum and the frequent loss of basal elytral foveae. *Dendrolasiophilus* has one basal elytral fovea, and lacks elytral discal striae; *Majappia* has the vertexal foveae connected by a transverse sulcus, and completely lacks basal foveae on the elytra. *Sinotrisus* also shares with *Hingstoniella* the constriction of the basal portion of the aedeagus and the similar placement of the male sexual features, but the broadly triangular pronotum lacking antebasal tubercles and foveae, the presence of a large basal elytral fovea, and the lack of carinae on the margins of tergites V–VI in *Hingstoniella* readily separate it from *Sinotrisus*.

***Sinotrisus kishimotoi* Yin & Nomura, sp. n.**

urn:lsid:zoobank.org:act:7432E342-C194-4D16-9139-DD82481DD409

http://species-id.net/wiki/Sinotrisus_kishimotoi

Figs 1–2

Type material. Holotype, male, labeled ‘Huangmaogeng Yakou / (2,710 m). Tianxi Xiang / Meigu Xian // [Sichuan, China] / [same locality data in Chinese] / 5.x.1997, T. kishimoto // HOLOTYPE [red] / *Sinotrisus kishimotoi* sp. n. / Yin and Nomura / det. 2012, NSMT’. Paratypes, 3 females, same label data as holotype, all bearing the following label: ‘PARATYPE [yellow] / *Sinotrisus kishimotoi* sp. n. / Yin and Nomura / det. 2012, NSMT’.

Diagnosis. Vertex strongly modified in male. Antennomeres VII slightly elongate. Pronotum with minute spines along discal ridges; basolateral foveae small. Mesotibiae with apical spur longer than first tarsomeres.

Description. Male (Fig. 1A). Length 3.07. Head (Fig. 2A) slightly wider than long, HL 0.58, HW 0.65; vertex with deep cavity surrounding median triangular rostrum, anterior margin of cavity and posterior margin of rostrum edged by thickened ridge, cavity with tufts of setae at anterolateral margins, surface of rostrum densely setose, rostrum followed by short median carina; each eye composed of about 60 facets; lacking obvious occipital carinae; postocular margins evenly narrowed toward head base; antennomeres IV (Fig. 2B) subequal in length to VI, IX–XI enlarged to form distinct club. Pronotum about as long as wide, PL 0.64, PW 0.63; small median antebasal fovea in fusiform mediobasal impression; paranotal carinae extending half length of prosternum. Elytra slightly wider than long, EL 1.01, EW 1.16; slightly angulate at humeri. Mesotrochanters (Fig. 2C) with short, thick ventral spine; mesotibiae with apical spur (Fig. 2D) longer than first tarsomeres; metatrochanters (Fig. 2E) with broad, blunt elongate protuberance at ventral side. Abdomen wider than long, AL 0.84, AW 1.03; sternites IV with small triangular mediobasal ridge, V–VII with such ridge successively smaller. Aedeagus (Figs 2F–I) well-sclerotized, length 0.38.

Female (Fig. 1B). Similar to male in general, vertex and legs not modified. BL 3.05–3.12, HL 0.59–0.60, HW 0.67–0.68, PL 0.66–0.67, PW 0.64–0.66, EL 0.97–0.99, EW 1.16–1.18, AL 0.83–0.86, AW 1.07–1.10. Each eye composed of about 55 facets. Genital complex well-sclerotized (Figs 2J–K).

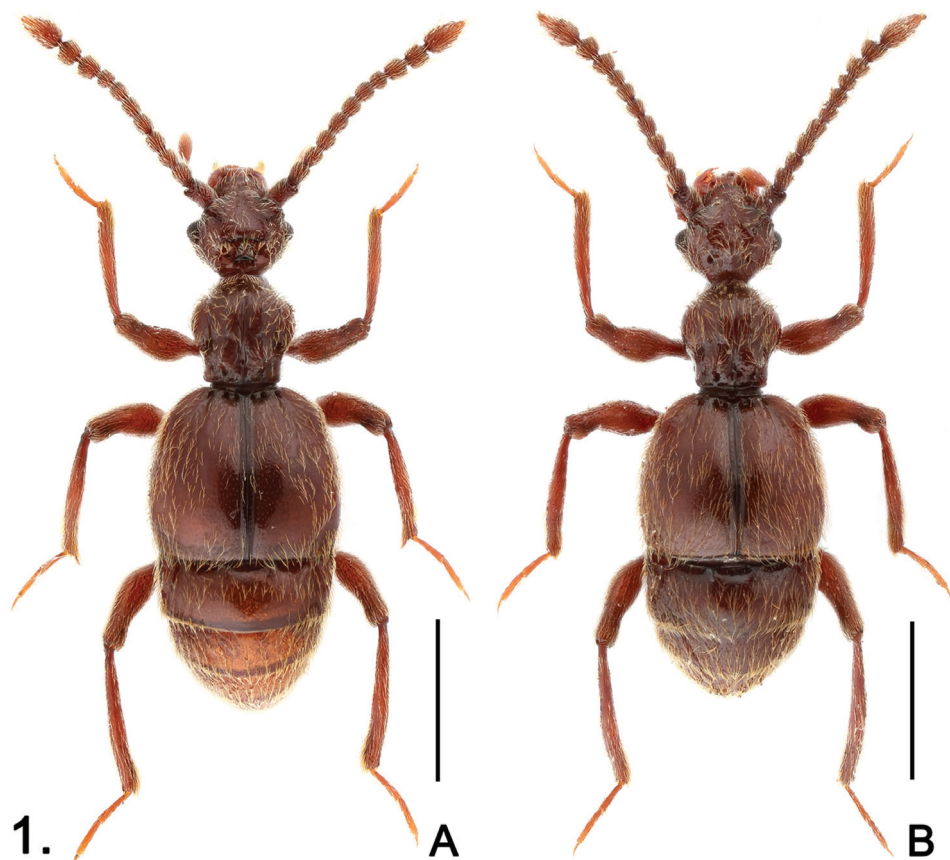


Figure 1. Habitus of *Sinotrisus kishimotoi* **A** male **B** female. Scales (mm): 1.0.

Distribution. Southwest China: Sichuan.

Host ant. *Formica* sp.

Etymology. Named after the collector of the holotype, T. kishimoto.

***Sinotrisus nomurai* Yin, Li & Zhao**

http://species-id.net/wiki/Sinotrisus_nomurai

Fig. 3

Sinotrisus nomurai Yin, Li & Zhao, 2010: 251.

Type material examined. Holotype, male, labeled 'China: Zhejiang Prov. / W. Tianmushan Mt. / firebreak / 01.v.2009, 1,400 m / Xiao-Bing SONG leg. // HOLOTYPE

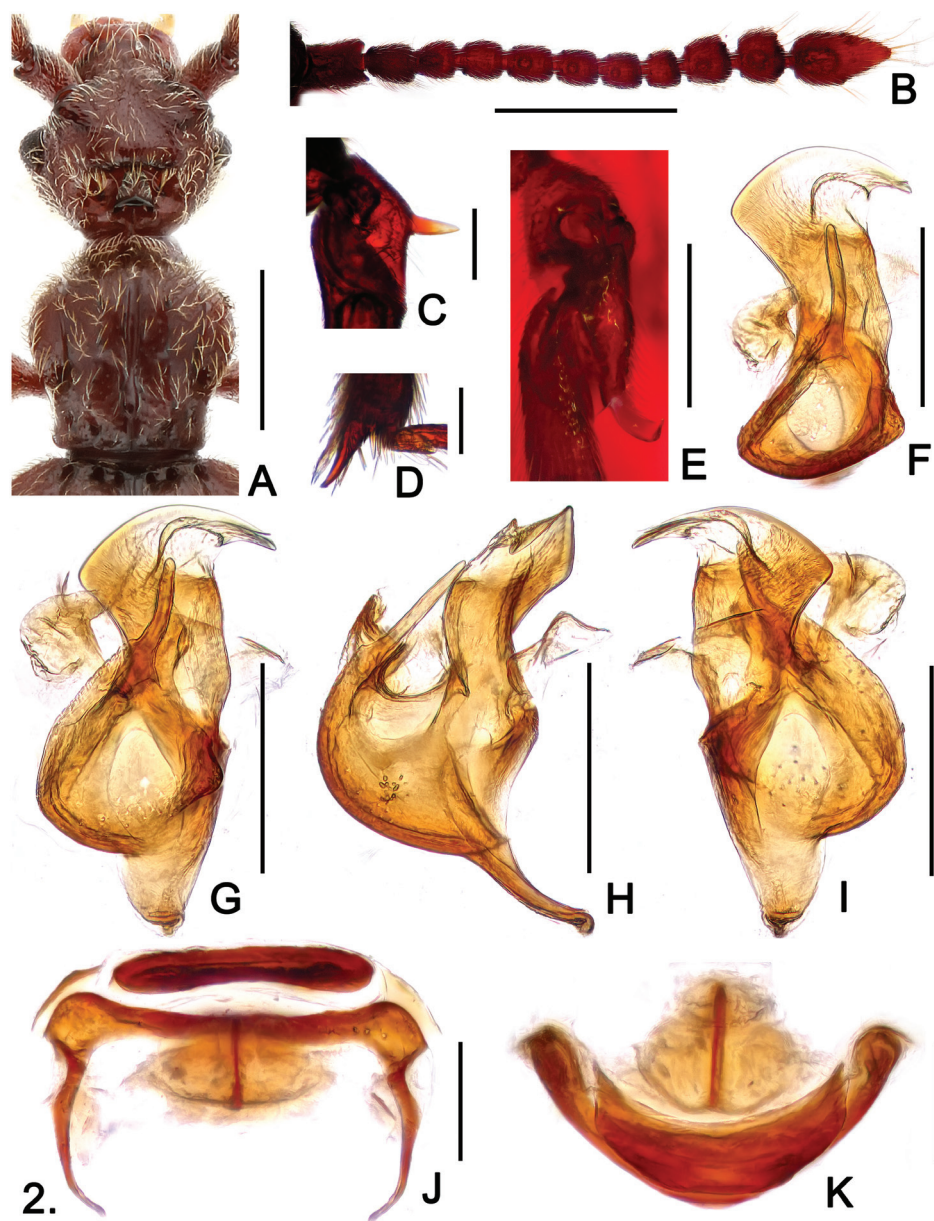


Figure 2. *Sinotrisus kishimotoi* **A** head and pronotum **B** antenna. **C** mesotrochanter **D** apex of mesotibia **E** metatrochanter **F** aedeagus, in top view **G** same, in dorsal view **H** same, in lateral view. **I** same, in ventral view **J** female genital complex, in dorsal view **K** same, in top view. Scales (mm): **A**, **B** = 0.5; **C**, **D**, **E**, **J**, **K** = 0.1; **F**, **G**, **H**, **I** = 0.2.

[red] / *Sinotrisus nomurai* sp. n. / Yin and Li / det. 2010, SNUC'. Paratype, male, same label data as holotype, with the following label: 'PARATYPE [yellow] / *Sinotrisus nomurai* sp. n. / Yin and Li / det. 2012, SNUC'.

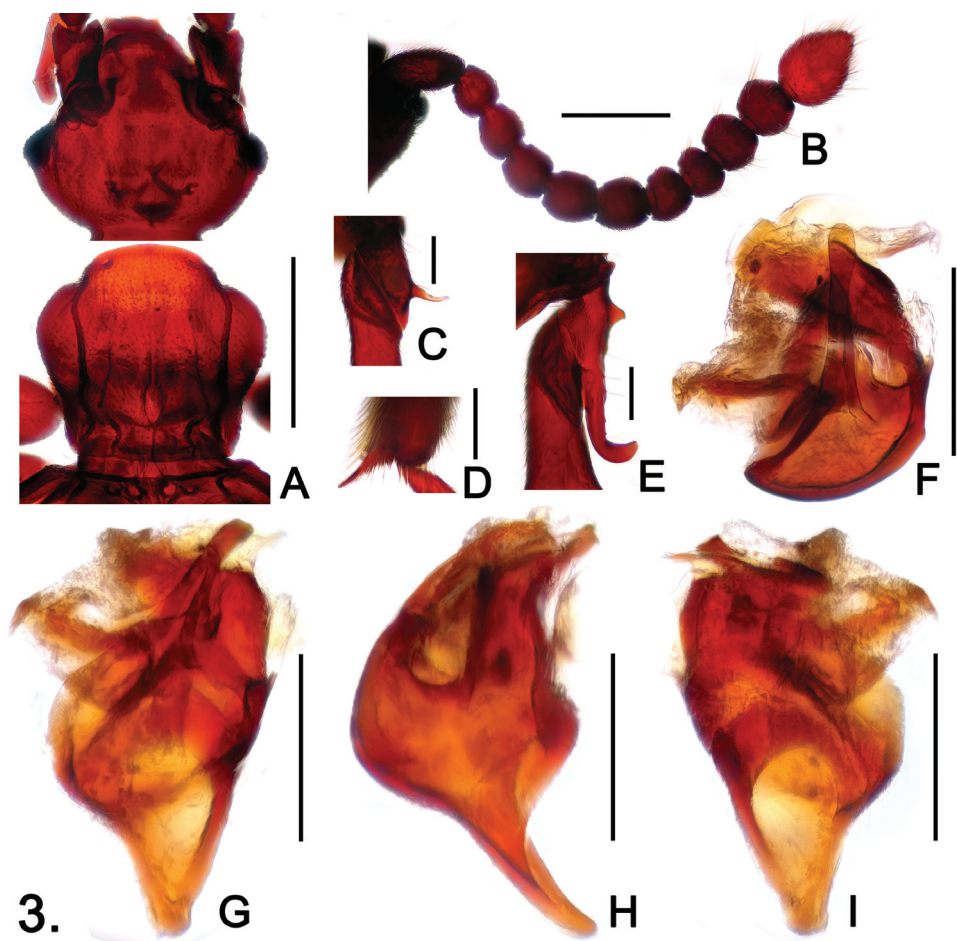


Figure 3. *Sinotrisus nomurai* **A** Head and pronotum **B** antenna **C** mesotrochanter **D** apex of mesotibia **E** metatrochanter **F** aedeagus, in top view **G** same, in dorsal view **H** same, in lateral view **I** same, in ventral view. Scales (mm): **A** = 0.5; **B** = 0.3; **C**, **D**, **E** = 0.1; **F**, **G**, **H**, **I** = 0.2.

Diagnosis. Vertex modified in the male. Antennomeres VII transverse. Pronotum lacking spines along discal ridges; basolateral foveae broad. Mesotibiae with one tiny and one long apical spur.

Redescription. Male. Length 3.30. Head (Fig. 3A) wider than long, HL 0.57, HW 0.71; surface convex anterior and posterior to vertexal foveae, forming median angulate projection; with distinct occipital carinae; postocular margins evenly narrowed toward head base; antennomeres IV (Fig. 3B) smaller than VI, IX–X transverse, XI nearly oval, clubs indistinct. Pronotum about as long as wide, PL 0.66, PW 0.68; mediobasal impression longitudinally oval, lacking median antebasal fovea; paranotal carinae extending through length of prosternum. Elytra slightly wider than long, EL 1.06, EW 1.18; angulate at humeri. Mesotrochanters (Fig.

3C) with long ventral spine slightly curved toward base in apical half; mesotibiae with apical spur (Fig. 3D) longer than first tarsomeres; metatrochanters (Fig. 3E) with blunt triangular tubercle and large elongate protuberance at ventral side. Abdomen slightly wider than long, AL 0.96, AW 1.08; tergites and sternites V–VII with basolateral ridges successively shorter and thinner. Aedeagus (Figs 3F–I) well-sclerotized, length 0.42.

Female. Unknown.

Distribution. East China: Zhejiang.

Host ant. *Lasius* sp.

***Sinotrisus sinensis* Yin & Nomura, sp. n.**

urn:lsid:zoobank.org:act:5536F78C-5ECA-4399-AFA8-FF78B62E1E59

http://species-id.net/wiki/Sinotrisus_sinensis

Figs 4A, 5

Type material. Holotype, male, labeled ‘Majiagou (3,140 m) / Kangding Xian / [Sichuan, China] / [same locality data in Chinese] / 9.ix.1998 / Toshio Kishimoto leg. // HOLOTYPE [red] / *Sinotrisus sinensis* sp. n. / Yin and Nomura / det. 2012, NSMT’.

Diagnosis. Vertex modified in male. Antennomeres VII elongate. Pronotum with indistinct spines along discal ridges; basolateral foveae punctiform. Mesotibiae with one tiny and another larger apical spur, larger spur shorter than first tarsomeres.

Description. Male (Fig. 4A). Length 3.20. Head (Fig. 5A) wider than long, HL 0.61, HW 0.66; vertex with foveae in broad median ‘∞’-shaped cavity, cavity densely setose at anterior margin; lacking occipital carinae; postocular margins parallel for short distance beneath eyes, then evenly narrowed toward head base; antennomeres IV (Fig. 5B) slightly shorter than VI, clubs formed by apical three antennomeres, IX–X nearly quadrate, XI elongate, narrowed toward apex in apical half. Pronotum slightly longer than wide, PL 0.65, PW 0.62; median longitudinal sulcus slightly widened to form oval antebasal impression, lacking median antebasal fovea; paranotal carinae extending through length of prosternum. Elytra slightly wider than long, EL 1.02, EW 1.17; slightly angulate at humeri. Mesotrochanters (Fig. 5C) with thick, short ventral spine; mesotibiae with apical spur (Fig. 5D) shorter than first tarsomeres; metatrochanters (Fig. 5E) with large elongate ventral projection. Abdomen slightly wider than long, AL 0.92, AW 1.05; sternites IV–VI with triangular mediobasal and basolateral ridges successively shorter and thinner. Aedeagus (Figs 5F–I) well-sclerotized, length 0.41.

Female. Unknown.

Distribution. Southwest China: Sichuan.

Host ant. *Formica* sp.

Etymology. Named after the country where the type locality lies.

