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Annotated type catalogue of the Amphibulimidae (Mollusca, Gastropoda, Orthalicoidea) in the Natural History Museum, London

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Abstract

The type status is described of 39 taxa classified within the family Amphibulimidae (superfamily Orthalicoidea) and kept in the London museum. One taxon, *Bulimus elaeodes* Pfeiffer, 1853, is removed to the Strophocheilidae. Lectotypes are designated for *Bulimus adoptus* Reeve, 1849; *Bulimus (Eurytus) eros* Angas, 1878; *Helix onca* d'Orbigny, 1835; *Amphibulima pardalina* Guppy, 1868. The type status of the following taxon is changed to lectotype in accordance with Art. 74.6 ICZN: *Strophocheilus (Dryptus) jubeus* Fulton, 1908.

As general introduction to this and following papers on Orthalicoid types in the Natural History Museum, a brief history of the London collection is given and several examples of handwriting from different authors are presented.

Keywords

Amphibulimidae, types, biohistory

Introduction

Annotated catalogues of type specimens are an important source of information on the primary types that constitute the basis of a stable taxonomy for a group. For the superfamily Orthalicoidea, with more than 1750 available taxa names, this has partly been achieved by the papers of Zilch (1971, 1972), Breure (1975, 1976,

2011), Neubert and Janssen (2004) and Köhler (2007). Breure (1979) and Breure and Schouten (1985) listed all the primary type material for this group, known at that time. During the course of an ongoing revision of the Orthalicoidea, which now also includes phylogenetic research (Breure et al. 2010, Breure and Romero, in press), it became evident that a re-study of types and a documentation up to present-day standards were needed to ensure a stable taxonomy at the species level. This paper is a first contribution presenting the type material of the Orthalicoidea in the collection of the Natural History Museum (hereafter NHM or the Museum), London, United Kingdom, which now houses more than 600 types of nominal taxa from this group. For practical reasons, this paper is dealing with the Amphibulimidae only. However, in the following introduction to the collection and the handwritings found therein, some examples from other families within the Orthalicoidea will be mentioned; these other families will be treated in subsequent papers.

The collection

The NHM collection is famous for its large amount of primary types of taxa, many of which were described throughout the 19th Century. For a concise general history of the collections, see Stearn (1981: 194–197); for acquisitions up to 1904, see E.A. Smith (1906). Biographical references have largely been obtained from Coan et al. (2011). In the context of this paper, the following acquisitions are important to mention as they contained type material of several taxa dealt with herein.

In 1837 the Trustees of the Museum purchased the collection of William J. Broderip, which probably also contained type material of species he described together with Sowerby (Broderip and Sowerby 1832a, b). However, some of these types came into the Cuming collection (see below), and were further exchanged (see Köhler 2007, Neubert and Janssen 2004). Around the same time, part of the extensive collection made by Lansdown Guilding in the West Indies was acquired at an auction, containing "the actual types or co-types of the various species described by Mr. Guilding" (E.A. Smith 1906: 704). However, none of the taxa described by Guilding pertaining to the Orthalicoidea could be traced during this research.

The collection of Hugh Cuming has been a source for thousands of species descriptions, giving it a unique position in its time-frame. As far as can be traced from the registration books in NHM, several series were purchased during Cuming's lifetime. In 1842 and 1843 the Museum purchased about 1800 specimens collected by Cuming, who lived for several years in Chile and made collecting trips to, among others, parts of South and Central America (Melvill 1895). He not only collected himself, but also gathered specimens from various sources, through exchange, and with the help of various assistants, e.g., Thomas Bland (see Martin 1886), Bourcier (possibly Jules Bourcier, who was at the time French consul to Ecuador; see Beolens and Watkins 2003), his son-in-law Thomas Bridges (Dall 1866), David Dyson (an assistant to Cuming, who collected in the Neotropics; le Tomlin 1945), Nicolas Funck (who was a draftsman

to J. Linden and accompanied him during his collecting travels; his third trip was to Venezuela in 1841–1842 and he returned to that country in 1845; see Urban 1902), Gueinzius (possibly Wilhelm Gueinzius, who never travelled in South America, but who exchanged extensively with Eduard Friedrich Poeppig, a German naturalist who spent several years in Brazil, Chile, and Peru; see Urban 1902), Karl Theodor Hartweg (a German botanist who collected extensively in Central America, Ecuador and Colombia (see Urban 1902, Anonymous 2011a), William Lobb (an English plant collector who travelled in South America in 1840–1848; see Shepard 2003), John Miers (an English botanist who lived for some years in Brazil; see Anonymous 2011b), Auguste Sallé (a French malacologist; see Crosse 1897), Louis Joseph Schlim (travelled with J. Linden to Venezuela, New Granada, Jamaica and Cuba from 1841–1844, and together with N. Funck in 1845 to Guadeloupe and Venezuela; see Urban 1902), and Richard Spruce (an English botanist who spent approximately 15 years exploring the Amazon from the Andes to its mouth; see Seaward and Fitzgerald 1996). As far as we could detect none of the lots inspected were found accompanied with a label bearing Cuming's handwriting (see also below). Cuming, "in the most free and liberal manner, opened the collection to the use of (..) conchologists and iconographers as would fall into his views as to the describing and naming of species" (Gray 1868: 726; cf. Gray 1869 where this account on the Cuming collection was re-published, spreading this tale also to the New World). Lovell Reeve and the Sowerby family made extensive use of this opportunity to describe and publish many species and publish series of books, as documented by Petit (2007, 2009). But Cuming also made contacts with continental malacologists, of which Louis Pfeiffer needs a special mention in the context of this paper. According to Neubert and Janssen (2004: 196) "in 1845, a large suite of terrestrial molluscs were exchanged with H. Cuming containing a considerable number of voucher specimens to the important works of (..) L. Pfeiffer". Gray (1868: 728) says that "Mr. Cuming was in the habit of sending to Dr. Pfeiffer, Reeve, Sowerby, and other describers and figurers of the species certain specimens from his duplicates marked with the same number as that attached to his own specimens; and the determination of the species depended on the accuracy with which these numbers were reported" (see also below and Fig. 5). Although a few cases have been spotted during our revisionary work where an obvious mistake has been made, it has also been possible to match many specimens to the original dimensions or figures given by Pfeiffer, Reeve, and Sowerby. This implies that specimens on which species descriptions were based were often returned by Pfeiffer to Cuming's collection. After the death of Cuming in 1865, the collection was acquired by the Museum in 1866 (E.A. Smith 1906: 710).

In 1844, the Museum obtained the material collected during the surveying voyage of H.M.S. *Fly* along the coasts of New Guinea and Australia (see Jukes 1847 [2011]). The material, collected by the naturalist John MacGillivray, contained several new species of Placostylidae later described by Pfeiffer. Also the material from the surveying voyages of H.M.S. *Herald* and H.M.S. *Pandora*, commanded by Captain Henry Kellett and Lieut. Wood respectively, along the coast of California and the Pacific coast of Central and South America (see Seemann 1853, Samson 1998, Colledge and Warlow

2010) was presented to the Museum shortly afterwards . Several species of Bulimulidae were described on the basis of this material by Edward Forbes (1850).

The collection of Alcide d'Orbigny came to London in 1854 (E.A. Smith 1906: 707). Part of it is based on the specimens collected during his journeys to South America (Gray 1854) and includes most of the specimens dealt with in his "Voyage..." (d'Orbigny 1834–1847) (dates according to Sherborn and Griffin 1934). Many taxa had been briefly described before in d'Orbigny (1835), but the importance of the "Voyage..." was mainly in the elaboration of the localities (see Breure 1973 for localisation in modern geography), and in accurately figuring most of the taxa. Between 1870 and 1886, the collection of Australian material made by George French Angas, containing many types, was donated by him to the Museum (see also Iredale 1959). In the same period the collection of Robert John Lechmere Guppy, an Englishman who lived for many years in Trinidad (see Newton 1917), came to the Museum. The material comprised the type specimens of taxa described by him from various islands in the West Indies. In 1875, the collection of Thomas Lombe Taylor was presented by his widow. Its importance is mainly marked by the many species described by Lovell Reeve in the "Conchologia Iconica" (see also Dance 1986: 170–171). In 1883 the Museum purchased the collection of Jean Baptiste Gassies (see Crosse and Fischer 1884), containing many types of Placostylidae described from New Caledonia. Ten years later the collection of Arthur Morelet came to London after having been bought at an auction by Fulton, a well-known dealer at that time (see Fulton 1920). It contained all the types described by Morelet, including several Bulimulidae from South America.

In 1901 Frederick DuCane Godman presented to the Museum his extensive collection of biological material from Central America. Jointly with Osbert Salvin he was co-editor of a multi-volume encyclopaedia on the natural history of that area, of which the land and freshwater Mollusca were treated by Eduard von Martens (1890–1901). The types of species described by von Martens can be found in the Godman collection. During the years 1902–1904, several type specimens described by James Cox (Placostylidae) and by James Cosmo Melvill and John H. Ponsonby (*Prestonella*) were either purchased or presented. Also type material described by S.I. da Costa and W.K. Weyrauch was presented by these authors to the Museum. Via dealers like H.B. Preston and Sowerby and Fulton, the Museum acquired material that had been either described by these dealers or originated from continental collections (e.g. Grateloup, Rolle).

For a complete understanding of the collection it is also necessary to know the history of its staff. While John Edward Gray was one of the first Keepers of the Zoology Collection (1840–1875), Edgar Albert Smith was certainly the most prominent staff member during the late 19th century; he joined the Museum in 1867 and retired in 1913. After his retirement, the Mollusca Section was formally set up. Guy Coburn Robson (1888–1945) was the first head of section, and had been working on the collections since 1911, when he entered the Museum after study at Oxford and in Naples. He had a particular interest in cephalopods, and published an important monograph

in 1931–1936, but also wrote on broader problems of species and variation. When Robson resigned due to ill health in 1935 he was succeeded by George Ivor Crawford, who had studied at Cambridge and worked at the Marine Biological Laboratory in Plymouth. Crawford was followed in 1946 by William James Rees (1913–1967), who was heavily involved in the post-war reconstruction of the galleries and a reorganisation of the collections. Like Robson, he paid particular attention to the cephalopods until he moved to the Coelenterate Section in 1955. The fourth head of the Section was Ian Courtney Julian Galbraith, who was followed by Norman Tebble in 1959 when he transferred to the Bird Section. The heads of section were assisted by J. C. Vickery, who joined as a Boy Attendant in 1897, and finally retired as a Higher Grade Technical Assistant in 1947 (Hindle 1946, Crawford 1967, Stearn 1981).

Labels, author's handwriting and matching specimens

Historical collections are not only a rich source of type material but they also permit us to have a glimpse back in time. Labels and their handwriting are often the sole remnants of work done by malacologists in the past. In the context of this project we came across many labels bearing original handwriting. Although some examples are given elsewhere (e.g. Dance 1966, Zilch 1967, Wood and Gallichan 2008, Breure 2011), it seems useful to present an overview of handwritings we encountered during this research and which we can attribute to authors of taxa (Figs 1–3, 4A–B).