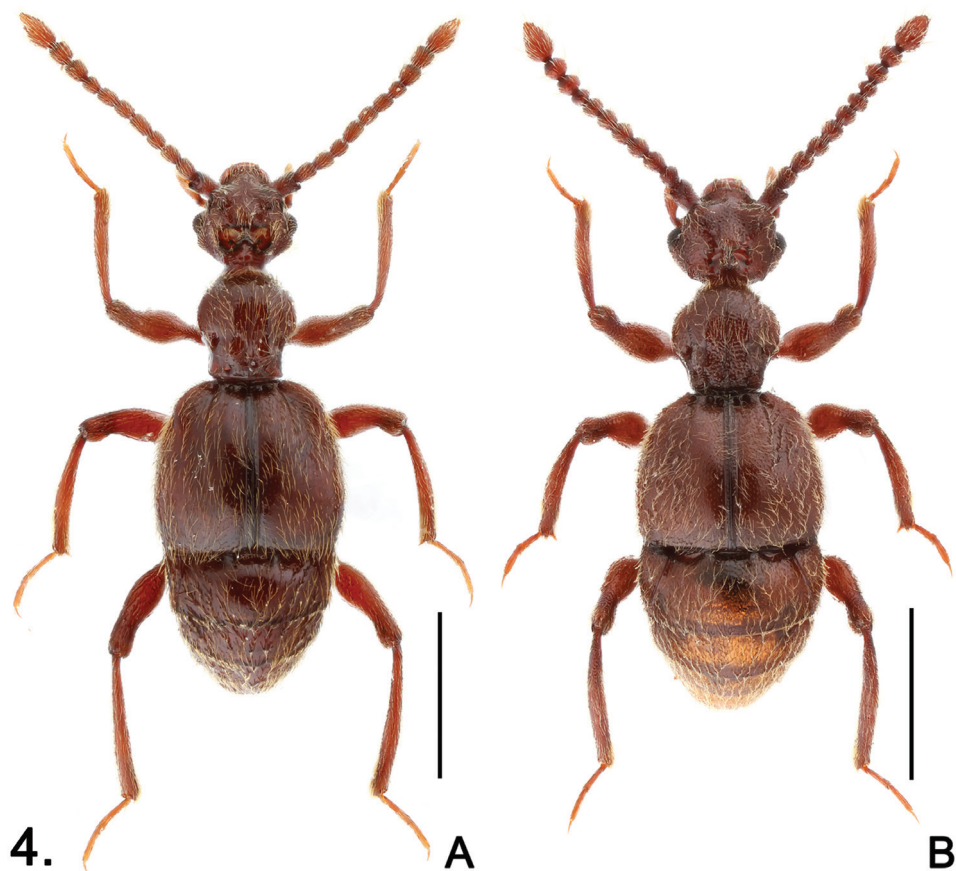


Figure 4. Habitus of *Sinotrisus*. **A** *S. sinensis* **B** *S. vietnamensis*. Scales (mm): 1.0

***Sinotrisus vietnamensis* Yin & Nomura, sp. n.**

urn:lsid:zoobank.org:act:0E6979F9-99FC-408B-BBF3-038C82E92618

http://species-id.net/wiki/Sinotrisus_vietnamensis

Figs 4B, 6

Type material. Holotype, male, labeled 'Mt. Phang Si Pang (moss: / 2,000 m). Lai Chau Prov. / [N. VIETNAM] / 17.v.2003, S. Nomura leg. // HOLOTYPE [red] / *Sinotrisus vietnamensis* sp. n. / Yin and Nomura / det. 2012, NSMT'.

Diagnosis. Vertex modified in male. Antennomeres VII greatly transverse. Pronotum lacking spines along discal ridges; basolateral foveae small. Mesotibiae with apical spur about as long as first tarsomeres.

Description. Male (Fig. 4B). Length 3.00. Head (Fig. 6A) distinctly wider than long, HL 0.57, HW 0.71; frons convex medially, extending posteriorly to anterior mar-

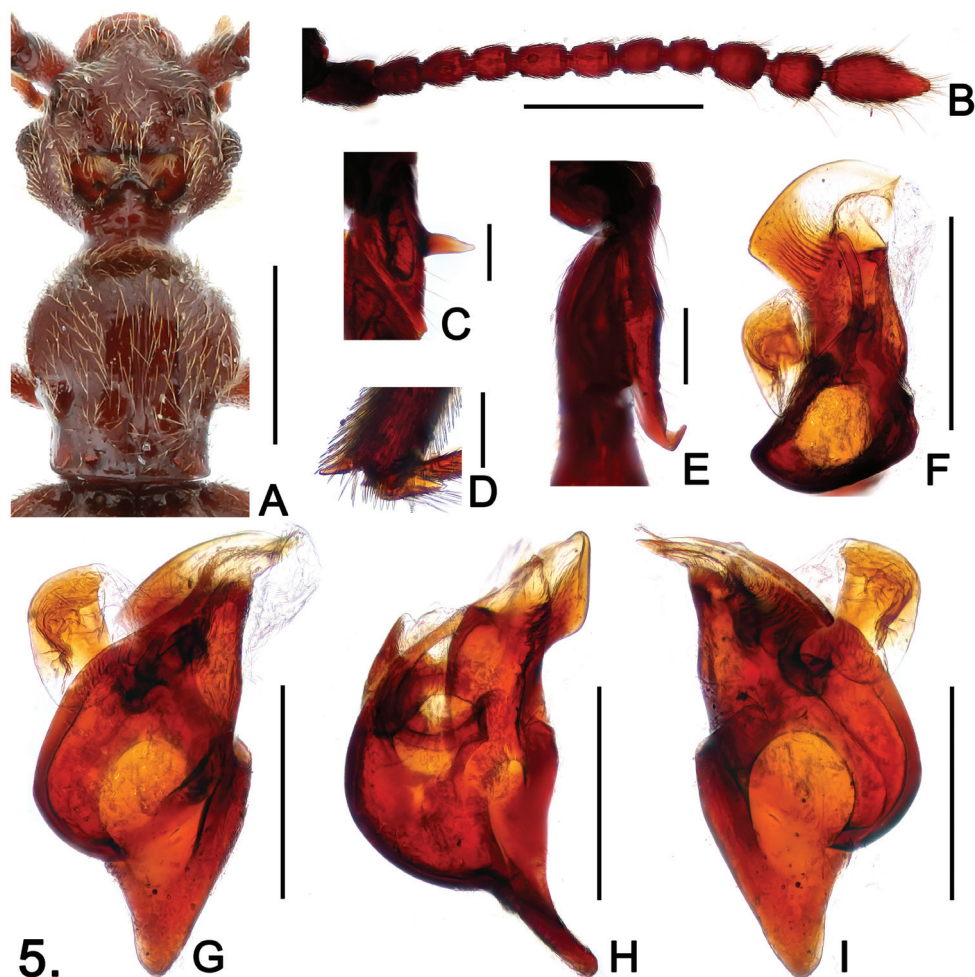


Figure 5. *Sinotrisus sinensis* **A** head and pronotum **B** antenna **C** mesotrochanter **D** apex of mesotibia **E** metatrochanter **F** aedeagus, in top view **G** same, in dorsal view **H** same, in lateral view **I** same, in ventral view. Scales (mm): **A**, **B** = 0.5; **C**, **D**, **E** = 0.1; **F**, **G**, **H**, **I** = 0.2.

gin of vertexal cavity; shallow transverse cavity with large foveae, area posterior to cavity strongly raised medially to form rostrum, densely covered with setae; with distinct occipital carinae; postocular margins evenly narrowed toward head base; antennomeres IV (Fig. 6B) about same length as VI, clubs formed by apical three antennomeres, IX strongly transverse, X slightly longer than IX, XI nearly oval, narrowed toward apex in apical half. Pronotum about as long as wide, PL 0.63, PW 0.65; median longitudinal sulcus slightly widened posteriorly to form shallow oval antebasal impression, lacking median antebasal fovea; paranotal carinae extending through length of prosternum. Elytra slightly wider than long, EL 0.92, EW 1.13; barely angulate at humeri. Mesotrochanters (Fig. 6C) with long basoventral spine; mesotibiae with apical spur (Fig. 5D) about same length of first tarsomeres; metatrochanters (Fig. 6E) broadly expanded ventrally, with

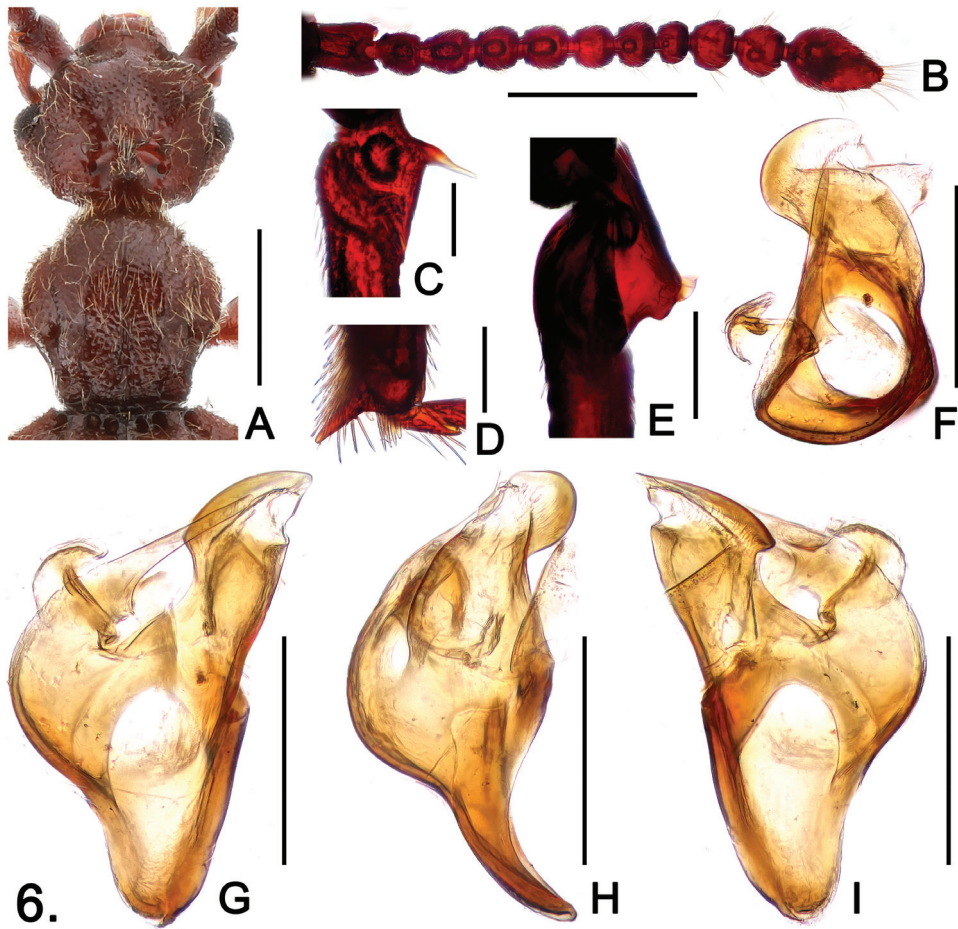


Figure 6. *Sinotrisus vietnamensis* **A** head and pronotum **B** antenna **C** mesotrochanter **D** apex of mesotibia **E** metatrochanter **F** aedeagus, in top view **G** same, in dorsal view **H** same, in lateral view **I** same, in ventral view. Scales (mm): **A**, **B** = 0.5; **C**, **D**, **E** = 0.1; **F**, **G**, **H**, **I** = 0.2.

small blunt tubercle at ventral margin. Abdomen slightly wider than long, AL 0.88, AW 1.10; segments lacking basal ridges. Aedeagus (Figs 6F–I) well-sclerotized, length 0.39.

Female. Unknown.

Distribution. Vietnam: Lai Chau.

Habitat. The individual was collected from a pile of moist moss.

Etymology. Named after the country where the type locality lies.

Key to males

- 1 Antennomeres VII strongly transverse (Figs 3B, 6B) 2
- Antennomeres VII slightly to moderately elongate (Figs 2B, 5B) 3

- 2 Antennomeres VI slightly larger than V (Fig. 3B); metatrochanters with small triangular spine and large elongate protuberant at ventral margin (Fig. 3E); ventral spine of mesotrochanters curved basally in apical half (Fig. 3C). (China: Zhejiang) ***S. nomurai* Yin, Li & Zhao**
- Antennomeres VI slightly smaller than V (Fig. 6B); metatrochanters broadly expended ventrally, with small, blunt ventral tubercle (Fig. 6E); ventral spine of mesotrochanters not curved in apical half (Fig. 6C). (Vietnam: Lai Chau) ***S. vietnamensis* sp. n.**
- 3 Postocular margins parallel for a short distance beneath eyes, then straightly narrowed toward head base (Fig. 5A); pronotum lacking spines along discal carinae (Fig. 5A); mesotibiae with apical spur shorter than first tarsomere (Fig. 5D). (China: Sichuan) ***S. sinensis* sp. n.**
- Postocular margins evenly narrowed toward head base (Fig. 2A); pronotum with two pairs of minute spines along discal carinae (Fig. 2A); mesotibiae with apical spur longer than first tarsomere (Fig. 2D). (China: Sichuan) ***S. kishimotoi* sp. n.**

Acknowledgements

All the collectors mentioned in the text are thanked for their efforts in the field. Two anonymous reviewers critically read an earlier draft and provided helpful comments. The present study was supported by the National Natural Science Foundation of China (No. 31172134) and Shanghai Normal University (No. SK201242).

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A review of the spider genus *Haplodrassus* Chamberlin, 1922 in Crimea (Ukraine) and adjacent areas (Araneae, Gnaphosidae)

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Abstract

Eight species of *Haplodrassus* are recorded from Crimea: *H. bohemicus* Miller & Buchar, 1977; *H. dalmatensis* (L. Koch, 1866); *H. isaevi* Ponomarev & Tsvetkov, 2006; *H. minor* (O. P.-Cambridge, 1879); *H. kulczynskii* Lohmander, 1942; *H. pseudosignifer* Marusik, Hippa & Koponen, 1996; *H. signifer* (C.L. Koch, 1839) and *H. umbratilis* (L. Koch, 1866). The occurrence of *H. cognatus* (Westring, 1861) in Crimea has not been confirmed. *Haplodrassus bohemicus* is a new species record for the Crimean fauna. *Haplodrassus pseudosignifer* is a new species record for Crimea and Ukraine as a whole, with Crimea as the westernmost point of its distribution range. *Haplodrassus invalidus* is recorded for the first time for the fauna of Azerbaijan, Caucasus and the former Soviet Union. Azerbaijan is the easternmost point of its known distribution range. All Crimean *Haplodrassus* species have only one peak of activity of adult specimens during the year. In Crimea we found syntopically two closely related species *H. dalmatensis* and *H. isaevi* in two localities (Sudak Distr., 10 km W Sudak, Mezhdurechie Vill., steppe; and Feodosiya Distr., Karadag Nature Reserve, steppes). These species differ in their phenology. The reproductive period of *H. dalmatensis* is in May–July, and that of *H. isaevi* occurs is in October–December. These phenological differences probably represent an additional mechanism of reproductive isolation between the two species. Diagnostic drawings are provided for all mentioned species as well as for *H. deserticola* Schmidt & Krause, 1996 and *H. pugnans* (Simon, 1880).

Keywords

Haplodrassus, Crimea, Ukraine, Azerbaijan, Kazakhstan, redescrptions, fauna, phenology

Introduction

Haplodrassus Chamberlin, 1922 with 65 species is a relatively large gnaphosid genus distributed in the Holarctic and India (Platnick 2012). The genus has been well revised for species that occur in North America (9 species) (Platnick and Shadab 1975), Central Europe (10 species) (Grimm 1985), Israel (8 species) (Levy 2004, 2009), China (8 species) (Song et al. 2004) and Japan (6 species) (Kamura 2007). However, in the Mediterranean region and Central Asia, the genus remains poorly studied.

In the former Soviet Union 21 species have been recorded to date (Mikhailov 1997; Tuneva 2005; Ponomarev and Tsvetkov 2006; Marusik et al. 2007; Ponomarev 2008; Ponomarev et al. 2008), with six of them reported from Crimea (Kovblyuk 2006, 2011). While identifying gnaphosid material collected in Crimea during the last few years we recognized two additional species. During our research to identify them we studied *Haplodrassus* species known from adjacent territories and found one species new to the fauna of Caucasus. Some of the species occurring in Crimea are relatively poorly known, and/or closely resemble widespread species. Therefore, this paper aims to illustrate all of the species found in the Crimea and those from adjacent territories. In addition, we provide data for the distribution and seasonal activity dynamics of adult *Haplodrassus* specimens in Crimea, a key to all Crimean species.

Material and methods

Microphotographs were made using an SEM Jeol JSM-5200 in the Zoological Museum, University of Turku, Finland. Photographs were taken in dishes of different sizes with paraffin at the bottom. Specimens were photographed using an Olympus Camedia E-520 camera attached to an Olympus SZX16 stereomicroscope at the Zoological Museum, University of Turku. Digital images were montaged using “CombineZM” image stacking software.

Coloration was described from specimens preserved in an ethanol/water solution. Leg segments were measured after detaching them from the cephalothorax. All measurements are in mm: minimum-maximum; a figure in brackets represents the average. Illustrations were made using both reflecting- and transmitted-light microscopes. All scale bars equal 0.1 mm.

The morphological terminology follows Platnick and Shadab (1975) and Levy (2004). In the text we provide references only to the most useful publications, including books and revisions.

All specimens treated in this study are held in the following collections: CP – personal collection of A.V. Ponomarev (Rostov-on-Don, Russia); EMZ – personal collection of E.M. Zhukovets (Minsk, Belarus); ISEA – Siberian Zoological Museum, Institute for Systematics and Ecology of Animals, Novosibirsk, Russia, G.N. Azarkina; TNU – Zoology Department, V.I. Vernadsky Taurida National University, Simferopol, Ukraine (M.M. Kovblyuk); ZMMU – Zoological Museum of the Moscow State

University, Moscow, Russia, K.G. Mikhailov; ZMT – Zoological Museum, University of Turku, Finland (S. Koponen); YMC – Yuri M. Marusik's temporary collection in the Zoological Museum, University of Turku, Finland.

The following abbreviations are used in the text: AM, AL, PM, PL – anterior median, anterior lateral, posterior median and posterior lateral eyes; RTA – retrolateral tibial apophysis.

Key to *Haplodrassus* species found in Crimea

Males

- 1 Terminal apophysis toothed (Fig. 37).....*H. kulczynskii*
- Terminal apophysis with 1–2 or without teeth 2
- 2 Total length ≤ 4 mm, carapace length ≤ 2 mm *H. minor*
- Total length more than 4 mm, carapace longer than 2 mm 3
- 3 Terminal apophysis with plate-like bulge (Fig. 81) *H. umbratilis*
- Terminal apophysis without plate-like bulge 4
- 4 Terminal apophysis with 1–2 teeth (Figs 23, 26) 5
- Terminal apophysis without teeth (Figs 2, 5, 69, 72) 6
- 5 Terminal apophysis with 1 tooth, embolus without tooth (Fig. 26), metatarsus I with 2 ventral spines *H. isaevi*
- Terminal apophysis with 2 teeth, embolus with tooth (Fig. 23), metatarsus I without ventral spines *H. dalmatensis*
- 6 RTA with dorsal “step”-like keel (Figs 1, 4), embolus without tooth (Figs 2, 5) *H. bohemicus*
- RTA without “step”-like keel (Figs 68, 71), embolus with tooth (Figs 69, 72) ... 7
- 7 Terminal apophysis short (Fig. 69), length/width ratio ca 2 *H. pseudosignifer*
- Terminal apophysis long (Fig. 72), length/width ratio ca 3 *H. signifer*

Females

- 1 Epigynal pockets with long protrusion directed anteriorly (Fig. 38) *H. kulczynskii*
- Epigynal pockets without long protrusion 2
- 2 Body length ≤ 5 mm, carapace ≤ 2 mm *H. minor*
- Body longer than 5 mm, carapace longer than 2 mm 2
- 3 Epigynal fovea constricted anteriorly (Figs 28, 30) 4
- Epigynal fovea not constricted anteriorly 5
- 4 Epigynal fovea with septum, fovea wider than spermathecae (Fig. 28), metatarsus IV with 3 retrolateral spines *H. dalmatensis*

- Epigynal fovea without septum, fovea narrower than spermathecae (Fig. 30), metatarsus IV with 4–5 retrolateral spines.....*H. isaevi*
- 5 Spermathecae oval (Figs 82–83).....*H. umbratilis*
- Spermathecae globular 6
- 6 Fovea without longitudinal groove (Figs 10, 12) *H. bohemicus*
- Fovea with long longitudinal groove (Figs 75–78)..... 7
- 7 Fovea rectangular (longer than wide) (Fig. 75) *H. pseudosignifer*
- Fovea square-shaped (length subequal to width) (Fig. 77) *H. signifer*

Survey of species

Haplodrassus Chamberlin, 1922

<http://species-id.net/wiki/Haplodrassus>

Type species: *Drassus hiemalis* Emerton, 1909.

Diagnosis. Male palp with large terminal apophysis, thick embolus, hooked median apophysis and RTA flattened, often shifted dorsally. Epigyne with thick sclerotized lateral pockets and with one anterior hood. Posterior median eyes close together, separated by their radius or less (Platnick and Shadab 1975; Levy 2004). *Haplodrassus* is most related to *Orodassus* Chamberlin, 1922 with three species from the Nearctic, but differs by having a flattened RTA (bifid or laterally expanded in *Orodassus*), lacking a median epigynal projection (present in *Orodassus*) and by the presence of lateral epigynal sclerites (absent in *Orodassus*) (Platnick and Shadab 1975).

In terms of habitus and coloration *Haplodrassus* resembles only two other genera that occur in Crimea and the eastern Mediterranean: *Parasyrisca* Schenkel, 1963 and, to a lesser extent, *Drassodes* Westring, 1851. However, *Haplodrassus* is easily distinguished by having a large terminal apophysis (absent in the other genera), a flat retrolateral tibial apophysis widened dorsally (conical or flat and tapering in *Drassodes* and *Parasyrisca*), a broad embolus (cylindrical or hidden in the other genera), and the presence of heavily sclerotized lateral epigynal pockets (absent in *Drassodes* and *Parasyrisca*).

Distribution. Holarctic and India (Platnick 2012).

Haplodrassus bohemicus Miller & Buchar, 1977

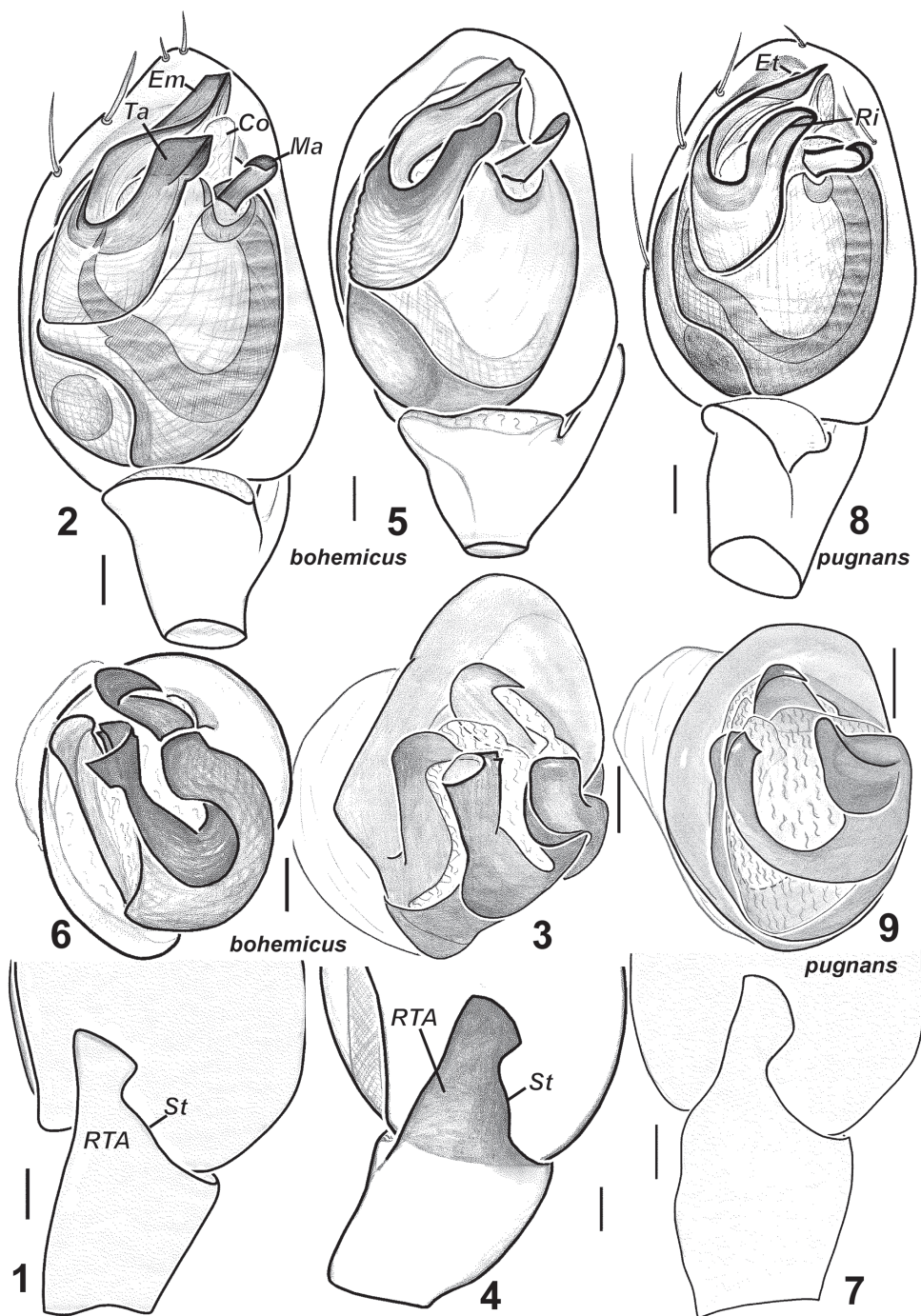
http://species-id.net/wiki/Haplodrassus_bohemicus

Figs 1–6, 10–12

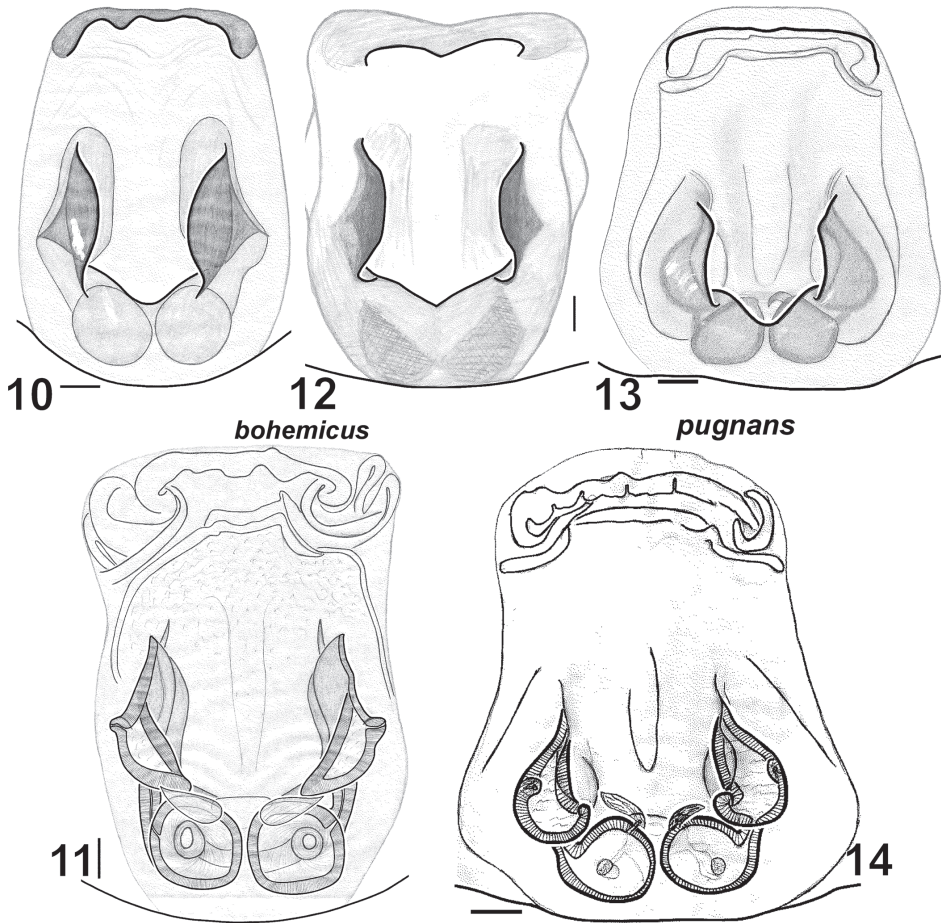
H. b. Miller and Buchar 1977: 163, pl. II, f. 1–6 (♂♀).

H. b.: Stefanovska et al. 2008: 37, f. 10–15 (♂♀).

Material. UKRAINE, CRIMEA: Saky Distr.: 12 ♂♂, 2 ♀♀ (TNU), near Pribrezh-naya railway station, 30.04.–24.06.2000, M.M. Kovblyuk.



Figures 1–9. Males of *Haplodrassus bohemicus* (1–3 from Rostov Area, 4–6 from Crimea) and *H. pugnans* (7–9 from Magadan Area): 1, 4, 7 RTA, retrolateral view 2, 5, 8 palp, ventral view 3, 6, 9 bulbus, apical view. Abbreviations: *Co* conductor; *Em* embolus; *Et* tooth of embolus; *Ma* median apophysis; *Ri* ridge of terminal apophysis; *RTA* retrolateral tibial apophysis; *St* "step"-like keel of RTA; *Ta* terminal apophysis.



Figures 10–14. Females of *Haplodrassus bohemicus* (10–11 from Rostov Area, 12 from Crimea) and *H. pugnans* (13–14 from Magadan Area): 10, 12–13 epigyne, ventral view 11, 14 epigyne, dorsal view.

Additional material. UKRAINE. Nikolaev Area: 6 ♂♂ (TNU), Pervomaysky Distr., Kuripchane Vil., 5.05.–8.06.2006, N.Yu. Polchaninova. Kherson Area: 2 ♂♂, 2 ♀♀ (TNU), Henichesk Distr., Arabatskaya strelka, 4 km S Henichesk Town, 23.05.–10.06.2011, N.A. Stasyuk. Donetsk Area: 4 ♂♂ (TNU), Pershotravnevy Distr., Belosaraiskaya Kosa, 11–22.06.2001, E.V. Prokopenko; 2 ♂♂ (TNU), Novozovsk Distr., Khomutovo Vil., “Khomutovskaya Steppe”, N47°16', E38°10', 15–20.06.2004, N.Yu. Polchaninova; 1 ♂ (TNU), Slavyansky Distr., Svyatogorsk Town, N49°02', E37°39', 8–30.06.2004, N.Yu. Polchaninova. RUSSIA. Rostov Area: 7 ♂♂, 1 ♀ (TNU), Ust'-Donetsk Distr., near Razdorskaya Vil., «Pukhlyakovskye sklony», 10.05.–28.06.2004, A.V. Ponomarev.

Comparative material. *Haplodrassus pugnans* (Simon, 1880): RUSSIA, Magadan Area: 1 ♂, 3 ♀♀ (ISEA, БИ-930), Ten'kynskiy Distr., env. Sibit-Tyellakh, Aborigen Field Station, *Betula*, 12–22.06.1983, A.V. Avershin.

Diagnosis. *Haplodrassus bohemicus* is most similar to *H. pugnans* (Simon, 1880), *H. signifer* (C.L. Koch, 1839) and *H. pseudosignifer* Marusiket al. 1996, but differs: 1) by the shape of RTA having a “step”-like dorsal margin (RTA dorsal margin without “step” in *H. pugnans*, *H. signifer* and *H. pseudosignifer*); 2) by the apically directed embolus lacking a tooth (retrolaterally directed embolus with a tooth in *H. pugnans*, *H. signifer* and *H. pseudosignifer*); 3) by the outlines of epigynal sclerites and relative proportions of the epigynal fovea (cf. Figs 10, 12 and 13, 75, 78).

Description. Male measurements (n = 5). Total length 5.8–7.5 (6.7); carapace 2.7–3.2 (3.0) long, 2.0–2.6 (2.3) wide. Diameters of eyes and distances between them: AM 0.10–0.15 (0.12), AL 0.10–0.16 (0.13), PM 0.15–0.22 (0.19), PL 0.10–0.14 (0.12), AM-AM 0.09–0.12 (0.10), AM-AL 0.03–0.04 (0.04), PM-PM 0.03–0.04 (0.03), PM-PL 0.12–0.16 (0.14), AM-PM 0.12–0.18 (0.15), AL-PL 0.10–0.16 (0.14). Distances between anterior eyes and margin of clypeus: AM-clypeus 0.18–0.22 (0.20), AL-clypeus 0.10–0.18 (0.15).

Length of leg segments (male):

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I	1.9–2.2 (2.1)	1.1–1.4 (1.2)	1.6–1.7 (1.6)	1.2–1.4 (1.3)	0.9–1.0 (1.0)	6.8–7.6 (7.2)
II	1.6–1.9 (1.8)	1.0–1.2 (1.1)	1.2–1.4 (1.3)	1.1–1.2 (1.2)	0.9–1.0 (1.0)	5.8–6.8 (6.3)
III	1.5–1.8 (1.6)	0.8–1.0 (0.9)	0.9–1.0 (1.0)	1.2–1.4 (1.3)	0.8–1.0 (0.9)	5.2–6.0 (5.6)
IV	2.1–2.3 (2.2)	1.0–1.2 (1.1)	1.6–1.7 (1.6)	1.8–2.0 (1.9)	1.0–1.2 (1.1)	7.5–8.3 (8.0)

Length of palp segments: femur 1.0–1.2 (1.1), patella 0.4–0.5 (0.5), tibia 0.3–0.5 (0.4), tarsus 1.0–1.2 (1.0). Cheliceral teeth: anterior – 2 (little; proximal tooth connected with keel of cheliceral groove), posterior – 2. Abdomen 2.9–4.0 (3.6) long, 1.8–2.2 (2.0) wide. Scutum is absent. Basal segment of anterior (inferior) spinnerets 0.5–0.6 (0.6) long. Coloration light brown, as in most *Haplodrassus* species.

Palp as in Figs 1–6. RTA with a “step” (*St*) on the promargin, terminal apophysis almost straight, without distinct ridge, embolus slightly twisted and lacks a tooth.

Female measurements (n = 2). Total length 7.8–8.0; carapace 2.7–3.5 long, 2.0–2.7 wide. Abdomen 4.3–5.1 long, 2.7–3.1 wide. Coloration light brown, as in most *Haplodrassus* species.

Epigyne as in Figs 10–12. Lateral pockets long, sub-parallel, spermathecae globular. Fovea of epigyne without narrow longitudinal groove.

Distribution. Czech Republic, Macedonia, Greece, Ukraine (Nikolaev, Kherson, Donetsk Areas, Crimea), Russia (Rostov and Stavropol Areas, Kalmykia, Dagestan) (Miller and Buchar 1977; Ponomarev and Tsvetkov 2006; Stefanovska et al. 2008; Ponomarev et al. 2011; present data).

Comments. *Haplodrassus bohemicus* is a new species record for the Crimean fauna.

Habitats. Meadows, steppes and sand dunes.

Phenology. ♂♀ – V–VI. In Crimea the peak activity of adults occurs in May.

***Haplodrassus cognatus* (Westring, 1861)**

http://species-id.net/wiki/Haplodrassus_cognatus

Figs 15–16

H. c.: Tullgren 1946: 106, f. 31C, pl. 17, f. 221–224 (♂♀).

H. c.: Miller and Buchar 1977: 168, pl. III, f. 8–10 (♂♀).

H. c.: Grimm 1985: 134, f. 155, 168–169 (♂♀).

H. c.: Roberts 1998: 109, f. (♂♀).

H. c.: Almquist 2006: 407, f. 351a–f (♂♀).

H. c.: Kamura 2007: 97, f. 7–8 (♂).

H. c.: Kamura 2009: 485, f. 32–34 (♂♀).

For a complete list of references see Platnick (2012).

Records from Crimea. Bragina (1984); Kovblyuk (2004a,b, 2006); Kovblyuk et al. (2008).

Note. The earlier record of *H. cognatus* from Crimea was based on specimens of unknown sex and number from Karadag Nature Reserve (Bragina 1984). *Haplodrassus cognatus* is absent in our material from Crimea, although we have large collections, especially from the Karadag Reserve). It is reasonable to conclude that the earlier records of *H. cognatus* from Crimea represent a misidentified material.

Additional material. UKRAINE. Donetsk Area: 1 ♀ (TNU), Slavyansky Distr., Svyatogorsk Town, N49°02', E37°39', *Quercus*, 7.06–9.07.2005, N.Yu. Polchaninova.

Comparative material. *Haplodrassus silvestris* (Blackwall, 1833): UKRAINE. Chernovtsy Area: 1 ♂ (TNU № 2153), Tsetsyno Town, *Fagus* wood, 23.04–18.05.2009, V.V. Garashchuk & T.O. Auzyak. Kharkiv Area: 1 ♂, 1 ♀ (TNU), Veliko-Burlukskiy Distr., Nesterivka Vill., N49°53' E37°17', 14.06–14.07.2003, N.Yu. Polchaninova. RUSSIA. Belgorod Area: 1 ♀ (TNU), Borisobsky Distr., Borisovka Town, “Les na Vorkle” Reserve, N50°38' E35°58', 5.07.unknown year, N.Yu. Polchaninova.

Diagnosis. *Haplodrassus cognatus* can be distinguished from all other *Haplodrassus* species by its straight terminal apophysis with a basal tooth in males, and by the shape of the fovea and wide anterior hood (*Ah*) in females.

Distribution. It has a trans-Palearctic boreo-nemoral range and occurs from France to Hokkaido, north to north Ural and Tomsk, and south to Greece (Marusik et al. 2000; Helsdingen 2010; Platnick 2012).

Phenology. In Central Europe ♂♀ – III–X (Nentwig et al. 2011).