As pointed out above, the Cuming collection is a rich source of material and this also extends to interesting labels. For example there are many examples (Fig. 4B) of labels with Pfeiffer's handwriting, which is quite characteristic and has been published before (Zilch 1967: 36). Although it is difficult to reconstruct the past with an accuracy that rules out any assumptions, the following observations may help to partially explain the way the Cuming collection was dealt with. Cuming himself has rarely left his handwriting on labels (see also Petit 2007: 74). Most of his labels were written by his collectors and his assistants (e.g., Fig. 4G), who wrote an abbreviation for the genus name plus the locality data and a number that apparently was used to check when the determinations came back. On the last line of some labels we have found some unknown reference, e.g. "1 in No.". Contrary to remarks found on labels added in a 20th Century handwriting, we are not of the opinion that this referred to the number of specimens, but instead to the number of lots that were sent under a given reference number (examples in Fig. 5). The examples also show that Cumingian material was either sent to Pfeiffer for identification and was afterwards returned to London, or Pfeiffer made his identifications during "his frequent trips to London to consult the Cuming collection" (Dance 1986: 122; see also Wheeler 1949: 52).

There has been some debate in literature about the accuracy of locality labels of Cuming material (Smith 1906: 710–711; Dance 1966: 167–170; Dance 1986: 127–129; Petit 2007: 30). "In many of the specimens, especially those that have not yet

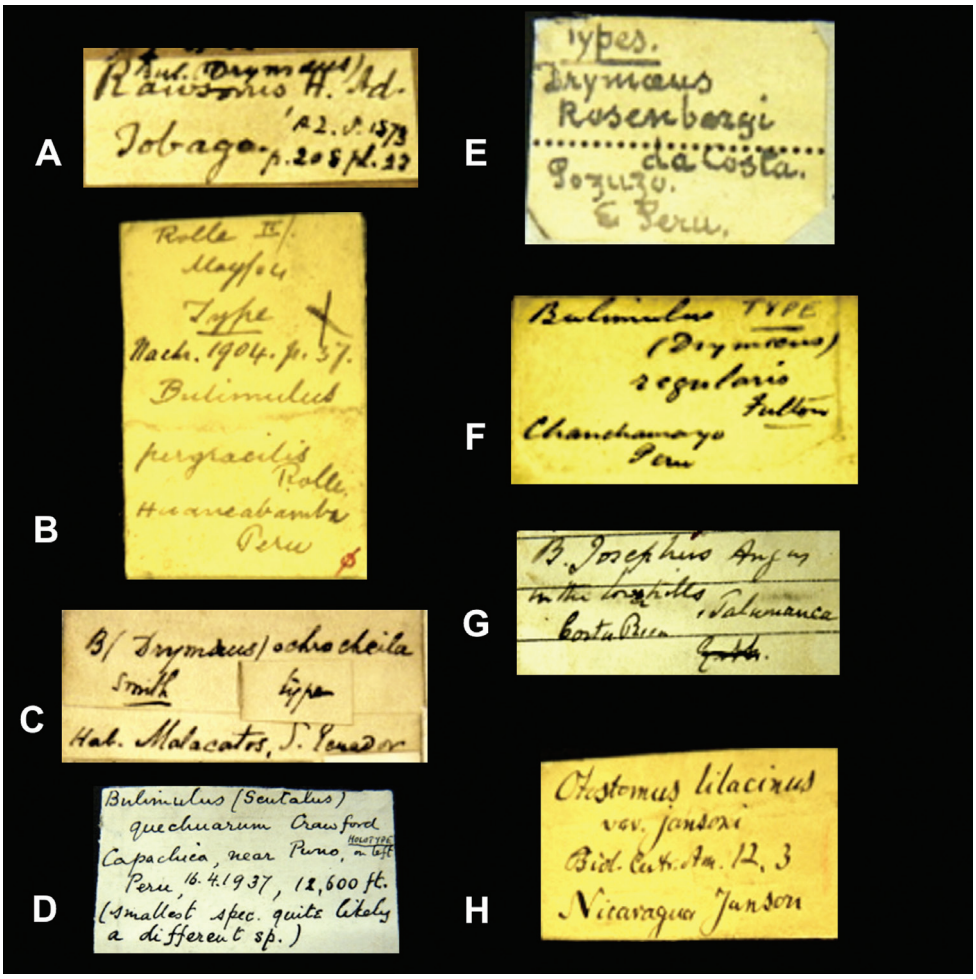

Figure 1. Labels of species bearing the author's handwriting. **A** H. Adams. **B** H. Rolle. **C** E.A. Smith. **D** G.I. Crawford. **E** S.I. da Costa. **F** H.C. Fulton. **G** C.F. Angas. **H** E. von Martens.

been determined or named, the habitat, written on a small paper label, is stuffed into the mouth of the shell" (Gray 1868: 727). Later these labels were gummed to the back of wooden tablets, as Gray (o.c.: 729) writes "I have had the shells of the Cumingian collection placed on [wooden] tablets so that they may be arranged in the same series as the other shells in the British Museum; but each tablet is marked in such a manner that it may be at once distinguished from the rest of the collection, so that there can be no doubt about which are the types or the presumed types of the species described from the collection". These marks are "M.C." or "Mus. Cuming" (Figs 6B–C). On the front side, the tablets have been covered with a sheet of gray paper, on which a summary of taxon name and locality data have been added, presumably after the arrival of the collection at the Museum. Around the turn of the century, glass-topped cardboard boxes came into use to house some of the specimens. In the course of the

Figure 2. Labels of species bearing the author's handwriting. **A** H.B. Preston. **B** H. Dohrn. **C** J.E. Gray (?). **D** C.M.F. Ancey. **E** A. Morelet. **F** Reibisch. The upper label has possibly been written by P. Reibisch, but it could also have been some else of the Reibisch family (K. Schniebs, pers. comm.). The lower label is in the handwriting of P. Reibisch (courtesy of K. Schniebs). **G** E. Forbes. **H** J.C. Melvill. **I** R. Tate. The author's name has been added in the NHM.

20th Century, it was decided to start with removing the shells and the labels from these wooden tablets or to cut the bottom of the cardboard boxes, mainly to save space (K.M. Way, pers. commun.). Due to the enormous amount of material, this has only partly been achieved so far. Therefore shells from the Cuming collection can now be found with one of the following 'label types': (I) the labels are still gummed on one or both sides of wooden tablets (Fig. 6A); (II) the labels are gummed to the bottom of the cardboard box in which the specimens are housed, with a summarizing label on the top side behind the glass lid (Fig. 6D); or (III) only the bottom of the cardboard has been preserved to which the labels are still glued (Figs 6B–C); (IV) the labels have

Figure 3. Labels of species bearing the author's handwriting. **A** W.J. Broderip. **B** W. Dunker. **C** R.J.L. Guppy. **D** A. d'Orbigny. **E** H. Crosse. The labels have been glued upon the shell. **F** A.W.B. Powell. The label is glued onto the cardbox. **G** J.B. Gassies. **H** M.W.K. Connolly. **I** A. Garrett.

been soaked off and are kept in archival pockets placed together with the specimens in an open box (Fig. 6E).

The specimens figured by Reeve in his 'Conchologia Iconica' (see also Petit 2009: 46) are never accompanied by written labels from that author (Figs 4C–E); instead, they have small printed labels with the taxon name on one side and the reference to a plate and figure on the other side ('label type' V: Fig. 4F); the font and position suggests that these labels were cut from a spare index to the 'Conchologica Iconica'. The shells in these lots can generally be matched to the published figures, as these are very accurate with regard to the shell shape, size and colour (K.M. Way, pers. comm.). However, several instances have been found where lots labelled in the indicated way could not be matched to the original figures; it may have been that also duplicate sets

Figure 4. A–B Labels of species bearing the author's handwriting. **A** J.P.S. de Grateloup. **B** L. Pfeiffer. **C–F** Labels of species described by L.A. Reeve. **C–D** Taxon name on printed labels. All other information seems to have been added after the arrival of the Cuming collection in NHM (post-1866); note the ambiguous locality information in **D. E** Taxon name in handwriting, probably in Pfeiffer's hand. **F** Two sides of a printed taxon label. *Recto*, the name and author of the species (Index: v, left row, third line from below). *Verso*, part of reference to Table and Species number (Index: vi, right row, third line from below). **G** Locality label probably in handwriting of one of Cuming's assistants. The text on the right-hand side was found in the archive of NHM Mollusca section.

have been labelled with these printed labels. The shells are usually figured in the "Conchologia Iconica" to their actual size, or the figures are accompanied by lines that indicate such size although two additional observations are worthwhile mentioning. While Reeve is known to have generally indicated by a scale bar whenever he figured a shell larger than actual size, some exceptions have been encountered (e.g., Plate XIV). The second observation is related to the way the shells might have been measured. Whenever the shells were elongate in shape with a high height/diameter ratio, the figured

Figure 5. Examples of labels with a reference number in the upper left-hand corner and a text on the lowest line most likely referring to the number of lots under this reference number (e.g., "1 in No."). Note that the labels all bear the taxon name in Pfeiffers's handwriting (plus additional notes in the left-hand example).

specimen always gave a good match. However, when the shell was more globose (viz. a lower height/diameter ratio), the figured specimen only had a good match when it was placed with the aperture downside; thus contrary to more modern practices where shells are always measured perpendicular to the ventral view.

In the collection, labels were found with handwriting that is attributed to the following persons (references to biographical data included): Henry Adams (Crosse and Fischer 1878; Fig. 1A), César-Marie-Félix Ancey (Wood and Gallichan 2008; Fig. 2D), George French Angas (Melvill 1890; Fig. 1G), William John Broderip (Melvill 1890; Fig. 3A), Matthew William Kemble Connolly (le Tomlin 1947; Fig. 3H), George Ivor Crawford (Fig. 1D), Joseph Charles Hippolyte Crosse (Poyard 1898; Fig. 3E), Solomon Israel da Costa (Melvill 1908; Fig. 1E), Wilhelm Dunker (Kobelt 1885; Fig. 3B), Hugh Coomber Fulton (Smith 1906; Fig. 1F), Edward Forbes (Melvill 1890; Fig. 2G), Jean Pierre Sylvestre de Grateloup (Fischer 1862; Fig. 4A), John Edward Gray (Anonymous 1875; Fig. 2C), Robert John Lechmere Guppy (Newton 1917; Fig. 3C), Karl Eduard von Martens (Kobelt 1905; Fig. 1H), James Cosmo Melvill II (Jackson 1930; Fig. 2H), Arthur Morelet (Crosse 1893; Fig 2E), Alcide d'Orbigny (Germain 1933; Fig. 3D), Louis Pfeiffer (Crosse and Fischer 1878; Figs 4B, 5), Rudolp Amandus Philippi (Barros 1904; Fig. 4G), Hugh Berthon Preston (Winckworth 1946; Fig. 2A), Paul Hermann Reibisch (Schniebs 1999; Fig. 2F), Hermann Rolle (Zilch 1967; Fig. 1B), Ralph Tate (Blake 1902; Fig. 2I).

When interpreting possible type material, it is always good practice to check against the original publication (e.g. locality, dimensions, collector). However, when working with historical collections, one cannot always expect the same data that is given in present-day publications, and often one has to investigate with a biohistorical time-frame in mind. In the case of material dating back to the early 19th century, written accounts documenting the history of a collection have vanished in many cases or label handwriting has faded away. And while malacologists like Broderip, Reeve, and Sowerby generally have not left their handwriting in collections (but see Fig. 3A for an exception), it may safely be assumed that they were in contact and may well have swapped material amongst their

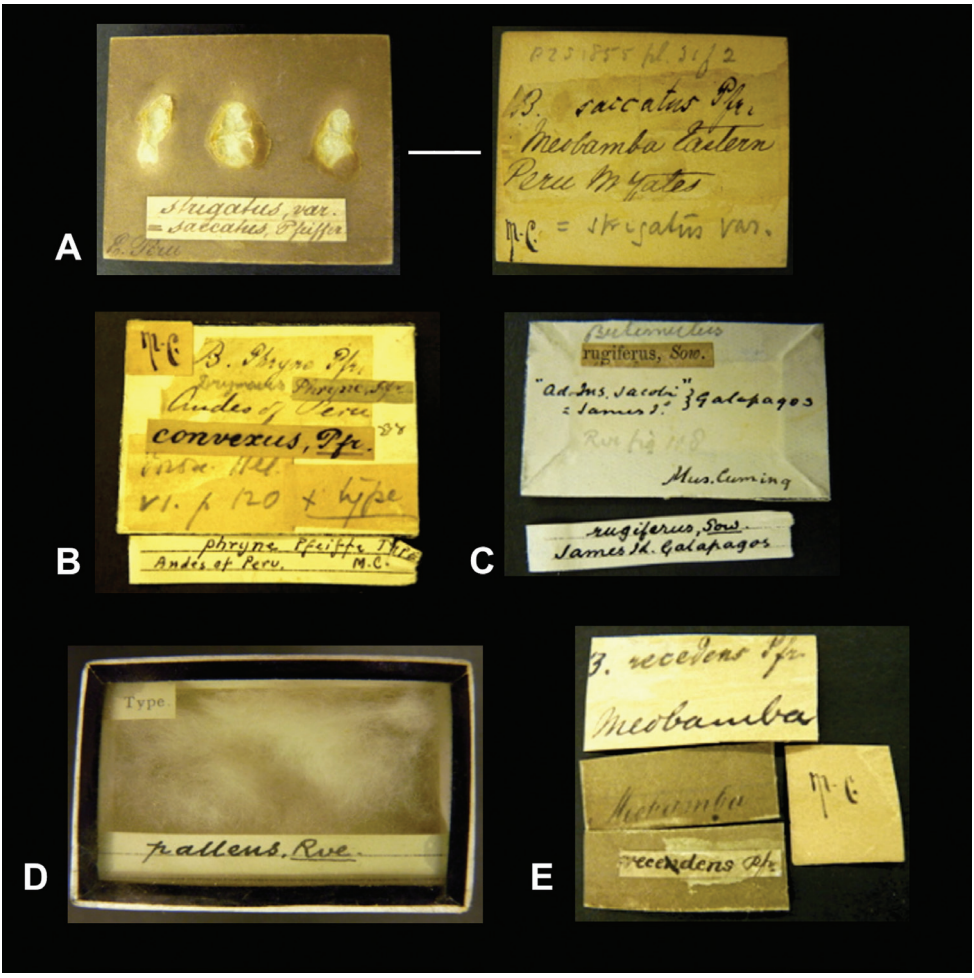

Figure 6. Label types in the Cuming collection. **A** Original wooden tablet. *Recto*, one side showing the places where the shells had been glued, a taxon label written by an assistant, and the locality written in the left-hand corner. *Verso*, Original label glued on the tablet, stating the locality and the taxon name (in this case, in Pfeiffer's handwriting), and notes by subsequent curators. The locality label is probably in the handwriting of Robert Furley Geale, who worked for Cuming as an Assistant for many years (P. Dance, pers. comm.). The characteristic abbreviation "M.C.", added after the collection had arrived in the NHM in 1866, appears in black ink in the left-hand corner. **B–C** Only the bottom of the cardboard has been preserved to which the labels are still glued. The summarizing label (with text written on lines) is kept as the second label. In **B** the upper taxon label bears Pfeiffer's handwriting; the locality data probably have been written by one of Cuming's assistants. The label "convexus, Pfr." is possibly in E.A. Smith's handwriting. The label at the bottom in G.I. Crawford's handwriting. In **C** all text in ink is probably by E.A. Smith. **D** The labels are gummed to the bottom of the cardboard box in which the specimens are housed, with a summarizing label on the top side behind the glass lid. **E** Labels which have been soaked off the wooden tablet and which are kept inside an archieval pocket.

collections (K.M. Way, pers. comm.). In general, lots originating from older collections, such as the Cuming collection, may not always be accompanied by label data that exactly matches the locality data given in the original publication. Some cases were found where labels have been added during later years, giving a different or broader defined locality than the original label has (Fig. 4D; compare the original published description and the label found in the Cuming collection, with a handwriting that is probably of an assistant during the late 19th century). This may have added in some instances to confusion in subsequent literature about the occurrence and distribution of a taxon.

Methods

When assessing possible type material, the following criteria have been applied: (a) the authorship and the locality fit with the original description (but see note above on the differences which may occur between published locality data and those on labels); (b) alleged type material is in accordance with the established understanding of the taxon. In order to fulfill the requirements of article 74 of the International Code of Zoological Nomenclature (ICZN), any lectotype designations herein are to be understood as to have the sole purpose to fix the status of these specimens as the sole name-bearing type of that nominal taxon, to ensure the name's proper and consistent application, even when this is not explicitly done in every single case but abbreviated as "lectotype designation". Lectotypes designated herein are made using the following criteria, in order of preference: (1) the relevant specimen was figured in the original description, or in subsequent revisionary works; (2) if no original figure was published, a specimen was selected that matches as closely as possible the measurements given in the original description. If it is known that the original collection has been destroyed (e.g., Pfeiffer, Strebel; teste Dance 1966), and specimens have been found with labels in the original author's handwriting or originating from the original author, these are herein treated as possible syntypes.

For each taxon the original publication—in which the taxon was proposed—is mentioned, as well as papers in which reference is made to the **Type material.** The type locality is quoted from the original publication in the original wording and language, with clarifying notes between square brackets. The name of the collector, if given in the original paper, is only mentioned (in italics) if it might give a clue about the type status of material present in the collection. The text of the original, or oldest, label is quoted, together with information from subsequent labels if containing information necessary for a correct interpretation. All labels have been photographed and are figured for future historic reference. The original dimensions are quoted, if necessary transferred to mm (see Stöver 1986; see also Rowlett 2004). Dimensions of the type specimens have been taken with a digital caliper, using the methods figured by Breure (1974: fig. 2); measurements up to 10 mm have an accuracy of 0.1 mm, those above 10 mm are accurate to 0.5 mm. Due to improvements in accuracy of calipers, the measurements given herein are in several

cases slightly different from those reported by Breure (1978), Breure and Eskens (1981) and Breure and Schouten (1985). Comparing the current measurements to those quoted from the original publication, one should be aware that the diameter especially may have been measured differently. In the case of syntypes, only the largest specimen has been measured. Under type material the NHM-registration numbers are given; if specimens from different localities are present, the order of the lots corresponds with the information of the different labels. The number of specimens originally available, if quoted by the original author, are mentioned under **Remarks.** Remarks are further given to describe any individual characteristics of the type specimens or any other details of the type lot. The current systematic position is given, following the generic scheme of Breure (1979) and the familiar arrangement of Breure et al. (2010) and Breure and Romero (in press).

Abbreviations used for depositories of material are: NHM, Natural History Museum, London, U.K.; RMNH, Netherlands Centre for Biodiversity Naturalis, Leiden, the Netherlands; SMF, Natur-Museum Senckenberg, Frankfurt am Main, Germany; ZMB, Zoologisches Museum, Humboldt Universität, Berlin, Germany. Other abbreviations used are: **/** end of line in cited text; coll., collection; D, diameter; H, shell height; M.C., Cuming collection; leg., *legit*, collected; W, number of whorls.

Systematics

Systematic list of taxa arranged in generic order

This systematic list follows the generic classification from Breure (1979), amended as proposed by Breure and Romero (in press), and unpublished data from the senior author; genera are presented in alphabetical order. As for some genera no phylogenetic data have been obtained yet (e.g. *Dryptus*), their familiar relationship remains tentative until a more satisfactory arrangement can be presented.

Family Amphibulimidae P. Fischer, 1873

Amphibulima Lamarck, 1805
pardalina Guppy, 1868.

Dryptus Albers, 1860
adoptus Reeve, 1849; *guerini* Pfeiffer, 1846; *jubeus* Fulton, 1908; *marmoratus* Dunker, 1844.

Pellicula P. Fischer, 1856
appendiculata Pfeiffer, 1847.

Plekocheilus (Aeropictus) Weyrauch, 1967
cathcartiae Reeve, 1849; *dissimulans* Preston, 1909; *latilabris* Pfeiffer, 1855; *quadricolor* Pfeiffer, 1848; *scytodes* Pfeiffer, 1853; *veranyi* Pfeiffer, 1848; *zilchi* Breure, 1977.

Plekocheilus (Eudolichotis) Pilsbry, 1896
aurissciuri Guppy, 1866; *dillwynianus* Pfeiffer, 1853; *lacerta* Pfeiffer, 1855; *otostomus* Pfeiffer, 1855; *perdix* Pfeiffer, 1848.

Plekocheilus (Eurytus) Albers, 1850
auriformis da Costa, 1904; *bruggeni* Breure, 1978; *castaneus* Pfeiffer, 1845; *corticosus* Sowerby, 1895; *doliarius* da Costa, 1898; *episcopalis* Pfeiffer, 1855; *eros* Angas, 1878; *lamarckianus* Pfeiffer, 1848; *onca* d'Orbigny, 1835; *piperitus* Sowerby, 1833; *pulicarius* Reeve, 1848; *rhodocheilus* Reeve, 1848; *roseolabrum* E.A. Smith, 1877; *superstriatus* Sowerby, 1833; *taylorianus* Reeve, 1849.

Plekocheilus (Plekocheilus) Guilding, 1828
linterae Sowerby, 1890; *loveni* Pfeiffer, 1848; *plectostylus* Pfeiffer, 1848; *speciosus* Pfeiffer, 1855; *taquinensis* Pfeiffer 1855.

Alphabetic list of taxa by species name

***Bulimus adoptus* Reeve, 1849**
http://species-id.net/wiki/Bulimus_adoptus
Figs 7A–B, 7i

Bulimus adoptus Reeve 1849 [1848–1850]: pl. 82 fig. 608.

Type locality. "Banks of the Orinoco".

Label. "Venezuela". M.C. label type V.

Dimensions. Not given; lectotype H 83.3, D 42.8, W 5.6.

Type material. NHM 20100517.1–3, lectotype and two paralectotypes (Cuming coll.).

Remarks. The specimen figured by Reeve has been traced in the collection and is here designated lectotype (design. n.). The specimen has been damaged several times during life-time and the shell is slightly deformed. The synonymisation of this taxon with *Dryptus funckii* (Nyst, 1843) by Pilsbry (1895 [1895–1896]) is here tentatively retained.

Current systematic position. Amphibulimidae, *Dryptus funckii* (Nyst, 1843).