***Haplodrassus dalmatensis* (L. Koch, 1866)**

http://species-id.net/wiki/Haplodrassus_dalmatensis

Figs 22–24, 28–29

H. d.: Tullgren 1946: 100, pl. 16, f. 201–203 (♂♀).

H. d.: Miller and Buchar 1977: 170, pl. IV, f. 1–3 (♂♀).

H. d.: Grimm 1985: 138, f. 156, 164–165 (♂♀).

H. d.: Roberts 1985: 66, f. 24a (♂♀).

H. d.: Roberts 1998: 110, f. (♂♀).

H. d.: Levy 2004: 23, f. 57–61 (♂♀).

H. d.: Almquist 2006: 408, f. 352a–e (♂♀).

For a complete list of references see Platnick (2012).

Records from Crimea. Apostolov and Onchurov (1998); Onchurov (1998); Mikhailov (2000); Kovblyuk (2004a,b, 2006); Kovblyuk et al. (2008).

Material. UKRAINE, CRIMEA: Bakhchisaray Distr.: 1 ♂ (TNU), Crimean State Nature Reserve, kordon Asport, 29.06.2001, M.M. Kovblyuk. Feodosiya Distr.: 4 ♂♂, 4 ♀♀ (TNU), Karadag Nature Reserve, 25.05.2003–21.11.2008, M.M. Kovblyuk, O.V. Kukushkin, A.A. Nadolny. Saky Distr.: 5 ♂♂, 7 ♀♀ (TNU), near Pribrezhnaya railway station, 19.05.–3.07.2000, M.M. Kovblyuk. Sevastopol Distr.: 2 ♂ (EMZ), Khersones, 29.05.1996 & 19.06.1998, M.M. Kovblyuk. Simferopol Distr.: 1 ♂, 1 ♀ (EMZ), near Simferopol water reservoir, 30.05.1996, M.M. Kovblyuk; 1 ♀ (TNU), near Fersmanovo Vill., ~ 250 m, 23.06.–16.07.2000, M.M. Kovblyuk; 1 ♀ (TNU), Chatyr-Dagh, Orlineo canyon, 10–25.06.2000, M.M. Kovblyuk; 3 ♂♂, 1 ♀ (TNU), near Skvortsovo Vill., 19.05.–10.07.2002, M.M. Kovblyuk; 1 ♀ (TNU), Krasnolesye Vill., 10.07.2002, Ya.I. Ibragimova. Sudak Distr.: 2 ♂♂, 2 ♀♀ (TNU), 10 km W Sudak, Mezhdurechie Vill., 23.05–24.06.2010, M.K. Yusufova.

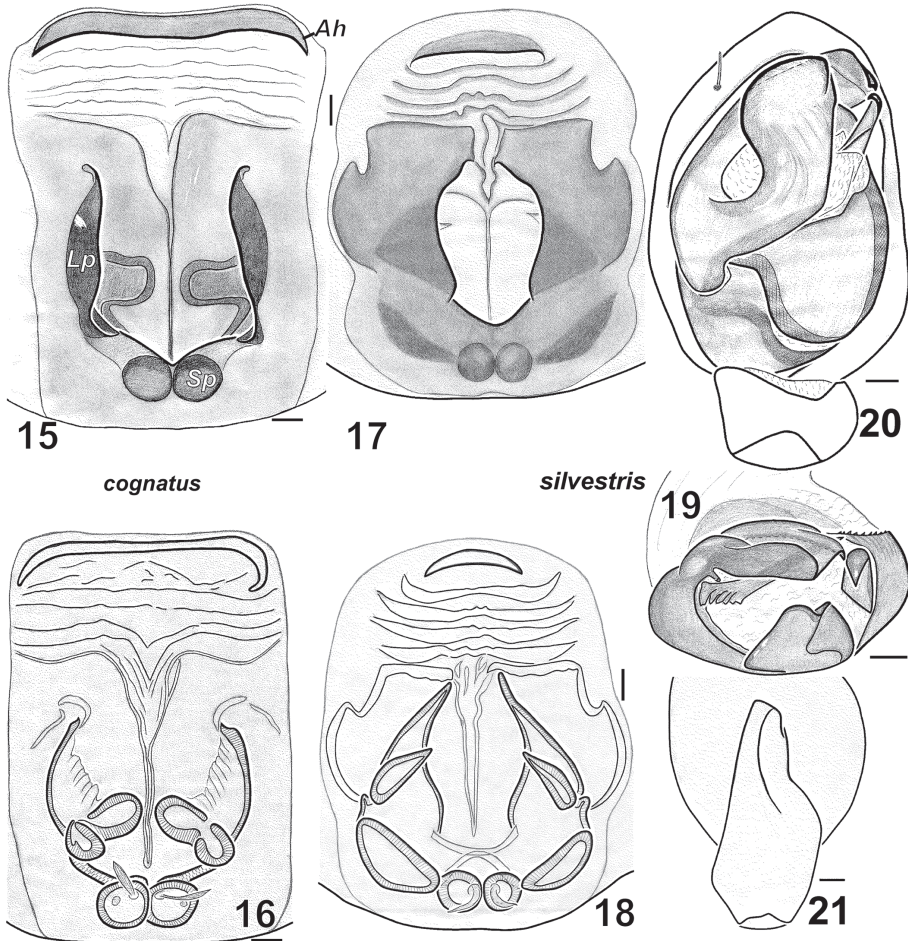
Additional material. UKRAINE. Kherson Area: 1 ♂ (TNU), Henichesk Distr., Arabatskaya strelka, 4 km S Henichesk Town, 1–10.06.2010, N.A. Stasyuk; 1 ♀ (TNU), Arabatskaya strelka, 7 km S Henichesk Town, 6.07.2010, N.A. Stasyuk.

Diagnosis. *Haplodrassus dalmatensis* can be easily distinguished from all other congeners by the shape of the terminal apophysis with two tooth-like apical processes and by the strong tooth on the embolus in males, and also by the shape of the epigynal fovea with a peculiar medial septum and converging lateral pockets in females.

Distribution. West and Central Palaearctic: North Africa, Europe, South Urals, Caucasus, Anatolia, Near East, Kazakhstan, Western Turkmenistan and mountains of South Siberia (Mikhailov 2000; Tuneva and Esyunin 2003; Levy 2004; Helsdingen 2010).

Habitats. Juniper forests, forest strips (=shelterbelts), grasslands, steppes, meadows, salt marshes.

Phenology. In Crimea ♂♀ – V–VI, ♀♀ – VII, XI–XII, the peak of activity in adults occurs in June. In Britain, the peak is in June (Harvey et al. 2002), as in Crimea. In Central Europe ♂♀ – IV–VII (Nentwig et al. 2011). In Israel the phenology is very different: ♂♀ – I–IV, ♂♂ – XII, ♀♀ – V–VII (Levy 2004).



Figures 15–21. *Haplodrassus cognatus* (15–16 from Donetsk Area) and *H. silvestris* (17–21 from Kharkiv Area): **15, 17** epigyne, ventral view **16, 18** epigyne, dorsal view **19** bulb, apical view **20** palp, ventral view **21** RTA, retrolateral view. Abbreviations: *Ah* anterior hood of epigyne; *Lp* lateral pocket of epigyne; *Sp* spermatheca.

***Haplodrassus invalidus* (O. P.-Cambridge, 1872)**

http://species-id.net/wiki/Haplodrassus_invalidus

Figs 32–34

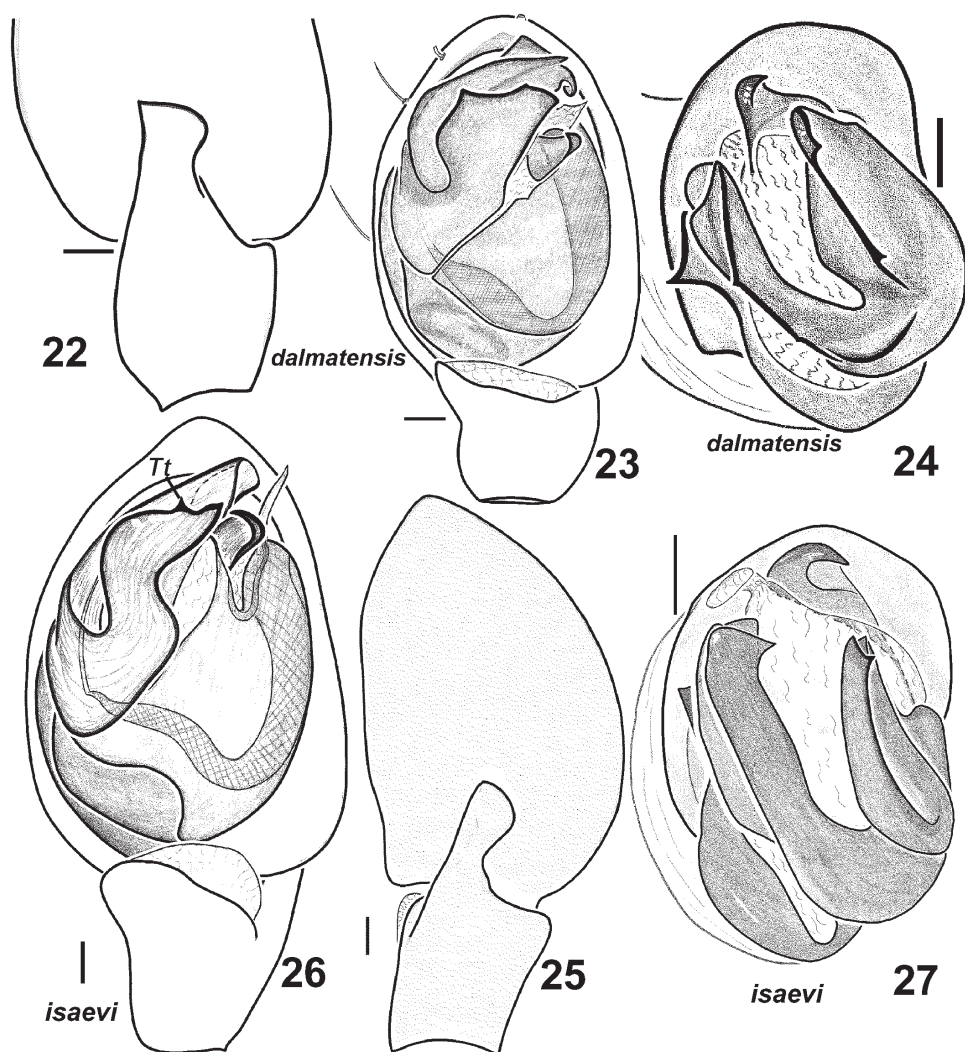
Drassus i. O. P.-Cambridge, 1872a: 237, pl. 15, f. 14 (♂).

H. vignai Di Franco, 1996: 173, f. 1–4 (♂♀).

H. i.: Levy 2004: 31, f. 70–73 (♂♀).

For a complete list of references see Platnick (2012).

Material. AZERBAIJAN. 1 ♂ (TNU), Gobustan, Beyuk-Dash, 17.05.2001, E.F. Huseynov.



Figures 22–27. Males of *Haplodrassus dalmatensis* (22–24 from Crimea) and *H. isaevi* (25–26 paratype from Rostov Area, 27 from Crimea): 22, 25 RTA, retrolateral view 23, 26 palp, ventral view 24, 27 bulbus, apical view. Abbreviations: *Tt* tooth-like process of terminal apophysis.

Diagnosis. Males of *H. invalidus* can be distinguished from all other *Haplodrassus* species by the peculiar thin embolus with an inner spur-like process, and also the peculiar shape of the RTA, which is not indented and has a claw-like tip (Figs 32–34).

Description. Well described by Levy (2004).

Distribution. Spain, Corsica, Italy (mainland and Sicily), Turkey, Israel and Azerbaijan (Levy 2004; Platnick 2012; present data).

Comments. *Haplodrassus invalidus* is a new species record for the fauna of Azerbaijan, Caucasus and the former Soviet Union. Azerbaijan is the easternmost point of the known distribution range.

***Haplodrassus isaevi* Ponomarev & Tsvetkov, 2006**

http://species-id.net/wiki/Haplodrassus_isaevi

Figs 25–27, 30–31

H. i. Ponomarev & Tsvetkov, 2006: 9, f. 12–14 (♂♀).

H. i.: Piterkina and Ovtsharenko 2007: 1426, f. 1.1–6 (♂♀).

Records from Crimea. Kovblyuk et al. (2008); Kovblyuk et al. (2009).

Type material. RUSSIA, ROSTOV AREA: 3 ♂♂ paratypes (TNU from CP 18.24.8), Orlovskiy Distr., Rostov Reserve, 6.10.2002, A.V. Ponomarev.

Material. UKRAINE, CRIMEA: Sudak Distr.: 2 ♂♂, 3 ♀♀ (TNU), 10 km W Sudak, Mezhdurechie Vill., 3.10.–7.11.2010, A.K. Yusufova. Feodosiya Distr.: 21 ♂♂, 10 ♀♀ (TNU), Karadag Nature Reserve, 28.05.2003–19.12.2008, M.M. Kovblyuk, O.V. Kukushkin.

Diagnosis. *Haplodrassus isaevi* is most similar to *H. dalmatensis* but differs by the shape of the terminal apophysis, which has only one tooth-like process (two tooth-like apical processes in *H. dalmatensis*), in lacking a tooth on the embolus (embolic tooth present in *H. dalmatensis*), and also by the proportions of the epigyne. Differences also occur in the spination of certain leg segments: male metatarsus I with two ventral spines in *H. isaevi*, but without spines in *H. dalmatensis*; female metatarsus IV with 4–5 retrolateral spines in *H. isaevi*, but with 3 spines in *H. dalmatensis*.

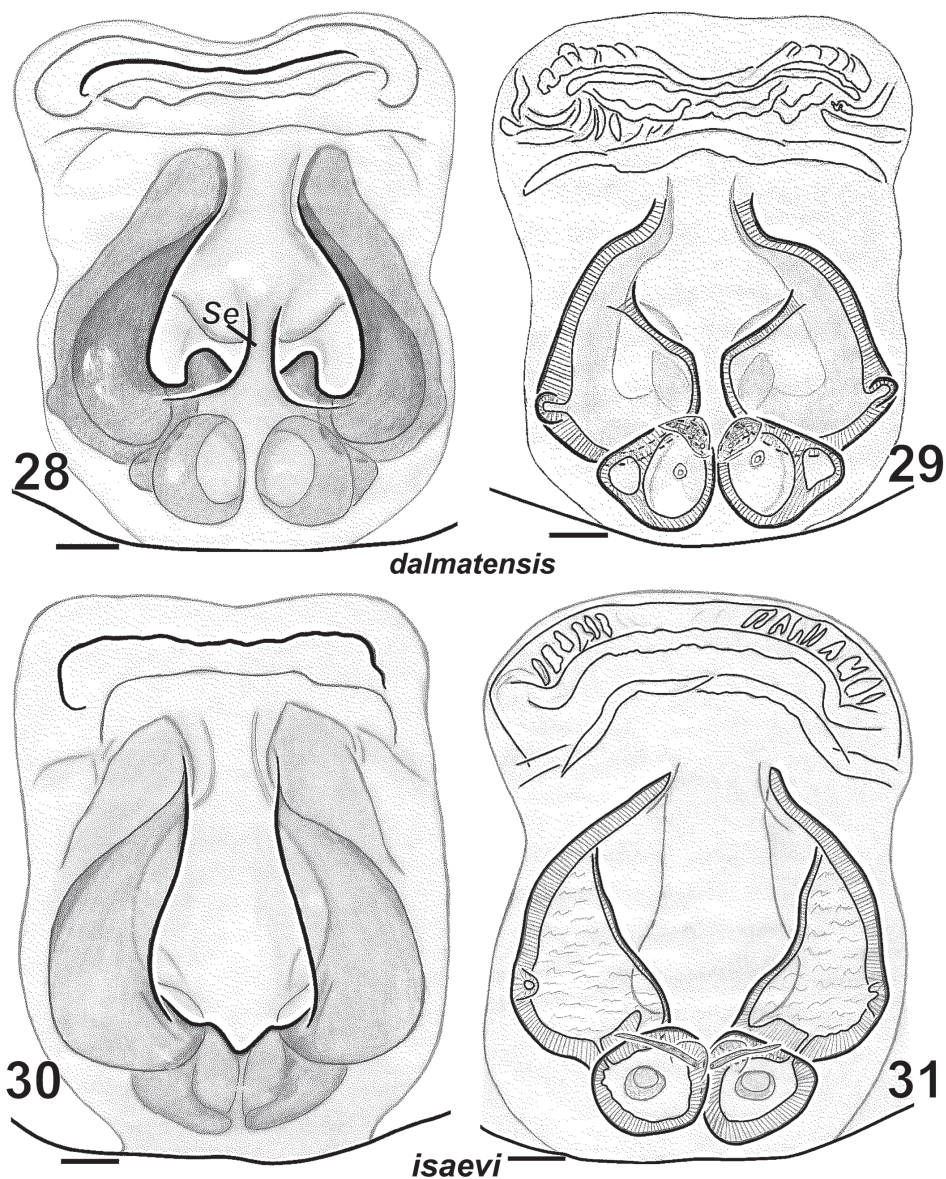
Description. Males (n = 5) and females (n = 5). Measurements (♂ / ♀): total length 5.4–7.2 (6.4) / 5.5–7.4 (6.3); carapace 2.3–2.9 (2.7) / 2.4–3.0 (2.7) long, 1.9–2.4 (2.2) / 1.9–2.2 (2.0) wide; abdomen 3.1–4.3 (3.7) / 3.0–4.4 (3.7) long, 1.7–2.3 (2.0) / 1.8–2.8 (2.3) wide.

Length of leg segments:

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I♂	1.6–2.0 (1.8)	1.1–1.3 (1.2)	1.3–1.6 (1.4)	1.0–1.2 (1.1)	0.8–1.0 (1.0)	5.8–7.1 (6.6)
II♂	1.4–1.7 (1.6)	0.9–1.2 (1.1)	1.0–1.3 (1.2)	0.8–1.1 (1.0)	0.8–0.9 (0.9)	5.0–6.3 (5.8)
III♂	1.3–1.6 (1.5)	0.7–0.9 (0.8)	0.8–1.0 (0.9)	0.9–1.2 (1.1)	0.6–0.8 (0.7)	4.3–5.4 (5.0)
IV♂	1.7–2.0 (1.9)	1.0–1.2 (1.3)	1.3–1.6 (1.5)	1.4–1.8 (1.6)	0.8–1.0 (0.9)	6.3–7.6 (7.0)
I♀	1.4–1.8 (1.7)	0.9–1.2 (1.1)	1.0–1.4 (1.3)	0.8–1.2 (1.0)	0.8–0.9 (0.8)	4.9–6.6 (5.9)
II♀	1.4–1.7 (1.5)	0.9–1.0 (1.0)	1.0–1.2 (1.1)	0.8–1.1 (0.9)	0.7–0.9 (0.8)	5.0–5.9 (5.4)
III♀	1.2–1.4 (1.3)	0.7–0.8 (0.8)	0.7–0.9 (0.8)	0.9–1.1 (1.0)	0.6–0.8 (0.7)	4.2–5.2 (4.8)
IV♀	1.6–2.0 (1.8)	0.9–1.1 (1.0)	1.2–1.6 (1.4)	1.3–1.8 (1.5)	0.8–1.0 (0.9)	5.8–7.4 (6.6)

Length of palp segments (male / female): femur 1.0–1.2 (1.1) / 0.8–1.1 (1.0), patella 0.4–0.5 (0.4) / 0.4–0.5 (0.5), tibia 0.3–0.4 (0.3) / 0.3–0.4 (0.4), tarsus 1.0–1.2 (1.0) / 0.6–0.7 (0.7).

Chelicerae with 2–3 promarginal and 2 retromarginal teeth in males and females. Number of promarginal teeth varies from 3 (most common) to 2 (seldom). One fe-

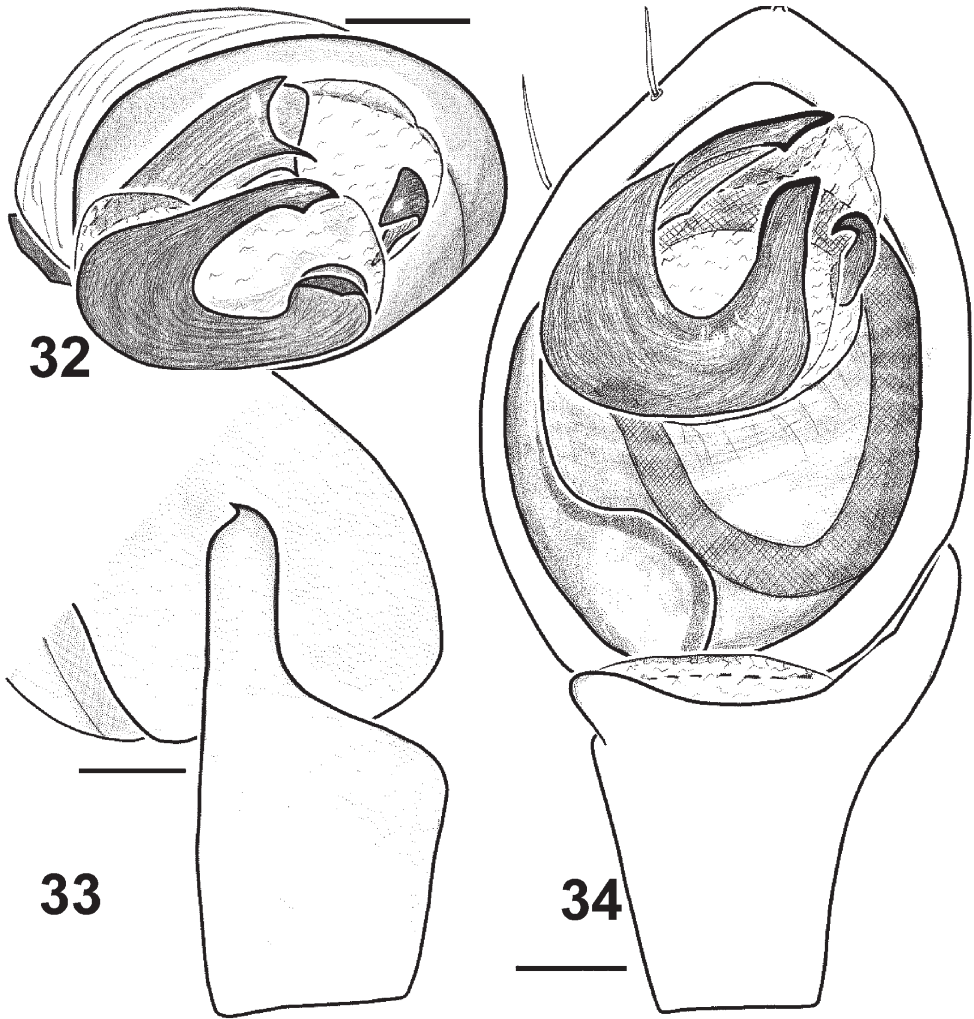


Figures 28–31. Females of *Haplodrassus dalmatensis* (28–29 from Crimea) and *H. isaevi* (30–31 from Crimea): **28, 30** epigyne, ventral view **29, 31** epigyne, dorsal view. Abbreviations: *Se* septum.

male studied had one chelicera with 3 and the other chelicera with 2 promarginal teeth. Coloration grey.

Male palp as in Figs 25–27. Terminal apophysis sharply turned, without ridge, but with tooth (*Tt*) in subterminal part, embolus without tooth.

Epigyne as in Figs 30–31. Fovea long, lateral pockets slightly converging, foveal width less than spermathecal span.



Figures 32–34. Males of *Haplodrassus invalidus* from Azerbaijan: **32** bulbus, apical view **33** RTA, retrolateral view **34** palp, ventral view.

Distribution. Greece, Ukraine (Crimea), Russia (Rostov Area), Kazakhstan (West-Kazakhstan Area) (Ponomarev and Tsvetkov 2006; Piterkina and Ovtsharenko 2007; Platnick 2012; present data).

Habitats. Steppes.

Phenology. In Crimea ♂♀ – X–XII, ♀♀ – II–III, V, the peak activity of adults occurs in December.

Comments. In Crimea we found both closely related species, *H. dalmatensis* and *H. isaevi*, to be syntopical in two localities (Sudak Distr., 10 km W Sudak, Mezhdurechie Vill. and Feodosiya Distr., Karadag Nature Reserve). However, these species have quite different phenologies and adults of the two different spe-

cies do not co-occur. The reproductive period of *H. dalmatensis* is in May–July with the peak in June, and in *H. isaei* adults can be found in October–December, with their peak of activity in December.

***Haplodrassus kulczynskii* Lohmander, 1942**

http://species-id.net/wiki/Haplodrassus_kulczynskii

Figs 35–39

H. k.: Miller and Buchar 1977: 170, pl. IV, f. 7–10 (♂♀).

H. k.: Grimm 1985: 141, f. 152, 162–163 (♂♀).

H. k.: Roberts 1998: 111, f. (♂♀).

H. k.: Marusik et al. 2007: 43, f. 5–10 (♂♀).

For a complete list of references see Platnick (2012).

Records from Crimea. Kovblyuk (2006).

Material. UKRAINE, CRIMEA: Simferopol Distr.: 2 ♂♂, 1 ♀ (YMC), near Fersmanovo Vill., ~ 250 m, 18.04.–1.05.2000, M.M. Kovblyuk; 1 ♂, 1 ♀ (YMC), Chatyr-Dag Mt., Orlinoe canyon, 27.04.–1.06.2000, M.M. Kovblyuk. Yalta Distr.: 2 ♂♂ (TNU), Nikitskaya Yaila Mt. (=Skrinita), 22.04.–25.05.2001, M.M. Kovblyuk.

Additional material. UKRAINE. Nikolaev Area: 1 ♂ (TNU), Pervomaysky Distr., Migiya Vill., 5.05.–8.06.2006, N.Yu. Polchaninova. AZERBAIJAN. Lenkoran Distr.: 1 ♀ (TNU), Alexeevka Vill., 27.04.2001, E.F. Huseynov.

Diagnosis. *Haplodrassus kulczynskii* is similar to *H. rugosus* Tuneva, 2005 from Kazakhstan and *H. taepaikensis* Paik, 1992 from Korea and the Russian Far East. Both species have a toothed terminal apophysis. *Haplodrassus kulczynskii* can be easily distinguished from similar species by having a much wider terminal apophysis, having a step-like subterminal outgrowth on the dorsal margin of the RTA (in *H. rugosus* and *H. taepaikensis* such an outgrowth is absent), and by the longer lateral pockets of the epigyne (in *H. taepaikensis* they are shorter; the female of *H. rugosus* is unknown).

Distribution. West Palaearctic – Far East disjunct nemoral-subtropical range: Central and Southern Europe to Urals, Caucasus, Turkey, Eastern China, Far East Russia and Korea (Mikhailov 1997; Tuneva and Esyunin 2003; Helsdingen 2010; Platnick 2012).

Habitats. Steppe.

Phenology. In Crimea ♂♀ – IV–V, the peak of activity in adults occurs in April. In Central Europe ♂♀ – IV–VIII (Nentwig et al. 2011).

***Haplodrassus minor* (O. P.-Cambridge, 1879)**

http://species-id.net/wiki/Haplodrassus_minor

Figs 43–49, 52–65

H. m.: Miller and Buchar 1977: 170, pl. IV, f. 4–6 (♂).

H. m.: Grimm 1985: 144, f. 176–178 (♂♀).

H. m.: Roberts 1985: 66, f. 24c (♂♀).

H. m.: Tuneva and Esyunin 2003: 232, f. 27–33 (♂♀).

For a complete list of references see Platnick (2012).

Records from Crimea. Kovblyuk (2006).

Material. UKRAINE. CRIMEA. Lenino Distr.: 1 ♀ (EMZ), Kerch peninsula, NW coast of Aktash lake, 8.06.1999, M.M. Kovblyuk. Saki Distr.: 5 ♂♂ (TNU), near Pribrezhnaya railway station, 9.05.–3.07.2000, M.M. Kovblyuk. Simferopol Distr.: 1 ♂ (TNU), Kirpichnoe Vill., 31.05.–12.06.1997, M.M. Kovblyuk; 18 ♂♂, 5 ♀♀ (YMC, TNU), Skvortsovo Vill., 27.04.–10.07.2002, M.M. Kovblyuk. Sovietsky Distr.: 1 ♂ (TNU), Uvarovka Vill., 28.04.1999, M.M. Kovblyuk. Yalta Distr.: 1 ♂ (TNU), Yalta, Nikita Vill., 13–30.05.2000, M.M. Kovblyuk.

Additional material. UKRAINE. Donetsk Area: 1 ♂ (TNU), Slavyansk Distr., Dronovka Vil., 4–8.07.2002, E.V. Prokopenko; 1 ♂, 1 ♀ (TNU), Volodarsky Distr., Nazarovka Vil., “Kamennye Mogily” Nature Reserve, N47°20', E37°06', 20.06.1983, N.Yu. Polchaninova. Nikolaev Area: 1 ♂, 1 ♀ (TNU), Ochakov Distr., Pokrovka Vil., ‘Volyzhin Les’ Department of the Chernomorsky Nature Reserve, 21.05.1987, N.Yu. Polchaninova; 2 ♂♂ (TNU), Pervomaysky Distr., Kuripchane Vil., 6.05.–8.06.2006, N.Yu. Polchaninova. Drawings from these specimens – see in Figs 43–45, 52–53. RUSSIA. Orenburg Area: 5 ♂♂ (TNU), Kuvandyk Distr., Aituar Vill., 22.05.1996, 5.07.2002, N.S. Mazura, T.K. Tuneva; 4 ♂♂, 1 ♀ (TNU), Sol-Iletsk Distr., Chybynda, 5–12.06.2000, S.L. Esyunin. POLAND. 2 ♂♂, 2 ♀♀ (TNU), “Krusne hoty a Polsko, 2001–2002, leg. Prof. E. Kula”.

Comparative material. *Haplodrassus deserticola* Schmidt & Krause, 1996 from the Canary Islands: 2 ♂♂, 1 ♀ (TNU), leg. et det. J. Wunderlich.

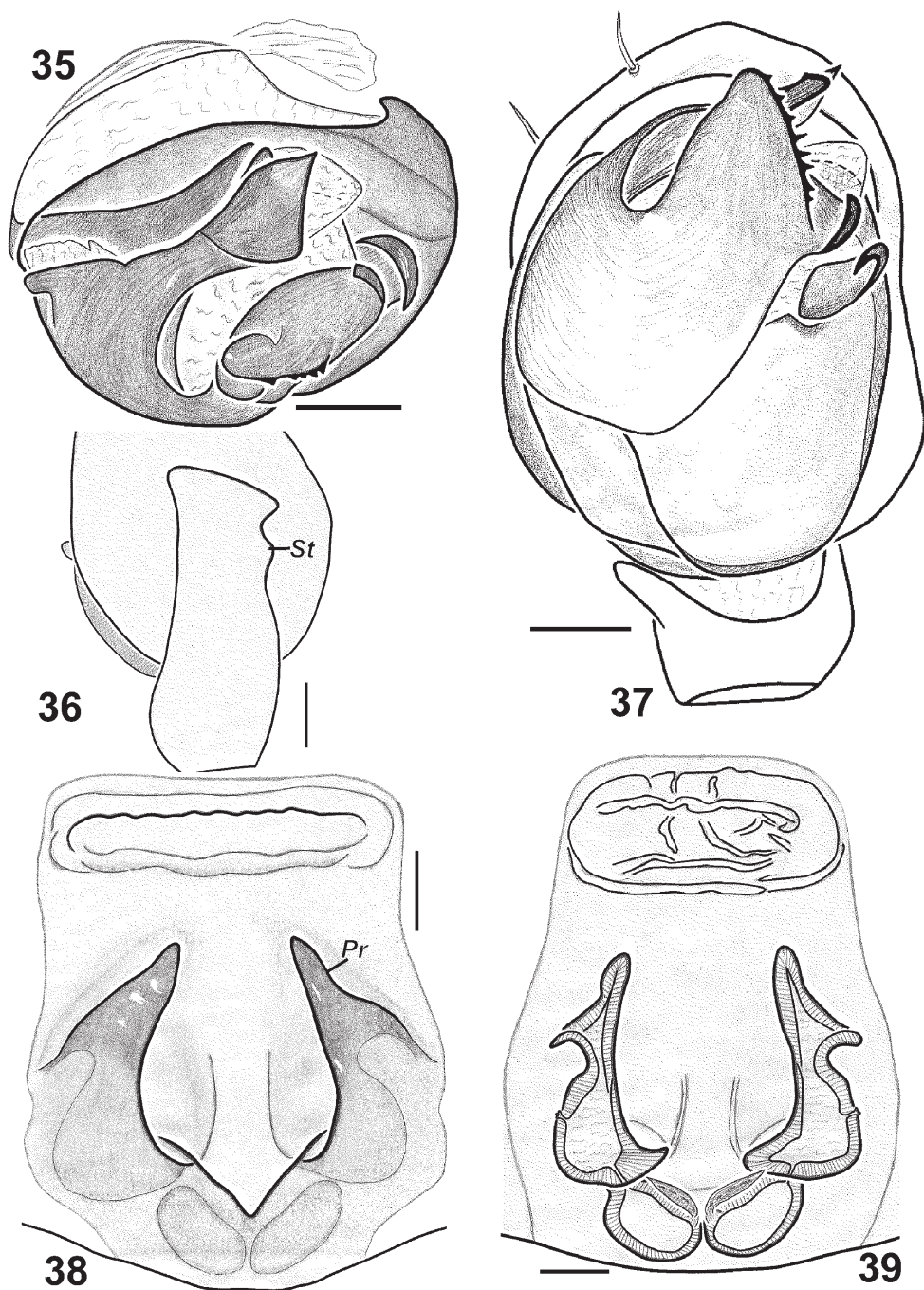
Diagnosis. This species is most similar to *H. deserticola* from the Canary Islands (Figs 40–42, 50–51). *Haplodrassus deserticola* differs from *H. minor* by having a dorsal abdominal pattern (Fig. 66). *Haplodrassus minor* and *H. deserticola* also differ by the shape of the embolus (thick in *H. minor*, and thin in *H. deserticola*), terminal apophysis (thick in *H. minor*, and thin in *H. deserticola*), median apophysis (short in *H. minor*, and long in *H. deserticola*), epigyne and spermathecae.

Variations. *Haplodrassus minor* is highly variable in body size and also in the shape of the bulbal apophyses, RTA (slightly indented or not indented) and the epigyne (Figs 43–65). It is interesting to note that the width of the terminal apophysis decreases with increasing longitude (i.e. from west to east) (cf. Figs 44, 47, 49, 57, 63).

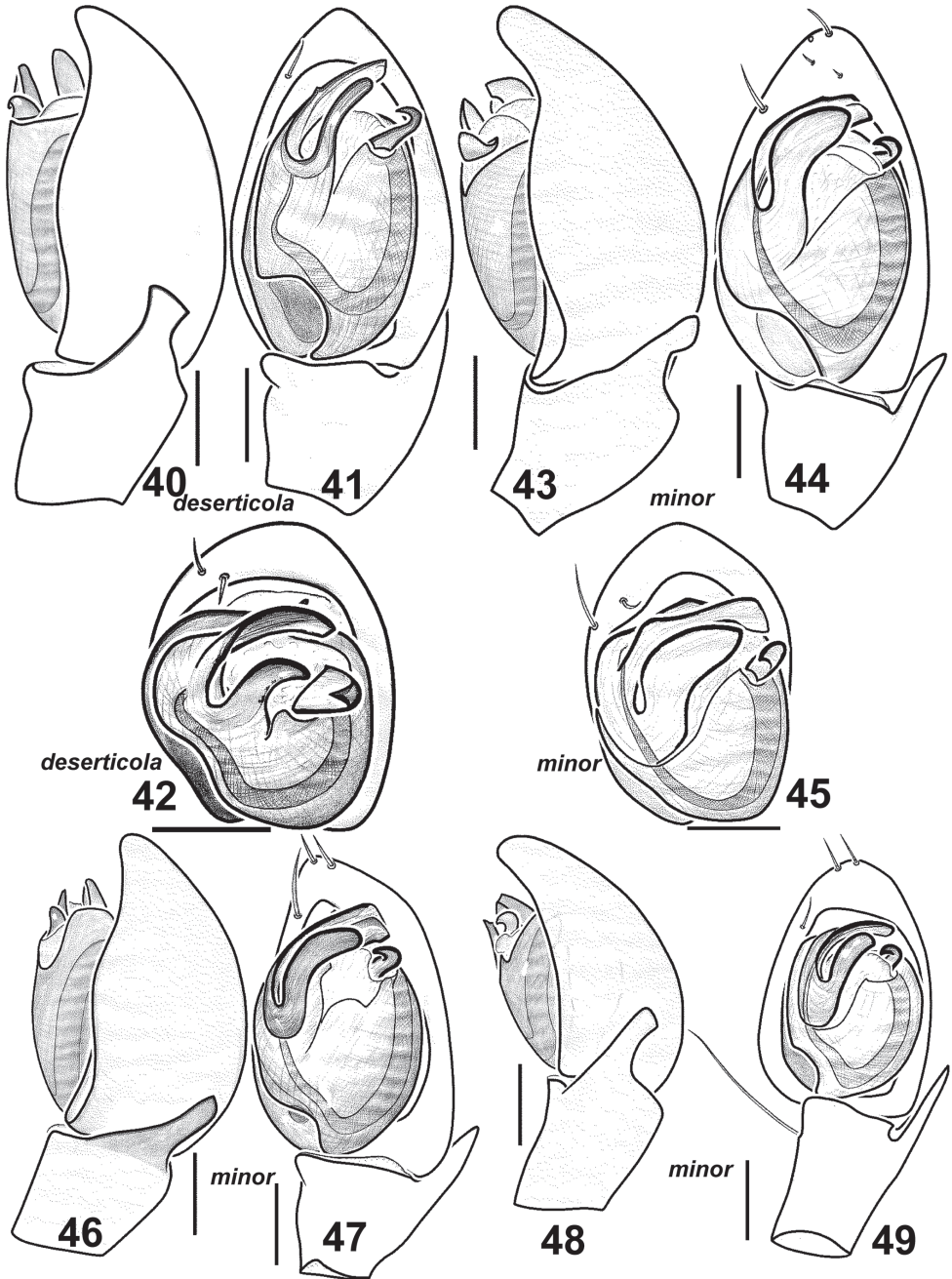
Distribution. The species has a European range and is known from Portugal to Ural, north to Wales and south to Crete (Tuneva, Esyunin 2003; Helsdingen 2010; Platnick 2012).