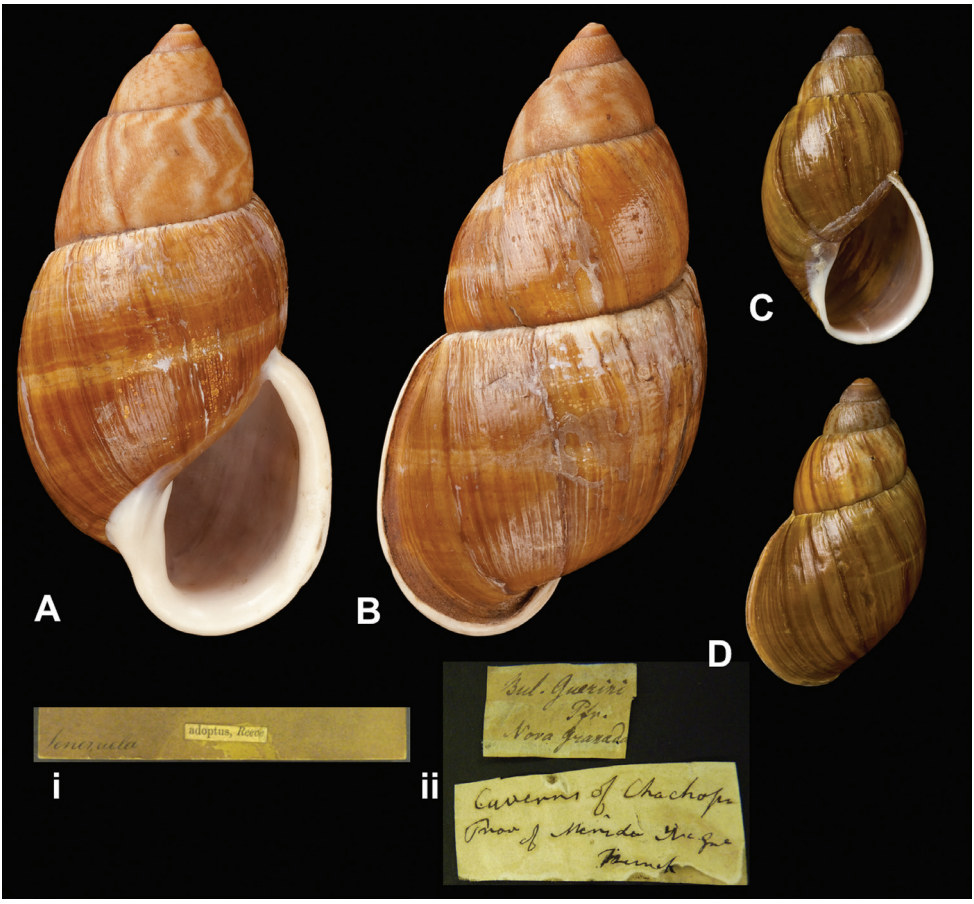

Figure 7. *Dryptus* species. **A–B, i** *D. marmoratus* (Dunker, 1844), lectotype of *Bulimus adoptus* Reeve, 1849 NHM 20100517 (H = 83.3) **C–D, ii** *D. gueirini* (Pfeiffer, 1846), lectotype NHM 1975272 (H = 41.0).

***Succinea appendiculata* Pfeiffer, 1847**
http://species-id.net/wiki/Succinea_appendiculata
Figs 10A–B, 10i

Succinea appendiculata Pfeiffer 1847:146.

Type locality. "insula Guadeloupe".

Label. "Guadeloupe"; taxon label in Pfeiffer's handwriting. M.C. label type III.

Dimensions. "Long. 14, diam. 9 mill."; figured specimen H 14.2, D 10.0, W 1.9.

Type material. NHM 20110303, three syntypes (Cuming coll.).

Remarks. The specimens are slightly damaged due to the thinness of the shells.

Current systematic position. Amphibulimidae, *Pellicula appendiculata* (Pfeiffer, 1847).

***Strophocheilus (Eurytus) auriformis* da Costa, 1904**
http://species-id.net/wiki/Strophocheilus_auriformis
Figs 14A–C, 14i

Strophocheilus (Eurytus) auriformis da Costa 1904: 5, pl. 1 fig. 1.
Plekocheilus (Eurytus) auriformis (da Costa); Breure 1979: 29.

Type locality. "Bogotá, Colombia".

Label. "Bogata, Colombia"; in da Costa's handwriting.

Dimensions. "Long. 74, diam. 38 mm"; holotype H 74.0, D 38.6, W 5.1.

Type material. NHM 1907.11.21.112, holotype (coll. da Costa).

Remarks. Da Costa (1904) mentions that "only one specimen has been obtained".

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) auriformis* (da Costa, 1904).

***Plekocheilus aurissciuri* Guppy, 1866**
http://species-id.net/wiki/Plekocheilus_aurissciuri
Figs 27A–C, 27ii

Plekocheilus aurissciuri Guppy 1866: 51.
Plekocheilus (Eudolichotis) aurissciuri Guppy; Breure 1979: 33.

Type locality. [Trinidad].

Label. "Trinidad"; in Guppy's handwriting.

Dimensions. "Height 1.65 inch, greatest breadth 0.7 inch"; figured specimen H 36.7, D 15.6, W 5.3.

Type material. NHM 1866.1.3.6, nine syntypes (ex Guppy).

Remarks. This material was mentioned as NHM 1975309 in error by Breure (1979).

Current systematic position. Amphibulimidae, *Plekocheilus (Eudolichotis) aurissciuri* Guppy, 1866.

***Plekocheilus (Eurytus) bruggeni* Breure, 1978**
http://species-id.net/wiki/Plekocheilus_(Eurytus)_bruggeni
Figs 18D–F, 18ii

Plekocheilus (Eurytus) bruggeni Breure 1978: 9, pl. 6 figs 5–7; Breure 1979: 29.

Type locality. "Peru, Dept. Pasco, Huancabamba".

Label. "Huancabamba, Peru".

Dimensions. "H 39.0, D 19.5 [mm]"; holotype H 39.0, D 19.5, W 4.5.

Type material. NHM 1911.11.2.88, holotype; 1911.11.2.89–90, two paratypes (ex Preston).

Remarks. There is one paratype RMNH 55122.

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) bruggeni* Breure, 1978.

***Bulimus castaneus* Pfeiffer, 1845**
http://species-id.net/wiki/Bulimus_castaneus
Figs 17A–C, 17i

Bulimus castaneus Pfeiffer 1845: 68; Reeve 1848 [1848–1850]: pl. 32 fig. 197.
Plekocheilus (Eurytus) castaneus (Pfeiffer); Breure 1978: 10 (lectotype designation); Breure 1979: 29.

Type locality. "Nova Granada; Vegas on the river Quenden".

Label. "Vegas of the River Quenden"; taxon label in Pfeiffer's handwriting. M.C. label type I.

Dimensions. "Long. 70, diam. 39 mill."; lectotype H 69.5, D 47, W 4.6.

Type material. NHM 1975279, lectotype; 1975280, one paralectotype (Cuming coll.).

Remarks. The lectotype corresponds to the figure given by Reeve (1848).

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) castaneus* (Pfeiffer, 1845).

***Bulimus cathcartiae* Reeve, 1848**
http://species-id.net/wiki/Bulimus_cathcartiae
Figs 11A–C, 11i

Bulimus cathcartiae Reeve 1848 [1848–1850]: pl. 42 fig. 265.

Plekocheilus (Aeropictus) cathcartiae Breure 1978: 18, pl. 11 fig. 7 (lectotype designation); Breure 1979: 32; Borrero and Breure 2011: 13, fig. 5S–U.

Type locality. "New Granada, Prov. Merida".

Label. "New Granada". M.C. label type IV.

Dimensions. Not given. Lectotype H 45.4, D 26.5, W 4.5.

Type material. NHM 1975288, lectotype; 1975289, four paralectotypes (Cuming coll.).

Remarks. The specimen figured by Reeve (fig. 265a–b) was designated lectotype by Breure (1978); the top of this shell is slightly damaged. One paralectotype corresponds to fig. 265c. The specimens are accompanied by a label in Pfeiffer's handwriting "Bul. pintadinus Orb.".

Current systematic position. Amphibulimidae, *Plekocheilus (Aeropictus) cathcartiae* (Reeve, 1848).

***Bulimus (Eurytus) corticosus* Sowerby III, 1895**

http://species-id.net/wiki/Bulimus_(Eurytus)_corticosus

Figs 15A–C, 15i

Bulimus (Eurytus) corticosus Sowerby III 1895: 214, pl. 13 fig. 2.

Plekocheilus (Eurytus) corticosus (Sowerby); Breure 1978: 11 (lectotype designation); Breure 1979: 30.

Plekocheilus (Eurytus) episcopalis corticosus (Sowerby); Borrero and Breure 2011: 26, figs 9C, 10D–G.

Type locality. [Colombia] "Bogota".

Label. "Bogota", in da Costa's handwriting.

Dimensions. "Long. 58, diam. 30 mm."; lectotype H 58.7, D 30.0, W 4.3.

Type material. NHM 1907.11.21.110, lectotype; 1907.11.21.11, one paralectotype (da Costa coll.).

Remarks. Sowerby (1895) writes "Type in the collection of Mr. S.I. Da Costa". The shell corresponds to Sowerby's figure.

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) episcopalis corticosus* (Sowerby III, 1895).

***Bulimus dillwynianus* Pfeiffer, 1853**

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

Figs 27G–I, 27iii

Bulimus dillwynianus Pfeiffer 1853: 258.

Plekocheilus (Eudolichotis) dillwynianus (Pfeiffer); Breure 1978: 24 (lectotype designation); Breure 1979: 33.

Type locality. "Andibus Novae Granadae".

Label. "Andes N. Granada", taxon label in Pfeiffer's handwriting. M.C. label type IV.

Dimensions. "Long. 39, diam. 16 1/2 mill."; lectotype H 39.5, D 18.5, W 5.1.

Type material. NHM 1975144, lectotype; 1975145, two paralectotypes (Cuming coll.).

Remarks. The type series proves to be somewhat variable in colour pattern. Only the lectotype has a white line as a bordering 'shadow' to the brown ones.

Current systematic position. Amphibulimidae, *Plekocheilus (Eudolichotis) dillwynianus* (Pfeiffer, 1853).

***Bulimus (Eurytus) dissimulans* Preston, 1909**
http://species-id.net/wiki/Bulimus_(Eurytus)_dissimulans
Figs 13A–D, 13i

Bulimus (Eurytus) dissimulans Preston 1909: 509, pl. 10 fig. 5.
Plekocheilus (Aeropictus) dissimulans (Preston); Breure 1978: 19, fig. 17 (lectotype designation); Breure 1979: 32.

Type locality. "Merida, Venezuela".

Label. "Merida, Venezuela".

Dimensions. "Alt. 30, diam. maj. 15 mm"; lectotype H 30.0, D 17.0, W 4.2.

Type material. NHM 1914.4.3.37, lectotype; 1912.5.4.20, paralectotype (in alcohol) (ex Preston).

Remarks. The surface of this species is smooth (Fig. 13D), but the axial pattern is unlike other *Plekocheilus* species. It is here tentatively retained under *P. (Aeropictus)*.

Current systematic position. Amphibulimidae, *Plekocheilus (Aeropictus) dissimulans* (Preston, 1909).

***Strophocheilus (Eurytus) doliarius* da Costa, 1898**
http://species-id.net/wiki/Strophocheilus_(Eurytus)_doliarius
Figs 16D–E, 16ii

Strophocheilus (Eurytus) doliarius da Costa 1898: 84, fig. 1; Neubert and Janssen 2004: 208, pl. 1 fig. 1.
Plekocheilus (Eurytus) doliarius (da Costa); Breure 1979: 30.

Type locality. "Paramba, Ecuador".

Label. "Paramba, Ecuador", in da Costa's handwriting.

Dimensions. "Long. 58, diam. 41 mm"; lectotype H 58.0, D 41.5, W 4.6.

Type material. NHM 1907.11.21.117, lectotype (da Costa coll.).

Remarks. Breure (1979) considered this specimen a holotype. Neubert and Janssen (2004) have pointed out that this specimen should be considered a lectotype [Art. 74.6 ICZN], as da Costa did not state on how many specimens his descripotion was based, and addional material has been found in the SMF collection.

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) doliarius* (da Costa, 1898).

***Bulimus episcopalis* Pfeiffer, 1855**

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

Figs 16A–C, 16i

Bulimus epicopalis Pfeiffer 1855d: 115.