Habitats. Steppes, meadows, forest strips (=shelterbelts) within steppes.

Phenology. In Crimea ♂♀ – V–VI, ♂♂ – IV, ♀♀ – VII, the peak of activity in adults occurs in May. In Britain ♂♀ – IV–VI, with the peak in June (Harvey et al. 2002), a month later than in Crimea.



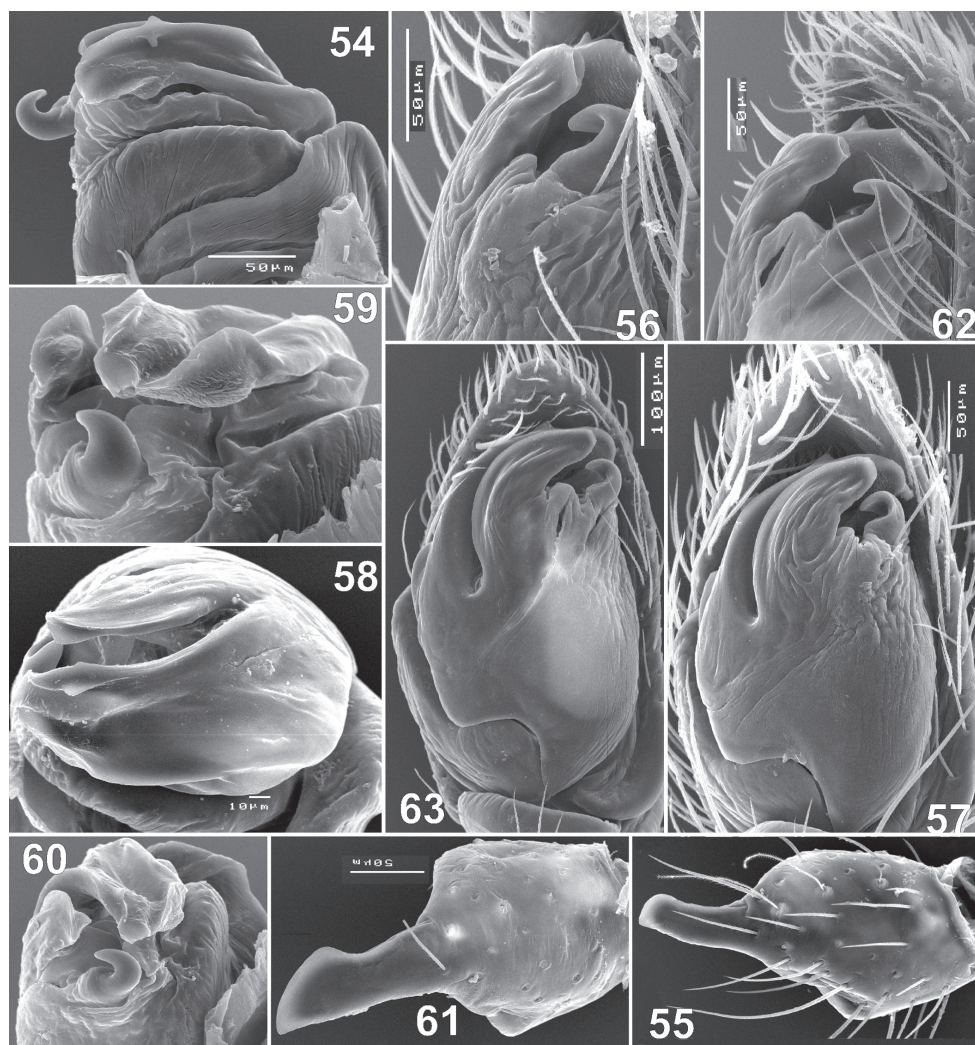
Figures 35–39. *Haplodrassus kulczynskii* from Crimea: **35** bulbus, apical view **36** RTA, retrolateral view **37** palp, ventral view **38** epigyne, ventral view **39** epigyne, dorsal view. Abbreviations: *Pr* protrusion of epigynal pocket; *St* “step”-like keel of RTA.



Figures 40–49. Males of *Haplodrassus deserticola* (40–42 from Canary Islands) and *H. minor* (43–45 from Poland, 46–47 from Nikolaev Area, 48–49 from Orenburg Area): 40, 43, 46, 48 palp, retrolateral view 41, 44, 47, 49 palp, ventral view 42, 45 bulb, apical view.



Figures 50–53. Females of *Haplodrassus deserticola* (50–51 from the Canary Islands) and *H. minor* (52–53 from Nikolaev Area): 50, 52 epigyne, ventral view 51, 53 epigyne, dorsal view.



Figures 54–63. Males of *Haplodrassus minor* (54–57 from Crimea, 58–63 from Orenburg Area): **54** apical part of bulbus, dorsal view **55, 61** tibia of palp, retrolateral view **56, 62** bulbus, retrolateral view **57, 63** bulbus, ventral view **58** bulbus, apical view **59** bulbus, retrolateral-dorsal view **60** apical part of bulbus, retrolateral view.

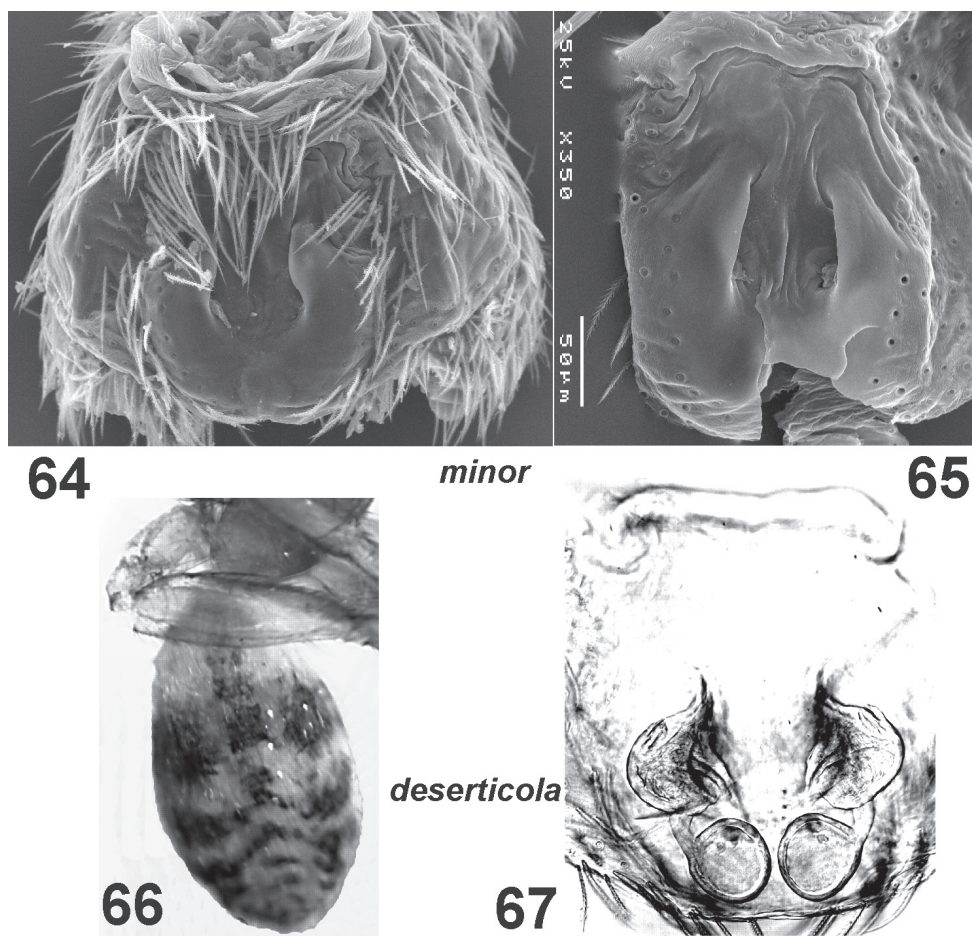
***Haplodrassus pseudosignifer* Marusik, Hippa & Koponen, 1996**

http://species-id.net/wiki/Haplodrassus_pseudosignifer

Figs 68–70, 75–76

H. p. Marusik et al., 1996: 26, f. 63–65, 69 (♂♀).

Type material. RUSSIA. 2 ♂♂ paratypes (ZMT), SW Altai, 7 km W Katanda, Katun River valley, forest steppe, pitfall traps, 22.06.–26.07.1983, H. Hippa.



Figures 64–67. *Haplodrassus minor* (64 from Crimea, 65 from Orenburg Area) and *Haplodrassus deserticola* (66–67 from the Canary Islands): 64–65 epigyne, ventral view 66 male abdomen, dorsal view 67 epigyne, dorsal view.

Material. UKRAINE, CRIMEA: Feodosiya Distr.: 19 ♂♂, 6 ♀♀ (TNU), Karadag Nature Reserve, 15.10.2006–05.2011, M.M. Kovblyuk, O.V. Kukushkin, A.A. Nadolny. Simferopol Distr.: 2 ♂♂, 2 ♀♀ (TNU), Bayrakly Mt. (519 m), ~ 400 m, 14.05.–23.06.2000, M.M. Kovblyuk; 1 ♂ (TNU), Chatyr-Dag Mt., east slope, 10–28.06.2000, M.M. Kovblyuk; 1 ♀ (TNU), near Skvortsovo Vill., 9–30.06.2002, M.M. Kovblyuk. Sudak Distr.: 28 ♂♂, 7 ♀♀ (TNU), 10 km west from Sudak Town, Mezhdurechie Vill., 3.05.–3.06.2010, M.K. Yusufova. Yalta Distr.: 1 ♂ (TNU), Ay-Petri Yaila Mt., west part, 12–13.06.1999, O.V. Kukushkin; 15 ♂♂, 1 ♀ (TNU), Nikitskaya Yaila Mt. (=Skrinita), ~ 1200 m, 2.06.–24.07.2001, M.M. Kovblyuk.

Additional material. UKRAINE. Nikolaev Area: 1 ♀ (TNU), Pervomaysky Distr., Kuripchane Vil., 26.05–8.06.2006, N.Yu. Polchaninova.

Note. Identification of this species was based on comparison of our specimens with the male paratypes from ZMT. Specimens from Crimea and Altai differ only slightly in the shape of the tooth on embolus. In our opinion the specimens from Crimea, Nikolaev Area and Altai are conspecific.

Diagnosis. *Haplodrassus pseudosignifer* is very similar to *H. signifer*. The two species have no distinct differences in coloration, size or leg spination, but *H. pseudosignifer* can be differentiated from *H. signifer* by having an almost straight and shorter terminal apophysis and thinner embolus, and by the shape of the lateral pockets and fovea of the epigyne.

Description. Males (n = 5) and females (n = 5). Measurements (♂ / ♀): total length 5.7–8.0 (6.79) / 6.6–10.5 (7.8); carapace 2.8–3.5 (3.1) / 2.6–3.6 (3.3) long, 2.2–2.6 (2.4) / 2.1–3.0 (2.6) wide; abdomen 3.1–4.8 (3.8) / 3.4–6.7 (4.7) long, 1.7–2.4 (2.0) / 2.1–4.2 (2.8) wide.

Length of leg segments:

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I♂	1.9–2.6 (2.3)	1.2–1.6 (1.4)	1.5–2.1 (1.8)	1.2–1.7 (1.5)	1.0–1.2 (1.1)	6.7–9.2 (8.4)
II♂	1.6–2.2 (2.0)	1.0–1.4 (1.2)	1.2–1.8 (1.5)	1.1–1.6 (1.3)	0.8–1.1 (1.0)	5.8–8.1 (7.0)
III♂	1.4–1.9 (1.7)	0.7–1.0 (0.9)	0.9–1.2 (1.0)	1.2–1.5 (1.4)	0.8–1.1 (0.9)	5.2–6.7 (5.9)
IV♂	2.0–2.6 (2.3)	1.0–1.4 (1.2)	1.5–2.02 (1.8)	1.7–2.4 (2.0)	1.0–1.3 (1.1)	7.2–9.8 (8.5)
I♀	1.8–2.4 (2.2)	1.0–1.5 (1.4)	1.4–1.9 (1.7)	1.1–1.5 (1.3)	0.8–1.1 (1.0)	6.2–8.4 (7.5)
II♀	1.6–2.2 (1.9)	1.0–1.4 (1.2)	1.1–1.6 (1.4)	1.0–1.4 (1.2)	0.8–1.0 (0.9)	5.6–7.5 (6.7)
III♀	1.4–1.9 (1.7)	0.8–1.0 (0.9)	0.8–1.2 (1.0)	1.1–1.5 (1.3)	0.7–1.0 (0.9)	4.9–6.6 (5.8)
IV♀	2.0–2.6 (2.4)	1.1–1.4 (1.3)	1.4–2.0 (1.8)	1.6–2.2 (2.0)	0.9–1.2 (1.1)	7.0–9.5 (8.5)

Length of palp segments (male / female): femur 1.0–1.3 (1.2) / 0.8–1.2 (1.1), patella 0.4–0.7 (0.5) / 0.5–0.6 (0.5), tibia 0.3–0.4 (0.38) / 0.4–0.6 (0.5), tarsus 1.0–1.2 (1.1) / 0.7–0.9 (0.8).

Chelicerae with 2–3 promarginal and 2 retromarginal teeth in males and females. Number of promarginal teeth varies from 2 (frequently) to 3 (rarely).

Coloration grey.

Male palp as in Figs 68–70. Terminal apophysis short (length/width ratio ~ 2) and straight, ridge poorly developed; embolus almost straight and with a tooth.

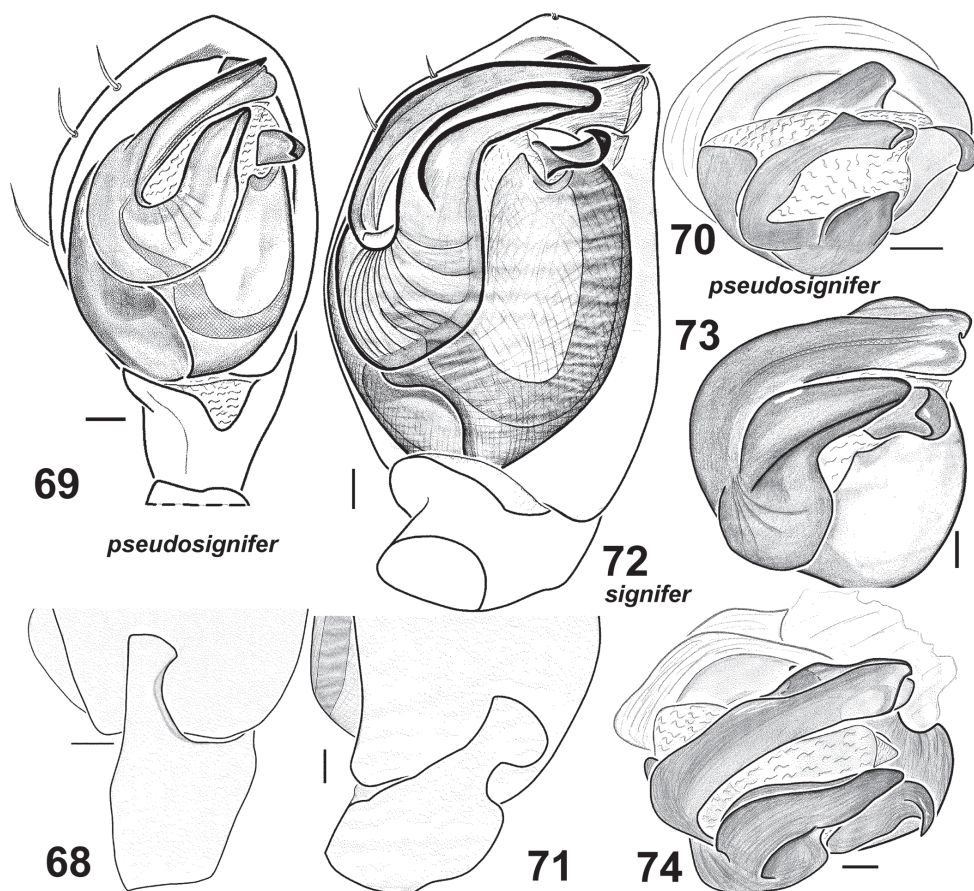
Epigyne as in Figs 75–76. Fovea elongated, rectangular (longer than wide) with narrow longitudinal groove.

Distribution. Steppe zone of Eurasia: from Crimea and Nikolaev Area of Ukraine east to Altai (Marusik et al. 1996; present data).

Comments. *Haplodrassus pseudosignifer* is a new species record for Crimea and Ukraine. Crimea is the westernmost point of the known distribution range.

Habitats. Forests with *Pistacia mutica* or *Quercus pubescens*, forest-steppes, forest stripes (=shelter belts), rocky steppes, grasslands.

Phenology. ♂♀ – V–VII, ♂♂ – IV, X. In Crimea the peak of activity in adults occurs in May.



Figures 68–74. Males of *Haplodrassus pseudosignifer* (68–70 from Crimea) and *H. signifer* (71–74 from Crimea): **68, 71** RTA, retrolateral view **69, 72** palpus, ventral view **70, 73–74** bulb, apical view.