Plekocheilus (Eurytus) epicopalis (Pfeiffer); Breure 1978: 11 (lectotype designation); Breure 1979: 30; Borrero and Breure 2011: 26, figs 10A–C.

Type locality. [Colombia] "Bogota".

Label. "New Granada", taxon label in Pfeiffer's handwriting. M.C. label type IV.

Dimensions. "Long. 47–58, diam. 22–27 mill."; lectotype H 58.0, D 33.5, W 4.5.

Type material. NHM 1953.11.30.1, lectotype; 1953.11.30.2–3, two paralectotypes (Cuming coll.).

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) episcopalis epicopalis* (Pfeiffer, 1855).

***Bulimus (Eurytus) eros* Angas, 1878**

http://species-id.net/wiki/Bulimus_(Eurytus)_eros

Figs 20D–F, 20ii

Bulimus (Eurytus) eros Angas 1878: 312, pl. 18 figs 6–7.

Plekocheilus (Eurytus) eros (Angas); Breure 1979: 30.

Type locality. "Ecuador".

Label. "Ecuador".

Dimensions. "Alt. 1 inch 5 1/2 lines, diam. 8 lines [H 36.9 D 16.9 mm]"; lectotype H 35.5, D 18.5, W 3.8.

Type material. NHM 1879.1.21.2, lectotype (ex Angas).

Remarks. Angas did not state on how many specimens his description was based. The label accompanying the specimen reads "the type"; there is, however, no evidence

that this was the sole specimen originating from Angas. Therefore the specimen is now designated lectotype (design. n.).

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) eros* (Angas, 1878).

***Bulimus guerini* Pfeiffer, 1846**
http://species-id.net/wiki/Bulimus_guerini
Figs 7C–D, 7ii

Bulimus guerini Pfeiffer 1846: 40.
Dryptus guerini (Pfeiffer); Breure 1978: 26 (lectotype designation); Breure 1979: 34; Borrero and Breure 2011: @@.

Type locality. "Neu Granada".

Label. "Nova Granada", taxon label in Pfeiffer's handwriting. See **Remarks.** M.C. label type IV.

Dimensions. "Long. 41, diam. 18 1/2 mill."; lectotype H 41.0, D 21.7, W 5.2.

Type material. NHM 1975272, lectotype; 1975273, two paralectotypes, Funck leg. (Cuming coll.).

Remarks. A second label is present, indicating that the specimens have been found at "Caverns of Chachopo / Prov. of Merida N Gr". Thus the type locality may now be restricted to Venezuela, Edo. Mérida, Chachopo.

Current systematic position. Amphibulimidae, *Dryptus guerini* (Pfeiffer, 1846).

***Strophocheilus* (*Dryptus*) *jubeus* Fulton, 1908**
http://species-id.net/wiki/Strophocheilus_(Dryptus)_jubeus
Figs 8A–B, 8i

Strophocheilus (*Dryptus*) *jubeus* Fulton 1908: 86, text fig.
Dryptus jubeus (Fulton); Breure 1979: 34; Borrero and Breure, 2011: 8, figs 3A–B.

Type locality. "Capas, Venezuela".

Label. "Capas, Venezuela, 2,000 m".

Dimensions. "alt. 111, maj. diam. 57 mm"; lectotype H 117.5, D 58.7, W 5+.

Type material. NHM 1905.5.3.1, lectotype, ex Fulton.

Remarks. Fulton (1908) remarked that he had seen four specimens. This specimen is the only one which is marked "type"; the top is damaged and thus the original shell height must have been larger than quoted above. The holotype designation by Breure (1979) has to be interpreted as lectotype designation (Art. 74.6 ICZN). During their

Figure 8. A–B, i *Dryptus jubeus* (Fulton, 1908), lectotype NHM 1905.5.3.1 (H = 117.5).

recent revision, Borrero and Breure (2011) compared the type material to that of *Dryptus guerini* (Pfeiffer, 1846), but tentatively retained Fulton's taxon as a separate species.

Current systematic position. Amphibulimidae, *Dryptus jubeus* (Fulton, 1908).

***Bulimus lacerta* Pfeiffer, 1855**
http://species-id.net/wiki/Bulimus_lacerta
Figs 28A–C, 28i

Bulimus lacerta Pfeiffer, 1855c: 94, pl. 31 fig. 15.
Plekocheilus (Eudolichotis) lacertus (Pfeiffer); Breure 1978: 26 (lectotype designation).
Plekocheilus (Eudolichotis) lacerta (Pfeiffer); Breure 1979: 33.

Type locality. [Brazil] "Para (*Mr. Yates*)".

Label. "Para M^{r} Yates", taxon label in Pfeiffer's handwriting. M.C. label type IV.

Dimensions. "Long. 33, diam. 14 mill."; lectotype H 33.5, D 17.0, W 5.2.

Type material. NHM 1975303, lectotype; 1975304, two paralectotypes, Yates leg. (Cuming coll.).

Current systematic position. Amphibulimidae, *Plekocheilus (Eudolichotis) lacerta* (Pfeiffer, 1855).

***Bulimus lamarckianus* Pfeiffer, 1848**

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

Figs 18A–C, 18i

Bulimus lamarckianus Pfeiffer 1848: 229; Reeve 1848 [1848–1850]: pl. 24 fig. 156.

Plekocheilus (Eurytus) lamarckianus (Pfeiffer); Breure 1979: 30.

Plekocheilus (Eurytus) coloratus (Nyst); Breure 1978: 10 (lectotype designation); Borrero and Breure 2011: 32.

Type locality. "Andes of New Granada, 8000 feet high (*Funck*)".

Label. "From the Andes of New Granda / 8000 feet high Mr Funck", taxon label in Pfeiffer's handwriting. M.C. label type IV.

Dimensions. "Long. 62, diam. 32 mill."; lectotype H 62.4, D 38.8, W [4.9].

Type material. NHM 1975295, lectotype; 1975296, two paralectotypes, Funck leg. (Cuming coll.).

Remarks. The top of the lectotype is damaged.

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) coloratus* (Nyst, 1845).

***Bulimus latilabris* Pfeiffer, 1855**

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

Figs 11D–F, 11ii

Bulimus latilabris Pfeiffer 1855b: 7; Pfeiffer 1855 [1854–1860]: 36, pl. 10 figs 1–2.

Plekocheilus (Aeropictus) latilabris (Pfeiffer); Breure 1978: 20 (lectotype designation); Breure 1979: 32.

Plekocheilus (Aeropictus) succineoides succineoides (Petit de la Saussaye); Borrero and Breure 2011: 16, fig. 5J–L.

Type locality. [Colombia] "Santa Fé de Bogota".

Label. "New Granada", added in a later handwriting. See **Remarks.** M.C. label type IV.

Dimensions. "Long. 49, diam. 26 mill."; lectotype H 49.0, D 28.5, W 4.0.

Type material. NHM 1975127, lectotype; 1975141, one paralectotype (Cuming coll.).

Remarks. The material is accompanied by a label signed by E.A. Smith, indicating that the specimen was figured in Pfeiffer (1854–1860) and were considered "types" by him. Since Pfeiffer based himself on Cuming's material for this taxon, the type status is here not questioned despite the fact that a label in Pfeiffer's handwriting is missing.

Current systematic position. Amphibulimidae, *Plekocheilus (Aeropictus) succineoides succineoides* (Petit de la Saussaye, 1840).

Bulimus fulminans linterae Sowerby III, 1890

http://species-id.net/wiki/Bulimus_fulminans_linterae
Figs 25D–F, 25i

Bulimus fulminans linterae Sowerby III 1890: 582, pl. 56 fig. 12.
Plekocheilus (Plekocheilus) blainvilleanus linterae (Sowerby); Breure 1978: 6 [not fig. 2] (lectotype designation).
Plekocheilus (Plekocheilus) linterae (Sowerby); Breure 1979: 29; Neubert and Janssen 2004: 214, pl. 1 fig. 4.
Plekocheilus (Plekocheilus) fulminans linterae (Sowerby); Breure 2009: 27, figs 4A–D, 9A

Type locality. [Guyana] "Mount Roraima, British Guiana".

Label. "Mount Roraima, British Guiana".

Dimensions. Not given. Lectotype H 43.8, D 23.8, W 4.6.

Type material. NHM 1889.4.25.1, lectotype; 1889.4.25.2, one paralectotype, ex Miss J.E. Linter.

Remarks. Further paralectotype material is in SMF (Neubert and Janssen 2004).

Current systematic position. Amphibulimidae, *Plekocheilus (Plekocheilus) linterae* (Sowerby III, 1890).

Bulimus loveni Pfeiffer, 1848

http://species-id.net/wiki/Bulimus_loveni
Figs 25A–C, 25ii

Bulimus loveni Pfeiffer 1848: 229.
Plekocheilus (Plekocheilus) blainvilleanus loveni (Pfeiffer); Breure 1978: 6 (lectotype designation).
Plekocheilus (Plekocheilus) loveni (Pfeiffer); Breure 1979: 29.

Type locality. "Colonia of Tovar, Venezuela (*Mr. D. Dyson*)".

Label. "From the Colonia of Tovar Venezuela / Mr D. Dyson", taxon label in Pfeiffer's handwriting. M.C. label type IV.

Dimensions. "Long. 42, diam. 20 mill."; lectotype H 43.5, D 24.0, W 4.3.

Type material. NHM 1975285, lectotype; 1975286, two paralectotype (Cuming coll.).

Current systematic position. Amphibulimidae, *Plekocheilus (Plekocheilus) loveni* (Pfeiffer, 1848).

***Bulimus marmoratus* Dunker in Philippi, 1844**

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

Figs 9A–B, 9i

Bulimus marmoratus Dunker in Philippi 1844 [1842–1844]: 157, pl. 2 figs 1–2.

Dryptus marmoratus (Dunker); Breure 1978: 26 (lectotype designation); Breure 1979: 34; Borrero and Breure 2011: 9.

Type locality. "Brasilia" [sic, Venezuela].

Label. "Venezuela", label in Dunker's handwriting. M.C. label type IV.

Dimensions. "Alt. 46"', diam. 26"' [H 100.3, D 56.7 mm]"; lectotype H 86.1, D 46.2, W 5.4.

Type material. NHM 1975474, lectotype, ex Dunker (Cuming coll.).

Remarks. The type locality as given in Philippi (1842–1844) is in error, as this species is only known from Venezuela. Apparently Dunker had seen three specimens, as he writes "I owe the figured specimen to the kindness of Consul Mr. Gruner from Bremen, in whose collection there are two additional, identical specimens". According to Dance (1966) the Dunker collection is in Berlin, with many types in the Cuming collection. The whereabouts of the Gruner collection are unknown to us. Köhler (2007) does not list any type material of this taxon, hence the Cuming collection seem to be the only extant source of material originating from Dunker. The type status of the London specimen is not questioned as it is accompanied by a label in Dunker's handwriting. The specimen, which was chosen lectotype by Breure (1978), is considerably smaller than the original dimensions and does not fit the figure in Philippi (1842–1844).

Current systematic position. Amphibulimidae, *Dryptus marmoratus* (Dunker in Philippi, 1844).

***Helix onca* d'Orbigny, 1835**

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

Figs 19A–C, 19i

Helix onca d'Orbigny 1835: 8.

Bulimus onca d'Orbigny 1837 [1834–1847]: 295, pl. 30 figs 1–2; Gray 1854: 19.

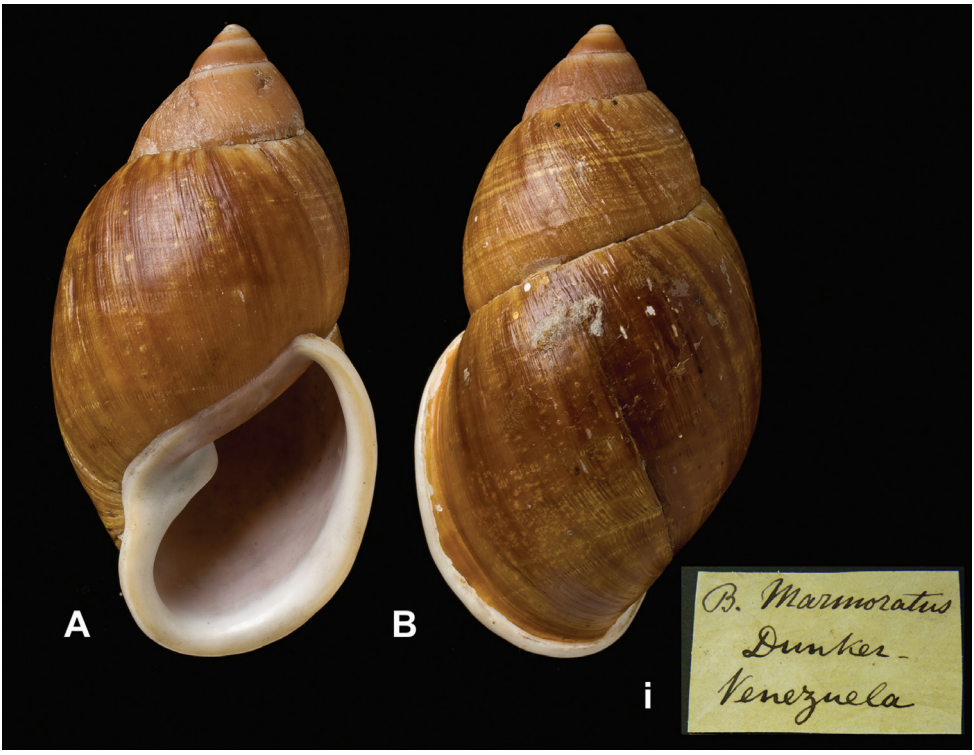

Figure 9. A–B, i *Dryptus marmoratus* (Dunker, 1844), lectotype NHM 1975474 (H = 86.1).

Type locality. Not given. [Bolivia] "...non loin du dernier point habité de Tutulima" in d'Orbigny 1837 [1834–1847]; see Breure (1973) for precise data.

Label. "Yuracares (Bolivia)", label in d'Orbigny's handwriting.

Dimensions. "Longit. 62 millim.; latit. 25 millim."; lectotype H 66.5, D 25.9, W 5.4.

Type material. NHM 1854.12.4.120, lectotype and three paralectotypes (d'Orbigny coll.).

Remarks. The locality on the label corresponds to the type locality of *Helix pentadina* d'Orbigny, 1835, which has been synonymized with *H. onca* by subsequent authors; the former name has page precedence. The specimen corresponding to d'Orbigny 1837 [1834–1847]: pl. 30 fig. 1 is now selected lectotype (design. n.). According to Gray (1854) the type specimen of *Bulimus pentadinus* d'Obigny is missing.

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) pentadinus* (d'Orbigny, 1835).

***Bulimus otostomus* Pfeiffer, 1855**
http://species-id.net/wiki/Helix_onca
Figs 27D–F, 27i

Bulimus otostomus Pfeiffer 1855a: 291; Pfeiffer 1855 [1854–1860]: 31, pl. 8 figs 12–13.
Plekocheilus (Eudolichotis) euryomphalus (Jonas); Breure 1978: 24 (lectotype designation).
Plekocheilus (Eudolichotis) otostomus (Pfeiffer); Breure 1979: 33.

Type locality. "Venezuela".

Label. "Venezuela", taxon label in Pfeiffer's handwriting. M.C. label type IV.

Dimensions. "Long. 31, diam. 13 mill."; lectotype H 31.5, D 13.8.

Type material. NHM 1975307, lectotype; 1975308, two paralectotypes (Cuming coll.).

Remarks. The lectotype, corresponding to Pfeiffer's figure, is misshapen and missing the top whorl.

Current systematic position. Amphibulimidae, *Plekocheilus (Eudolichotis) euryomphalus* (Jonas, 1844).

***Amphibulima pardalina* Guppy, 1868**
http://species-id.net/wiki/Amphibulima_pardalina
Figs 10C–D, 10ii

Amphibulima pardalina Guppy 1868: 432.

Type locality. "Dominica".

Label. No locality on label.

Dimensions. "Long. 20 millim., lat. 11 millim."; lectotype H 18.9, D 10.6, W 2.6.

Type material. NHM 1874.10.30.7, lectotype, ex Guppy.

Remarks. The lectotype (design. n.) is damaged at the last whorl.

Current systematic position. Amphibulimidae, *Amphibulima pardalina* Guppy, 1868.

***Bulimus perdix* Pfeiffer, 1848**
http://species-id.net/wiki/Bulimus_perdix
Figs 28D–F, 28ii

Bulimus perdix Pfeiffer 1848: 230.

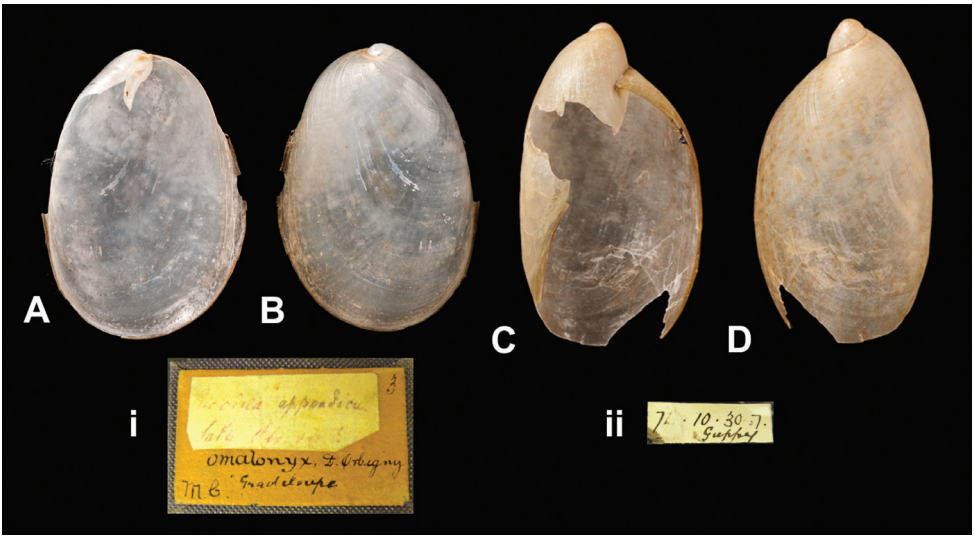

Figure 10. A–B, i *Pellicula appendiculata* (Pfeiffer, 1847), syntype NHM 20110303 (H = 14.2) **C–D, ii** *Amphibulima pardalina* Guppy, 1868, lectotype NHM 1874.10.30.7 (H = 18.9).

Plekocheilus (Eudolichotis) perdix (Pfeiffer); Breure 1978: 26, pl. 9 fig. 7 (lectotype designation); Breure 1979: 34; Neubert and Janssen 2004: 222, pl. 1 fig. 7; Köhler 2007: 128, fig. 8.

Type locality. "Agua de Obispo, New Granada (*Funck*)".

Label. "From Agua de Obispo / New Granada M^{r} Funck", taxon label in Pfeiffer's handwriting. M.C. label type IV.

Dimensions. "Long. 36, diam. 15 mill."; lectotype H 33.5, D 17.0, W 5.2.

Type material. NHM 1975305, lectotype; 1975306, two paralectotypes, Funck leg. (Cuming coll.).

Remarks. Further paralectotype material is in SMF (Neubert and Janssen 2004) and ZMB (Köhler 2007).

Current systematic position. Amphibulimidae, *Plekocheilus (Eudolichotis) perdix* (Pfeiffer, 1848).

Bulinus piperitus Sowerby I, 1837

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

Figs 20A–C, 20i

Bulinus piperitus Sowerby I 1837 [1833–1838]: 8, fig. 93; Reeve 1848 [1848–1850]: pl. 16 fig. 96.

Plekocheilus (Eurytus) piperitus (Sowerby); Borrero and Breure 2011: 48, figs 17G–J.

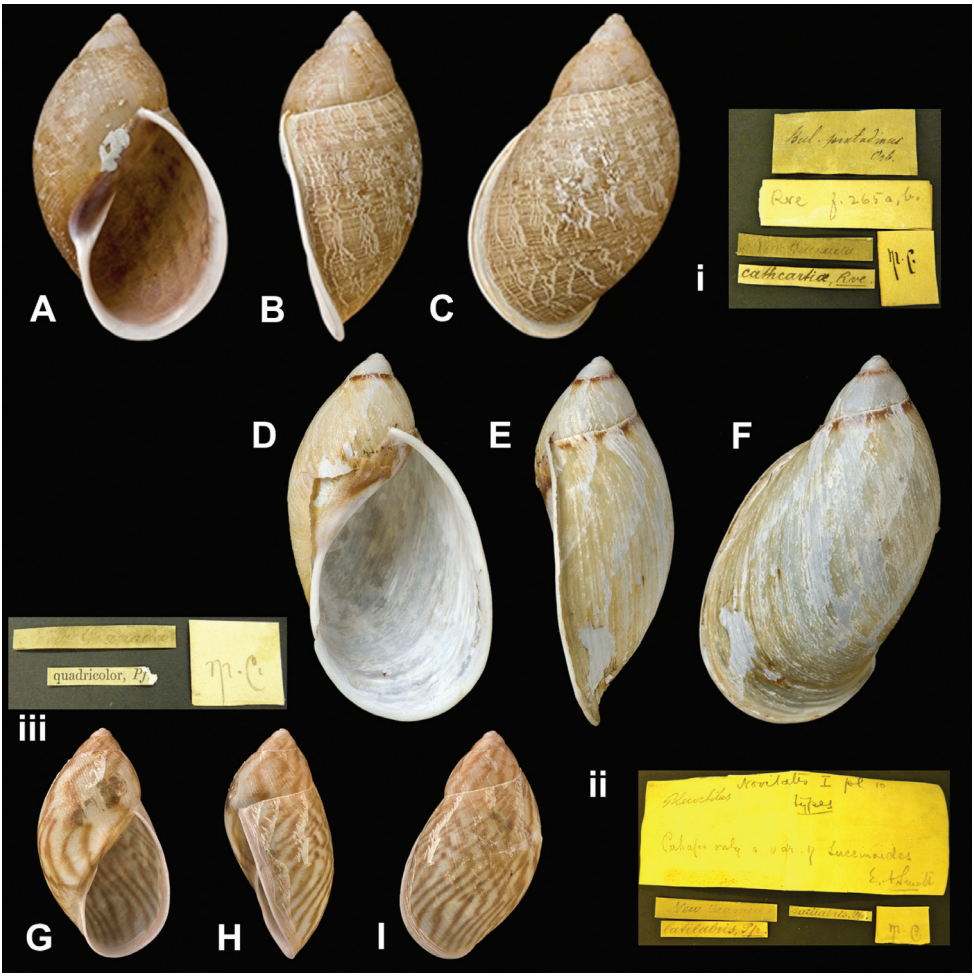

Figure 11. *Plekocheilus (Aeropictus)* species. **A–C, i** *P. (A.) cathcartiae* (Reeve, 1848), lectotype NHM 1975288 (H = 45.4) **D–F, ii** *P. (A.) latilabris* (Pfeiffer, 1855), lectotype NHM 1975127 (H = 49.0) **G–I, iii** *P. (A.) quadricolor* (Pfeiffer, 1848), lectotype NHM 1975283 (H = 30.3).