***Haplodrassus signifer* (C.L. Koch, 1839)**

http://species-id.net/wiki/Haplodrassus_signifer

Figs 71–74, 77–78

H. s.: Tullgren 1946: 98, f. 30A, pl. 16, f. 197–200 (♂♀).

H. s.: Miller and Buchar 1977: 168, pl. II, f. 7–10 (♂♀).

H. s.: Thaler 1984: 189, f. 9d–f, i (♂).

H. s.: Grimm 1985: 146, f. 146–148, 170–171 (♂♀).

H. s.: Roberts 1985: 66, f. 23g (♂♀).

H. s.: Marusik et al. 1996: 26, f. 66–68, 70 (♂♀).

H. s.: Roberts 1998: 109, f. (♂♀).

H. s.: Levy 2004: 19, f. 46–52 (mf).

H. s.: Songet al. 2004: 139, f. 82A–I (♂♀).

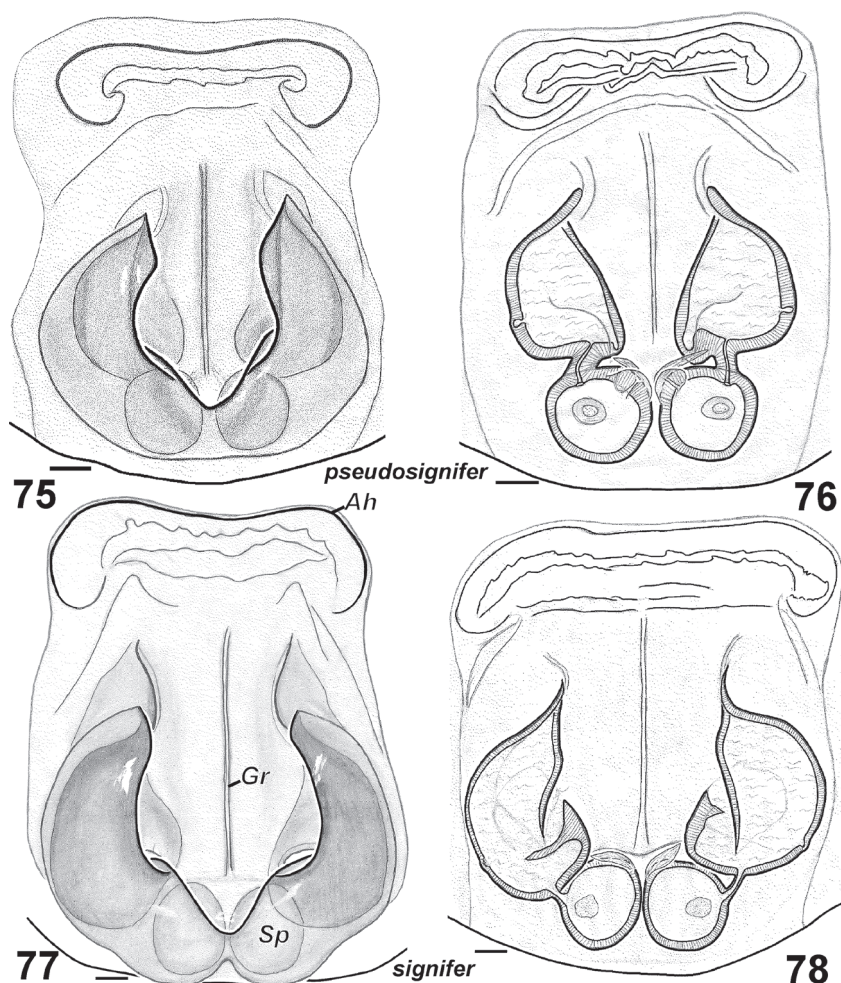
H. s.: Almquist 2006: 411, f. 354a–i (♂♀).

For a complete list of references see Platnick (2012).

Records from Crimea. Thorell (1875) – sub *Drassus troglodytes* C.L. Koch; Spassky (1927) – sub *Drassodes*; Charitonov (1932) – sub *Drassodes*; Ovtsharenko (1982); Mikhailov (1997); Kovblyuk (2001, 2004, 2006); Kovblyuk and Kukushkin (2007); Kovblyuk et al. (2008).

Material. UKRAINE, CRIMEA: Feodosiya Distr.: 5 ♂♂, 2 ♀♀ (TNU), Kara-dag Nature Reserve, 27.04.2004.–23.05.2008, M.M. Kovblyuk, O.V. Kukushkin. Saky Distr.: 121 ♂♂, 27 ♀♀ (TNU), near Pribrezhnaya railway station, 16.04.–24.06.2000, M.M. Kovblyuk. Simferopol Distr.: 2 ♂♂ (EMZ), near Simferopol water reservoir, 2.05.1997, M.M. Kovblyuk & G.V. Reutov; 1 ♀ (EMZ), near Strogonovka Vill., 16.05.1997, M.M. Kovblyuk & S. Dyadyushkin; 46 ♂♂, 1 ♀ (EMZ), near Kirpichnoe Vill., 14.05.–12.06.1997, M.M. Kovblyuk; 1 ♀ (TNU), near Fersmanovo Vill., Kesslers' forest, 350–400 m, 6–23.06.2000, M.M. Kovblyuk; 1 ♂ (TNU), Bayrakly Mt. (519 m), ~ 400 m, 26.05.–6.06.2000, M.M. Kovblyuk; 3 ♂♂, 2 ♀♀ (TNU), near Lozovoe Vill., ~ 250 m, 1.05.–6.06.2000, M.M. Kovblyuk; 8 ♂♂ (TNU), near Simferopol water reservoir, 1.05.–23.06.2000, M.M. Kovblyuk; 2 ♂♂, 1 ♀ (TNU), Simferopol, Bitak Mt., 3.05.–6.06.2000, M.M. Kovblyuk; 4 ♂♂ (TNU), Chatyr-Dag Mt., 20–17.07.2000, M.M. Kovblyuk; 267 ♂♂, 51 ♀♀ (TNU), near Skvortsovo Vill., 12.03.–30.06.2002, M.M. Kovblyuk; 1 ♀ (TNU), Lozovoe Vill., 18.05.2006, M.M. Kovblyuk. Sudak Distr.: 9 ♂♂ (TNU), 10 km W from Sudak Town, Mezhdurechie Vill., 6.05.–22.05.2010, M.K. Yusufova. Yalta Distr.: 5 ♂♂, 3 ♀♀ (TNU), 1 km N Nikita Vill., 22.04.–30.05.2000, M.M. Kovblyuk; 1 ♂, 2 ♀♀ (YMC), Nikitskaya Yaila Mt. range, (=Skrinita), ~ 1200 m, 2.06.–3.07.2001, M.M. Kovblyuk; 2 ♂♂ (TNU), Yalta Mountain-Forest Natural Reserve, near Upper Nikita Lake, 28.04.–12.05.2002, A.A. Khaustov; 2 ♂♂, 2 ♀♀ (TNU), near Nikita Vill., 13–26.05.2002, A.A. Khaustov.

Additional material. SLOVAKIA. 2 ♂♂, 2 ♀♀ (TNU), Nova'ky, 11.05.1990, S. Pekar. UKRAINE. Chernovtsy Area: 1 ♀ (TNU), Tsetsino Town, 8–19.05.2009, V.V. Garashchuk, T.O. Auzyak. Donetsk Area: 1 ♀ (TNU), Slavyansky Distr., Svyatogorsk Town, N49°02', E37°39', 07.2004, N.Yu. Polchaninova. Kherson Area: 2 ♂♂, 3 ♀♀ (TNU), Henichesk Distr., Arabatskaya strelka, 4 km S Henichesk Town, 23–30.05.2011, N.A. Stasyuk. RUSSIA. Leningrad Area: 3 ♂♂, 2 ♀♀ (TNU), Nizhnesvirskiy Reserve, 21.07.1994, T.I. Oliger. Kursk Area: 2 ♂♂, 1 ♀ (TNU), Medvensky Distr., “Kazatskaya Steppe” Department of the Tsentral'no-Chernozemny Nature Reserve, 51°30'N, 36°17'E, 20.05.–30.06.2004, N.Yu. Polchaninova. Rostov Area: 8 ♂♂, 1 ♀ (TNU from CP), Orlovsky Distr., Rostovsky Nature Reserve, Starikovskiy region, 15.06.2003 & 7.05.2004, Z.G. Prishutova. ABKHAZIA. Gagra Distr.: 3 ♀♀ (TNU), Gagra Distr., Gagra Range, Mamdzyshkha Mt. (1866 m), from border of forest (43°18'N, 40°19'E, 1705 m) to the peak, wood (*Abies*, *Fagus*, *Acer*) and alpine meadows, 7–15.07.2009, M.M. Kovblyuk.



Figures 75–78. Females of *Haplodrassus pseudosignifer* (75–76 from Crimea) and *H. signifer* (77–78 from Crimea): **75, 77** epigyne, ventral view **76, 78** epigyne, dorsal view. Abbreviations: **Ah** anterior hood; **Gr** groove of epigyne; **Sp** spermatheca.

Diagnosis. The species can be easily recognized by the shape of the terminal apophysis, which has a peculiar long ridge, and also by the shape of the epigyne. *Haplodrassus signifer* is very similar to *H. pseudosignifer* (see the diagnosis for *H. pseudosignifer*).

Distribution. Circum-Holarctic polyzonal range (Marusik et al. 2000; Platnick 2012).

Habitats. Steppes, meadows, shrubby communities, forests.

Phenology. ♂♀ – IV–VII, ♂♂ – III. In Crimea the peak activity in adults' occurs in May. In Central Europe ♂♀ – IV–XII (Nentwig et al. 2011).

Comments. *Haplodrassus signifer* is the largest and most abundant *Haplodrassus* species in Crimea.

***Haplodrassus umbratilis* (L. Koch, 1866)**

http://species-id.net/wiki/Haplodrassus_umbratilis

Figs 79–83

H. u.: Tullgren 1946: 101, f. 30B, pl. 16, f. 204–208 (♂♀).

H. u.: Miller and Buchar 1977: 168, pl. III, f. 2–4 (♂♀).

H. u.: Grimm 1985: 156, f. 150, 158–159 (♂♀).

H. u.: Roberts 1985: 66, f. 25a (♂♀).

H. u.: Roberts 1998: 112, f. (♂♀).

H. u.: Almquist 2006: 413, f. 357a–f (♂♀).

For a complete list of references see Platnick (2012).

Records from Crimea. Kovblyuk (2006).

Material. UKRAINE. CRIMEA. Feodosiya Distr.: 2 ♂♂, 1 ♀ (TNU), Karadag Nature Reserve, thalweg Karadag beams, 44°55'11.4"N 35°12'25.5"E, 43 m, 9.05.–6.06.2008, M.M. Kovblyuk. Simferopol Distr.: 1 ♀ (TNU), 2 km N Pionerskoe Vill., 10.06.1998, M.M. Kovblyuk; 4 ♂♂ (TNU), 1.5 km NE Fersmanovo Vill., Kesslers' forest, 14.05.–6.06.2000, M.M. Kovblyuk; 64 ♂♂, 15 ♀♀ (TNU), Chatyr-Dag Mt., 23.04.–2.09.2000, M.M. Kovblyuk. Sudak Distr.: 1 ♂ (TNU), 10 km W Sudak Town, Mezhdurechie Vill., 6–8.05.2010, M.K. Yusufova. Yalta Distr.: 68 ♂♂, 27 ♀♀ (TNU), Nikitskaya Yaila Mt. (=Skrinita), ~ 1200 m, 4.05.–10.11.2001, M.M. Kovblyuk.

Additional material. UKRAINE. Donetsk Area: 5 ♀♀ (TNU), Slavyansky Distr., Syvatogorsk Town, N49°02', E37°39', 8–30.06.2004, N.Yu. Polchaninova. Kherson Area: 6 ♂♂, 4 ♀♀ (TNU), Goloprystynskiy Distr., Chernomorskiy Reserve, Rybalchie Vill., 04–08.1989, Zelinskaya.

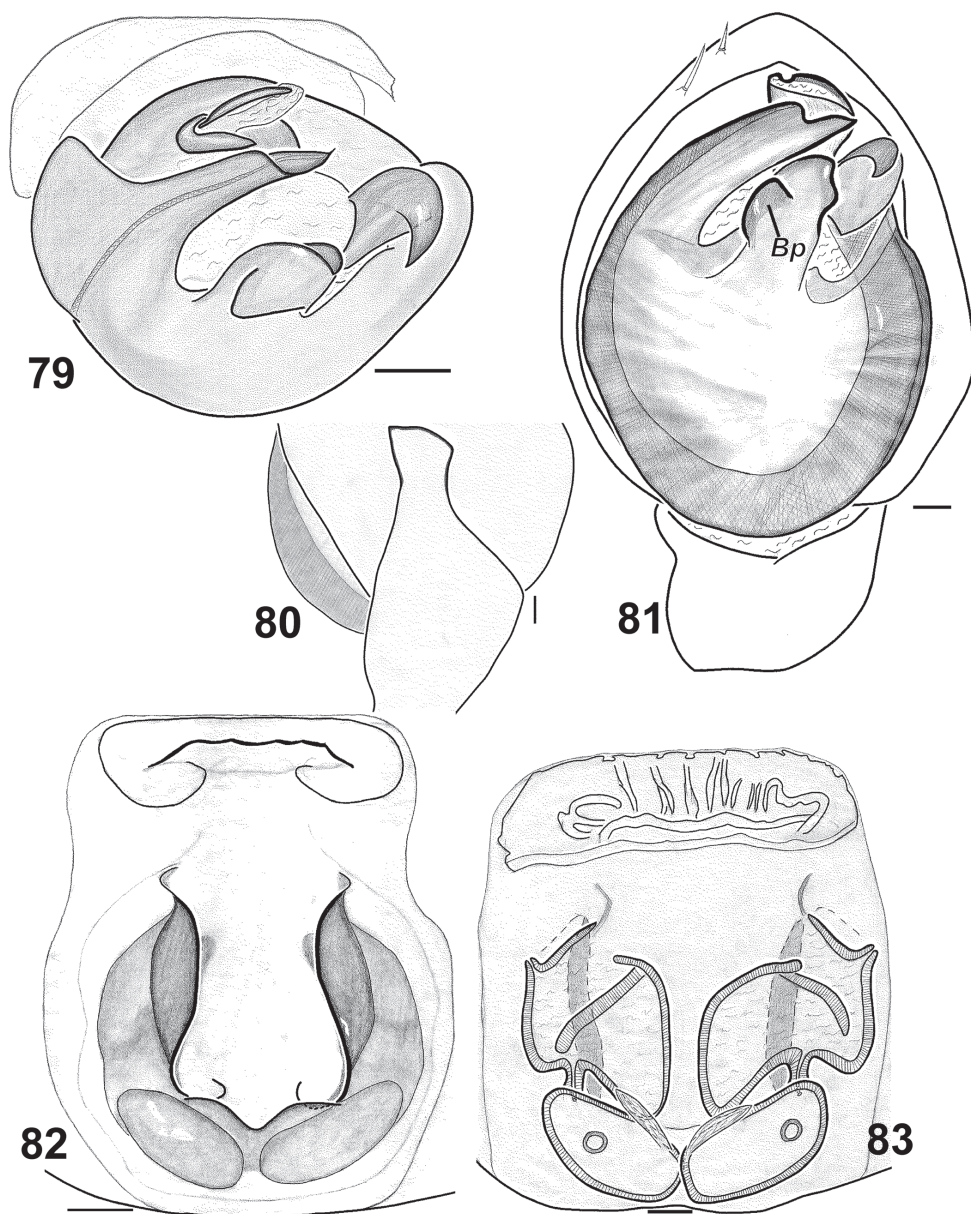
Comparative material. *Haplodrassus soerenseni* (Strand, 1900): UKRAINE. Sumy Area: 1 ♀ (TNU), Vakolovshchina Vill., 1.06.1990, V.A. Gnelitsa.

Diagnosis. *Haplodrassus umbratilis* can be easily differentiated by from all other *Haplodrassus* species found in Crimea by its terminal apophysis, which has a broad process (*Bp*). From the similar *H. soerenseni* males differ in the shape of the terminal apophysis and embolus, and females by having longer lateral epigynal pockets.

Distribution. West and Central Palaearctic: all Europe, Turkey, Caucasus, mountains of Central Asia and South Siberia (Mikhailov 1997; Helsdingen 2010; Platnick 2012).

Habitats. Dry forests, forest edges, meadows and steppes.

Phenology. ♂♀ – V–VII, ♂♂ – IV, ♀♀ – VIII, X, the peak of activity in adults occurs in June. In Central Europe ♂♀ –VI–VIII (Nentwig et al. 2011). In Britain, the peak is in May (Harvey et al. 2002), a month earlier than in Crimea.



Figures 79–83. *Haplodrassus umbratilis* from Crimea: **79** bulbus, apical view **80** RTA, retrolateral view **81** palp, ventral view **82** epigyne, ventral view **83** epigyne, dorsal view. Abbreviations: *Bp* broad process of terminal apophysis.

Discussion

Species diversity

The number of *Haplodrassus* species found in Crimea is rather high. Eight species, as in Crimea are known in the larger area of Bulgaria and Hungary (Helsdingen 2010). Several large countries such as Austria, Germany, Poland and Romania have 9 species of *Haplodrassus*. 10 species are known to occur in the Czech Republic, Switzerland and France. The highest species diversity in Europe, and probably in the Holarctic, is in Italy, with 13 species known from the mainland (Helsdingen 2010). Although Crimea was intensively investigated during only a short period we do not expect additional *Haplodrassus* species on the peninsula. The neighboring mainland Ukraine and Caucasus have no species that are absent in Crimea. There are several species that occurs in Romania or Bulgaria that are absent in Crimea: *H. cognatus*, *H. moderatus* (Kulczyński, 1897), and *H. silvestris* (Blackwall, 1833). In terms of species diversity per unit area of a country or region, Crimea rates as the most diverse place in Europe and in the Mediterranean (8 species in ~ 26 000 km²). Only Israel has a similar number of species per unit area (8 species in ~27 000 km²).

Phenology

Many specimens were collected using pitfall traps, which were regularly checked once in two week during one or two years. Thus, it was possible to analyze the seasonal dynamics of adult activity. All Crimean *Haplodrassus* species have one peak of activity of adults during the year. The maximum number of individuals and peak of activity for the adults of *H. kulczynskii* occurred in April; for *H. bohemicus*, *H. minor*, *H. pseudosignifer* and *H. signifer* in May; for *H. dalmatensis* and *H. umbratilis* in June; for *H. isaei* in December. Probably all of the species studied have only one generation per year.

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First description of the male with redescription of the female of *Araneus strandiellus* Charitonov, 1951 (Araneae, Araneidae)

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Abstract

Redescription of Central Asian orb-weaver *Araneus strandiellus* Charitonov, 1951, only known from the original description of female. The male of this species, previously unknown, is described here for the first time.

Keywords

Central Asia, orb-weaver, taxonomy, redescription

Introduction

Araneidae with 3029 species belonging to 168 genera is third largest spider family (Platnick 2012). The most species rich genus in the family and possibly in the whole order is *Araneus* Clerck, 1757. It encompasses 668 species distributed throughout the globe (Platnick 2012). The genus is studied unevenly in different parts of the world. The most comprehensive studies were made in the Nearctic (Levi 1971, 1973), Europe (Grasshoff 1968; Šestáková et al. 2009), China (Yin et al. 1997) and Japan (Tani-kawa 2007, 2009). Only few attempts were made to split the genus into smaller and

more natural groups. The most significant contribution was made by Archer (1951a-c, 1958) who described or revalidated over a dozen of genera and subgenera. Most of these taxa were synonymized with *Araneus* by Levi (1971, 1973).