Type locality. [Peru] "Huallaga".

Label. "Hualuago [sic] / Peru". M.C. label type IV.

Dimensions. Not given. Figured specimen H 55.8, D 31.3, W 5.3.

Type material. NHM 1975329, two syntypes (Cuming coll.).

Remarks. The material is accompanied by a taxon label in Pfeiffer's handwriting. A second label indicates that this specimen has probably been figured by Reeve 1848 [1848–1850].

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) piperitus* (Sowerby I, 1837).

Figure 12. *Plekocheilus (Aeropictus)* species. **A–C, i** *P. (A.) veranyi* (Pfeiffer, 1848), syntype of *Bulimus scytodes* Pfeiffer, 1853 NHM 19991537 (H = 35.2) **D–F, ii** *P. (A.) veranyi* (Pfeiffer, 1848), lectotype NHM 1975297 (H = 33.0).

***Bulimus plectostylus* Pfeiffer, 1848**

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

Figs 21A–D, 21i

Bulimus plectostylus Pfeiffer 1848: 230.

Plekocheilus (Plekocheilus) plectostylus (Pfeiffer); Breure 1978: 8 (lectotype designation); Breure 1979: 29.

Plekocheilus (Eurytus) plectostylus (Pfeiffer); Borrero and Breure 2011: 28, figs 9C, 10O–Q.

Type locality. [Venezuela] "Chachopo, Province of Merida, New Granada (*Funck*)".

Label. "From Chachopo province of Merida / New Granada Mr Funck", taxon label in Pfeiffer's handwriting. M.C. label type IV.

Dimensions. "Long. 35, diam. 17 mill."; lectotype H 36.0, D 22.0, W 4.8.

Type material. NHM 1975287, lectotype, Funck leg. (Cuming coll.).

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) plectostylus* (Pfeiffer, 1848).

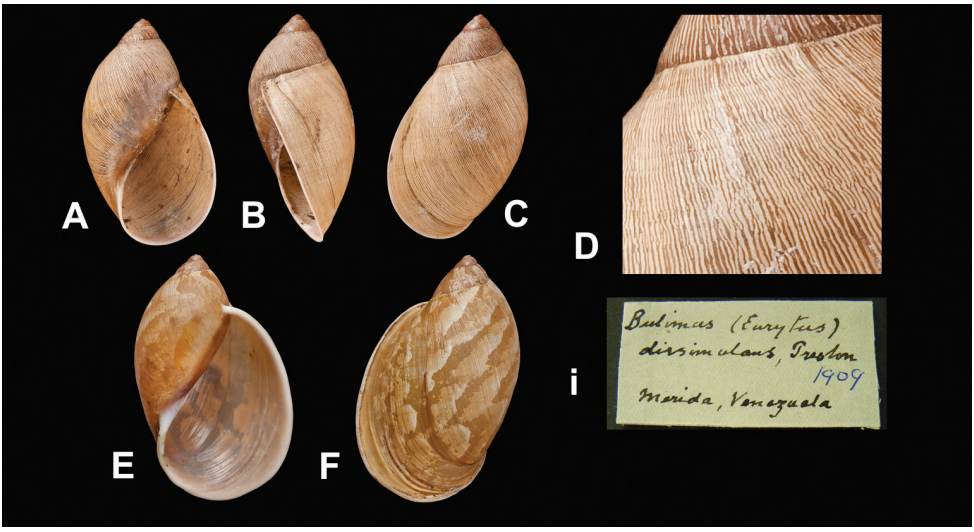

Figure 13. *Plekocheilus (Aeropictus)* species. **A–D, i** *P. (A.) dissimulans* Preston, 1909, lectotype NHM 1914.4.3.37 (H = 30.0) **E–F** *P. (A.)* zilchi Breure, 1977, paratype NHM 1975496 (H = 39.0).

***Bulimus pulicarius* Reeve, 1848**
http://species-id.net/wiki/Bulimus_pulicarius
Figs 22A–C, 22i

Bulimus pulicarius Reeve 1848 [1848–1850]: pl. 42 fig. 267.
Plekocheilus (Eurytus) pulicarius (Reeve); Breure 1978: 16 (lectotype designation); Breure 1979: 31; Borrero and Breure 2011: 46, figs 14B, 16G–M.

Type locality. "New Granada".

Label. "New Granada". M.C. label type V.

Dimensions. Not given. Lectotype H 31.5, D 19.5, W 4.3.

Type material. NHM 1975281, lectotype; 1975282, two paralectotypes (Cuming coll.).

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) pulicarius* (Reeve, 1848).

***Bulimus quadricolor* Pfeiffer, 1848**
http://species-id.net/wiki/Bulimus_quadricolor
Figs 11G–I, 11iii

Bulimus quadricolor Pfeiffer 1848: 229; Philippi 1849 [1847–1851]: 37, pl. 8 fig. 4.

Figure 14. A–C, i *Plekocheilus (Eurytus) auriformis* (da Costa, 1904), holotype NHM 1907.11.21.112 (H = 74.0)

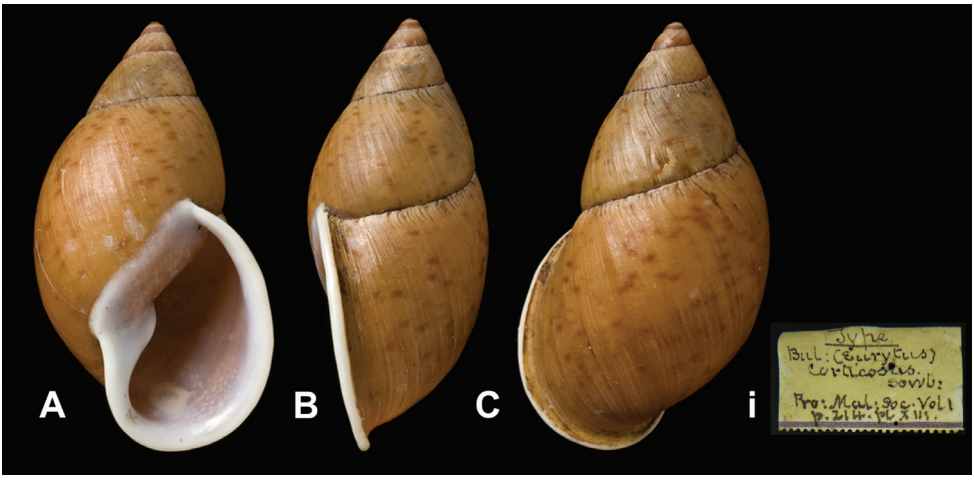

Figure 15. A–C, i *Plekocheilus (Eurytus) episcopalis corticosus* (Sowerby III, 1895), lectotype NHM 1907.11.21.110 (H = 58.7).

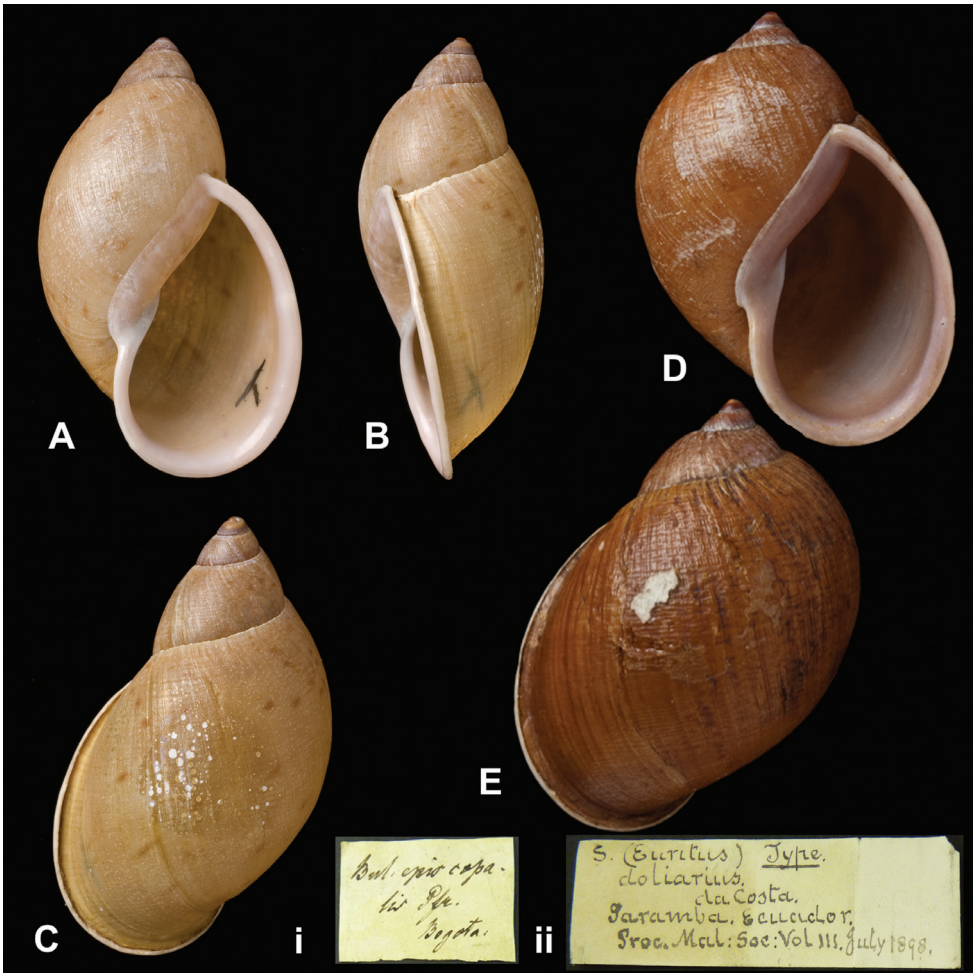

Figure 16. *Plekocheilus (Eurytus)* species. **A–C, i** *P. (E.) episcopalis episcopalis* (Pfeiffer, 1855), lectotype NHM 1953.11.30.1 (H = 58.0) **D–E, ii** *P. (E.) doliarius* (da Costa, 1898), lectotype NHM 1907.11.21.117 (H = 58.0).

Plekocheilus (Aeropictus) quadricolor (Pfeiffer); Breure 1978: 21 (lectotype designation); Breure 1979: 32; Borrero and Breure 2011: 13, figs 5X–AA.

Type locality. [Venezuela] "Chachopo, Province of Merida, New Granada (*Funck*)".

Label. "New Granada", added in a later handwriting. M.C. label type V.

Dimensions. "Long. 30 1/2, diam. 14 mill."; lectotype H 30.3, D 17.5, W 4.3.

Type material. NHM 1975283, lectotype; 1975284, two paralectotypes (Cuming coll.).

Current systematic position. Amphibulimidae, *Plekocheilus (Aeropictus) quadricolor* (Pfeiffer, 1848).

Figure 17. A–C, i *Plekocheilus (Eurytus) castaneus* (Pfeiffer, 1845), lectotype NHM 1975279 (H = 69.5).

***Bulimus rhodocheilus* Reeve, 1848**
http://species-id.net/wiki/Bulimus_rhodocheilus
Figs 21E–H, 21ii

Bulimus rhodocheilus Reeve 1848 [1848–1850]: pl. 28 fig. 173.
Plekocheilus (Aeropictus) rhodocheilus (Reeve); Breure 1978: 21, pl. 9 fig. 15 (lectotype designation); Breure 1979: 32.