The orb weaving spider *Araneus strandiellus* Charitonov, 1951 is only known by female and since the description was never considered in any other taxonomical publication (cf. Platnick 2012). This species was originally described from northern Tajikistan on the basis of the female holotype. Besides the type locality, the species has been reported from Uzbekistan (Marusik 1989), western Kazakhstan (Pavlenko 1985) and Tuva in South Siberia (Logunov et al. 1998; Marusik et al. 2000). In the original description Charitonov (1951) defined main features of the new species in detail, but did not compare it with any other *Araneus*.

While working with Araneidae material from Siberia and Central Asia we found several samples of *A. strandiellus* containing both sexes. The main goal of this paper is description of the male for the first time, and providing detailed redescription of the female.

Material and methods

Microphotographs were made with an Olympus Camedia E-520 camera attached to an Olympus SZX16 stereomicroscope at the Zoological Museum, University of Turku. Digital images were montaged using “CombineZP” image stacking software. Figures were edited in Corel Photo Paint X4 and Corel Paint Shop Pro Photo X2. Specimens were photographed while placed in dish with paraffin on the bottom filled with 70% ethanol and using different sized holes to keep the samples in the required position. Studied material is deposited in Department of Zoology, Perm State University (PSU), Zoological Museum of Moscow State University (ZMMU), Siberian Zoological Museum of the Institute for Ecology and Systematics of Animals (ISEA), Institute for Biological Problems of the North, Magadan (IBPN) or Alexander V. Gromov (Almaty, Kazakhstan) personal collection (AGA). All measurements are in millimetres.

Taxonomy

Araneus strandiellus Charitonov, 1951

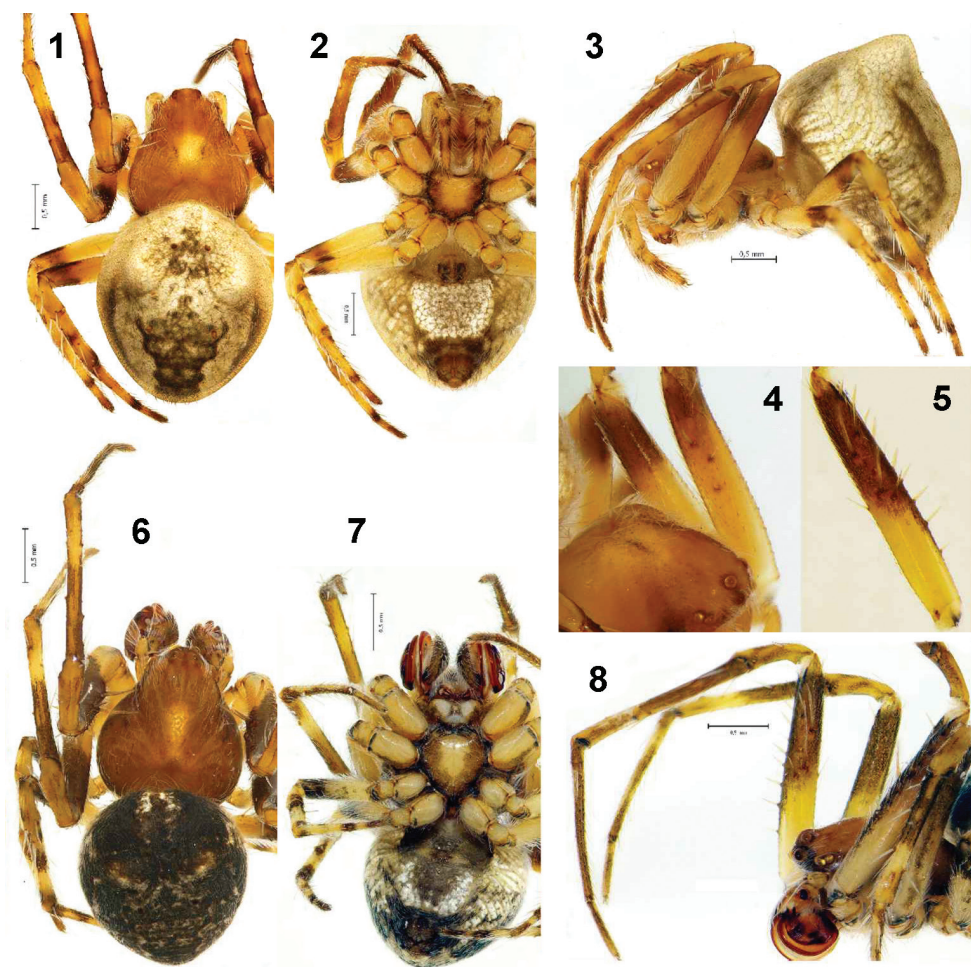
http://species-id.net/wiki/Araneus_strandiellus

Figs 1–14, 18–21

A. s. Charitonov 1951: 210, f. 2a-b (♀).

A. s.: Pavlenko 1985: 153; Marusik 1989: 41; Marusik et al. 1990: 17; Mikhailov 1997: 116; *A. s.*: Logunov et al. 1998: 130; Marusik et al. 2000: 13.

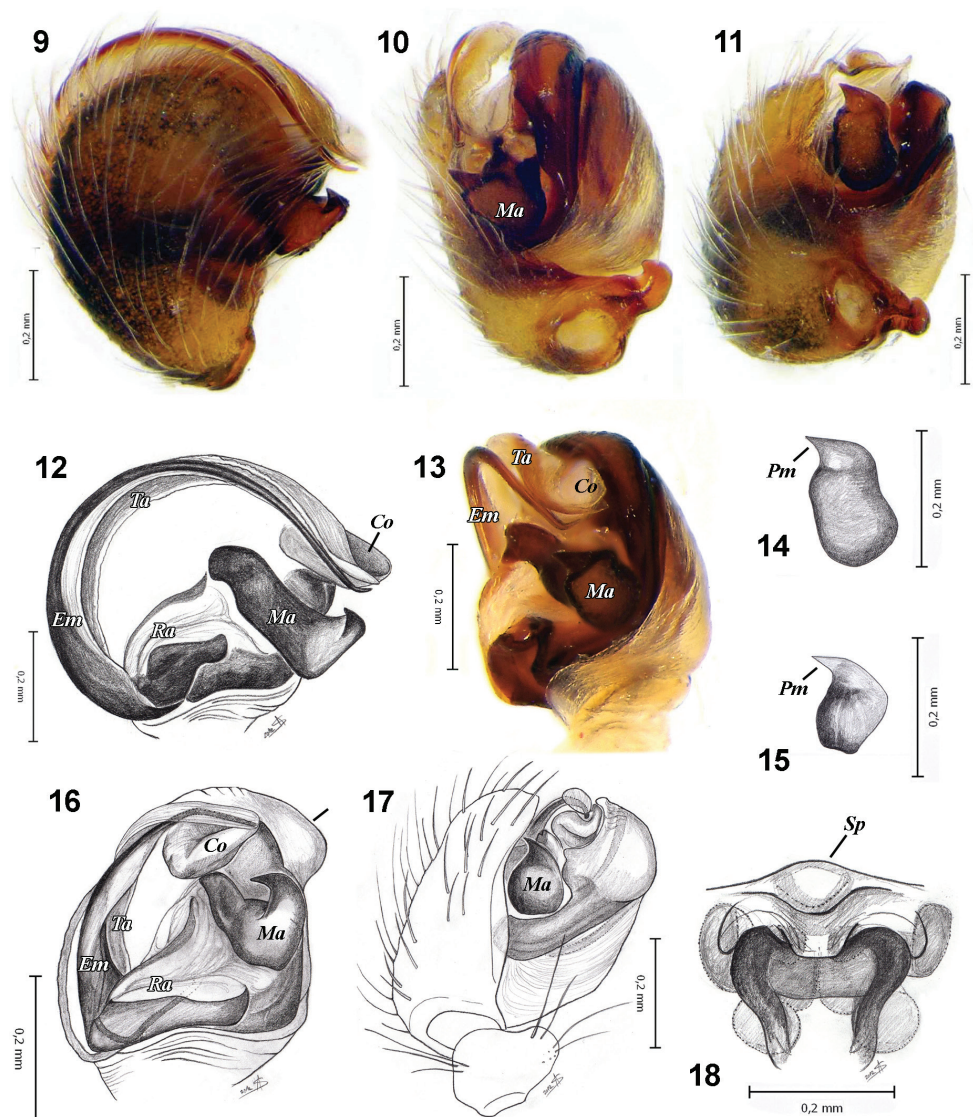
Material examined. Holotype ♀ (PSU), **TAJIKISTAN**, Varzob botanical Station, 30.07.1945 (V.V.Gussakovski) [ca 38°50'N, 68°50'E]. **KAZAKHSTAN**, *Almaty*



Figures 1–8. Habitus of *Araneus strandiellus*. 1–3 female, dorsal, ventral and lateral 4 female carapace and femora I and II, prolateral 5 male femur I, prolateral 6–7 male, dorsal and ventral 8 prosoma of male, lateral.

Area: 1♂ 3♀ 1juv. (ZMMU), environs of Bakans Town, tugai and thicket, June 1986 (Ch.K. Tarabaev); 1♀ (AGA), Charyn River canyon, Sartogai Boundary, 12.06.1993 (S.V. Ovchinnikov). **RUSSIA, Tuva:** 1♂ 4♀ (IBPN), Tere-Khol' Lake, Sharlaa Stand and around, 40°01.47'N, 95°03.45'E, 1150 m, 6–14.07.1996 (Yu.M. Marusik); 1♂ 1♀ (ISEA), Tere-Khol' Lake, SE shore, Eder-Elezin Sands (Desert), 1150 m, 12.07.1993 (Yu.M. Marusik); 1♂ (ISEA), Tere-Khol' Lake, S shore, sands with sparse *Caragana* shrubs, 6–26.05.1990 (O. Lyakhov).

Diagnosis. Habitus, pattern and copulatory organs of *A. strandiellus* resemble only those in *A. pallasi*. Both species have simple, weakly sclerotised epigyne with inflexible scapus; males lack stipes, subterminal apophysis, embolic cup, and have



Figures 9–18. Copulatory organs of *Araneus strandiellus* (9–14, 18) and *A. pallasi* (15–17). 9–17 left male palp 9 prolateral 10 ventral-anterior 11 ventral-posterior 12 cymbium removed, prolateral 13 same, ventral 14 median apophysis, ventral 15 same 16 cymbium removed, prolateral 17 same, ventral 18 epigyne, posterior. Co conductor Em embolus Ma median apophysis Pm terminal process of median apophysis Ra radix Sp pocket on scapus of epigyne Ta terminal apophysis.

weakly sclerotised conductor; long filamentous embolus; long (as embolus), narrow terminal apophysis; median apophysis with one prolaterally directed process (Fig. 9–17) (much shorter non filamentous embolus, and median apophysis with two

processes in majority of *Araneus* s. s.¹, e. g. *diadematus* group (Levi 1971)) and males have unmodified tibia II. *Araneus strandiellus* can be distinguished from sibling *A. pallasi* by having dorsal abdominal humps, and triangular scapus with pocket (wide, round scapus in *A. pallasi*). Males of these two species can be separated from other *Araneus* species by the round base of embolus, absence of the hump on tegulum and having longer median apophysis (Fig. 12, 16) with a triangular process in *A. strandiellus* (Fig. 14), and claw-like in *A. pallasi* (Fig 15).

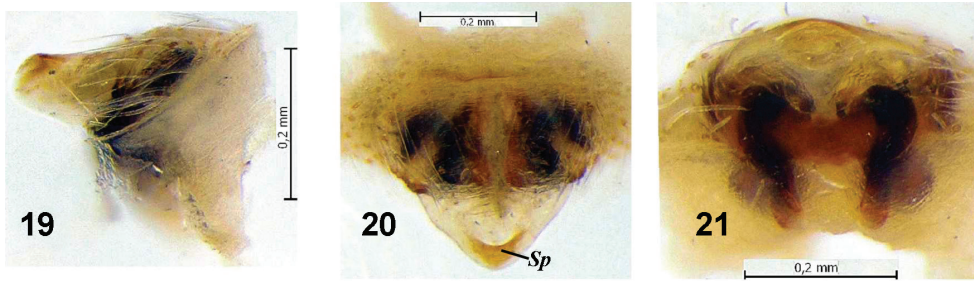
Description (specimens from Kazakhstan). Male. Total length 3.0. Carapace 1.4 long, 1.3 wide. Length of patella + tibia I 2.15 (patella 0.7; tibia 1.45). Carapace pale brown, covered with pale hairs; indistinctly darker on margins and with elongate whitish median spot (Fig. 6). Cephalic area of carapace slightly protruding. Diameter of AME subequal to PME. Distance between PME 1.3 times longer than between AME. Basal part of chelicera and retrolateral side dark brown. Promargin of chelicera with 3 teeth, retromargin with 2 small teeth. Sternum brown, with wide light spot in the centre (Fig. 7). Dorsum of abdomen with pair of small humps (Fig. 6). Humps separated by less than one diameter. Abdomen dark brown, with two white transverse bands. Venter of abdomen with dark median band, and whitish lateral bands (Fig. 7). Legs with annulations. Tibia II unmodified, similar to tibia I. Femur I prolaterally with 4 strong and long spines (Figs 5, 8) and with 7 short strong retrolateral spines.

Palp as in Figs 9–14. Patella with 2 macrosetae. Tegulum enlarged and all sclerites (embolus, conductor, radix, terminal and median apophyses) partly hidden by tegulum and cymbium. Terminal apophysis (*Ta*) long, flat, semicircular and weakly sclerotised; it runs apically between cymbium and tegulum. The long, thin and well sclerotised filiform embolus (*Em*) follows a groove in the terminal apophysis. Radix (*Ra*) short, stipes absent. Conductor (*Co*) very small, weakly sclerotised; supports tip of embolus from below. Median apophysis (*Ma*) with relatively small, triangular process (*Pm*) directed prolaterally.

Female. Total length 2.75–4.0. Carapace 1.25–1.45 long, 1.2–1.4 wide. Length of patella + tibia I 1.9–2.15 (patella 0.6–0.7; tibia 1.3–1.5). Coloration and pattern of carapace as in male, but paler (Figs 1–3). Diameter of AME 1.3 times smaller than PME. Distance between PME 1.4 times longer than distance between AME. Chelicerate teeth as in male. Frontal part of chelicerae yellow, retrolateral side dark. White spot in the centre of sternum wider than in male.

Dorsum of abdomen with pair of conical humps separated by less than one diameter. Abdomen pale with dark pattern (Fig. 1). Venter of abdomen white between epigastric furrow and spinnerets; white area as wide as epigastric furrow (Fig. 2).

¹ *Araneus* is the largest genus of all orb-weavers with many misplaced species. Unfortunately only few informal groups was made (e.g. *diadematus* group (Levi 1971), small orb weavers of the genus *Araneus* (Levi 1973), big species with humps, middle-sized species without humps and small species without humps (Šestáková et al. 2009)). It is impossible to compare studied species with others of this huge genus, for that reason we chose not very specific and convenient term “sensu stricto” meaning species close to nominal species *A. angulatus* Clerck, 1758, in other words “the true *Araneus* species”.



Figures 19–21. Epigyne of *Araneus strandiellus*. **19** lateral **20** ventral **21** posterior. *Sp* pocket on scapus of epigyne.

Femur I with 2–3 strong, long and pale spines (Figs 4). Legs yellow, with indistinct dark annulation. Ventral side of femur pale in almost all length. Patella pale with indistinct dark spot. Tibia and metatarsi without central dark rings or with small, dark spots.

Epigyne as in Figs 18–21, flat with weakly sclerotised inflexible triangular scapus (i.e. immovable merged with base of epigyne); tip of scapus with pocket (*Sp*); copulatory ducts and spermatheca slightly visible through cuticle. Base of epigyne always embedded in epigastric furrow, therefore posterior part visible only after its dissection or excavation.

Variations. Specimens from Tuva have darker coloration, lack white spot on carapace and sternum. Females from Tuva have no wide median band on the venter of abdomen. Importance of these differences is unclear to us.

Distribution. The species is known from the Aral Sea to eastern Tuva (Fig. 22) south to Tajikistan.

Comments. Generic affinity to *Araneus*, a genus comprising over 600 species (cf. Platnick 2012), is debatable. In comparison to *Araneus* s. s., *A. strandiellus* has only 3 promarginal and 2 retromarginal teeth (4 promarginal and 3 retromarginal in *Araneus* s. s.); females do not have heavy sclerotised epigyne and flexible scapus; and males lack stipes, subterminal apophysis and cap on embolus, conductor is very small and weak sclerotised and median apophysis has only one process.

Judging from the general shape of epigyne (presence of inflexible scapus) and the male palpal configuration (shape of median and terminal apophysis, embolus) *A. strandiellus* and probably the closest relative *A. pallasi* mostly resemble *Neoscona* Simon, 1864 (one of the junior synonyms of *A. pallasi* was considered in *Neoscona*) or *Agalenatea* Archer, 1951. However unlike *A. strandiellus* and *A. pallasi*, males of both *Agalenatea* and *Neoscona* have stipes and subterminal apophysis, an anticlockwise course of embolus, legs with hook on coxa I and modified tibia II (more numerous and stronger spines than on other legs). Epigyne of these two related species are weakly sclerotised and embedded in epigastric furrow (posterior part visible only after its dissection or excavation), while in *Agalenatea* and *Neoscona* epigyne are not embedded and heavy sclerotised.

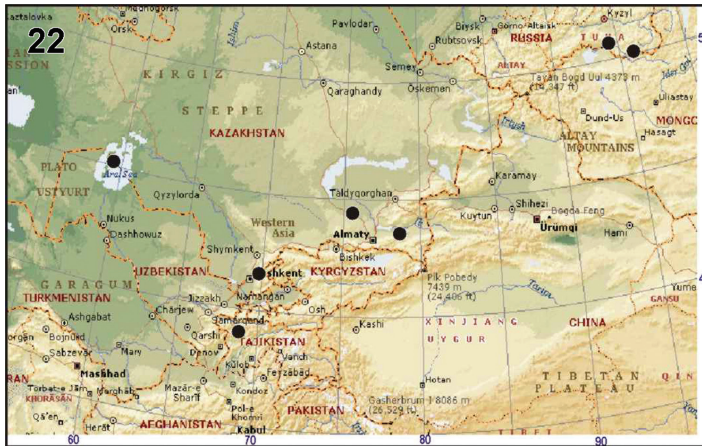


Figure 22. Known collecting localities of *Araneus strandiellus*.

Acknowledgements

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