Figure 18. *Plekocheilus (Eurytus)* species. **A–C, i** *P. (E.) lamarckianus* (Pfeiffer, 1848), lectotype NHM 1975259 (H = 62.4) **D–F, ii** *P. (E.) bruggeni* Breure, 1978, holotype NHM 1911.11.2.88 (H = 39.0).

Dryptus rhodocheilus (Reeve); Simone 2006: 147, fig. 493.

Type locality. "Brazil".

Label. "Brazil". M.C. label type IV.

Dimensions. Not given. Lectotype H 55.0, D 28.5, W 4.1.

Type material. NHM 1975129, lectotype (Cuming coll.).

Remarks. The material is accompanied by several later labels with the indication "type" or "holotype". The specimen is damaged at the peristome. The shell is sculptured with spiral series of granules, a characteristic which accords better with *Plekochei-*

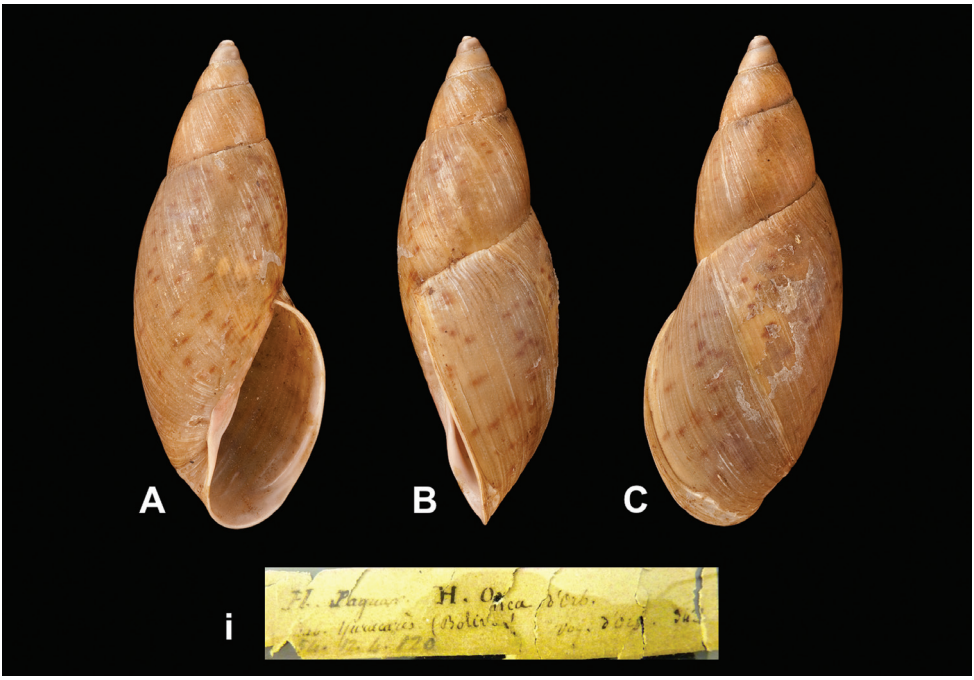

Figure 19. A–C, i *Plekocheilus (Eurytus) pentadinus* (d'Orbigny, 1835), lectotype of *Helix onca* d'Orbigny, 1835 (H = 66.5).

lus (Eurytus). Close examination of the yellowish colour marks reveal that these are unlike the 'air pockets' commonly found in *P. (Aeropictus)*.

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) rhodocheilus* (Reeve, 1848) (**comb. n.**).

***Bulimus roseolabrum* E.A. Smith, 1877**
http://species-id.net/wiki/Bulimus_rhodocheilus
Figs 22D–F, 22ii

Bulimus roseolabrum E.A. Smith, 1877: 362, pl. 39 fig. 8.
Plekocheilus (Eurytus) roseolabrum (Smith); Breure 1978: 16 (lectotype designation); Breure 1979: 31; Breure and Borrero 2008: 6; Borrero and Breure 2011: 44, figs 13G–I.

Type locality. "Malacatos, South Ecuador".
Label. "Malacatos, S. Ecuador", in Smith' handwriting.
Dimensions. "Long. 42 mill., diam 18"; lectotype H 42.0, D 22.5, W 4.5.
Type material. NHM 1975135, lectotype; 1877.3.28.2, paralectotype.

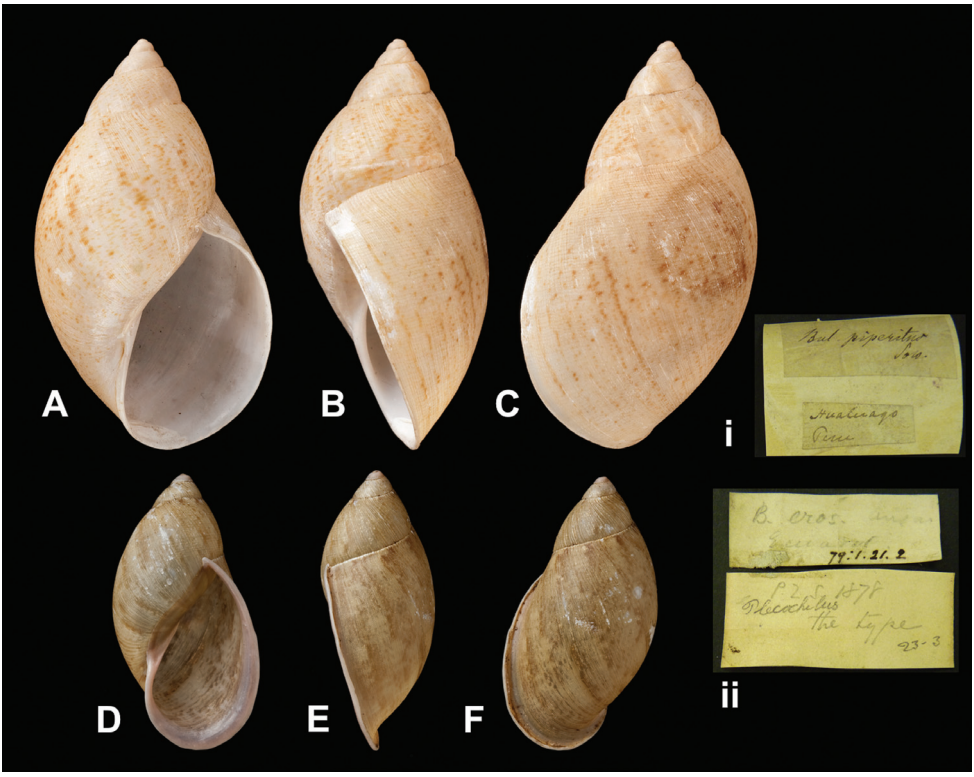

Figure 20. *Plekocheilus (Eurytus)* species. **A–C, i** *P. (E.) piperitus* (Sowerby I, 1837), syntype NHM 1975329 (H = 55.8) **D–F, ii** *P. (E.) eros* (Angas, 1878), lectotype NHM 1879.1.21.2 (H = 35.5).

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) roseolabrum* (E.A. Smith, 1877).

***Bulimus scytodes* Pfeiffer, 1853**
http://species-id.net/wiki/Bulimus_scytodes
Figs 12A–C, 12i

Bulimus scytodes Pfeiffer 1853: 256.

Type locality. "in Andibus Novae Granadae".

Label. "Andes N. Granada", taxon label in Pfeiffer's handwriting. M.C. label type I.

Dimensions. "Long. 35, diam. 17 1/2 mill."; figured specimen H 35.2, D 21.4, W 4.5.

Type material. NHM 19991537, three syntypes (Cuming coll.).

Remarks. This is the first time this type material is figured.

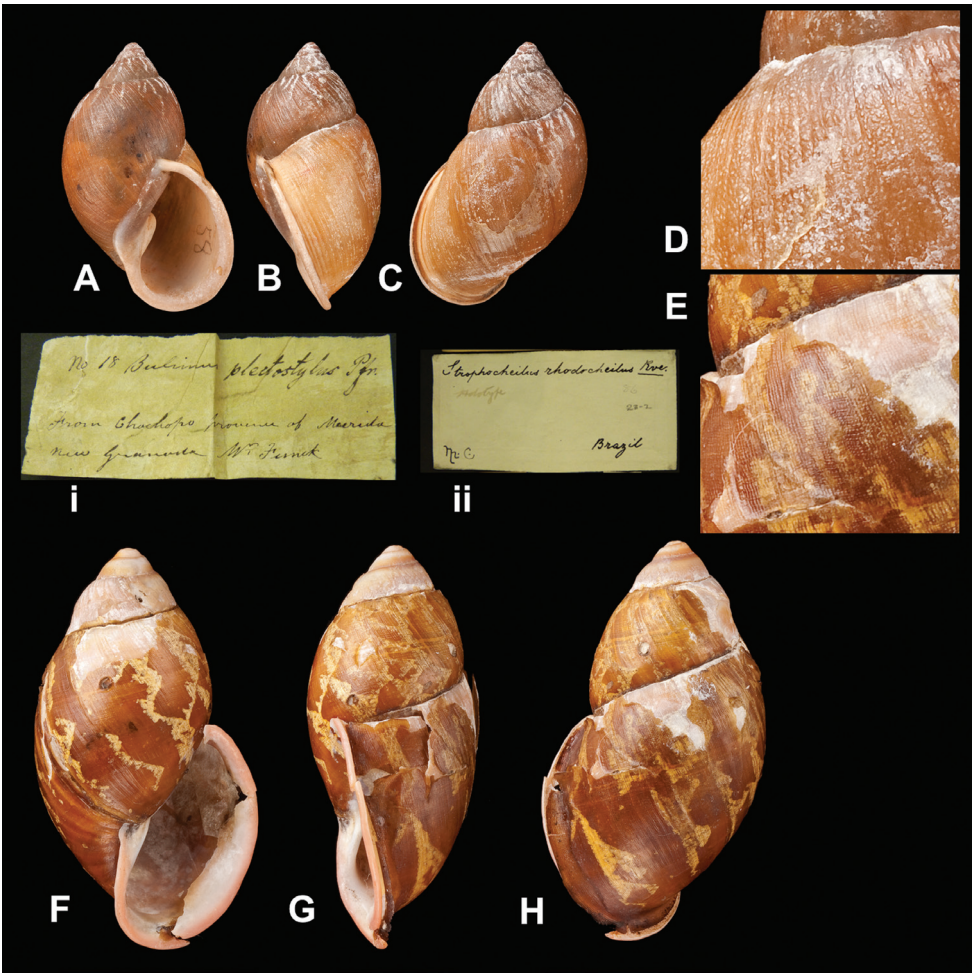

Figure 21. *Plekocheilus (Eurytus)* species. **A–D, i** *P. (E.) plectostylus* (Pfeiffer, 1848), lectotype NHM 1975287 (H = 36.0); **D** sculpture of dorsal side of last whorl **E–H, ii** *P. (E.) rhodocheilus* (Reeve, 1848), lectotype NHM 1975129 (H = 55.0); **E** sculpture of dorsal side of last whorl.

Current systematic position. Amphibulimidae, *Plekocheilus (Aeropictus) veranyi* (Pfeiffer, 1848).

***Bulimus speciosus* Pfeiffer, 1854**
http://species-id.net/wiki/Bulimus_speciosus
Figs 26A–D, 26ii

Bulimus speciosus Pfeiffer 1854 [1854–1860]: 14, pl. 5 figs 1–2.

Figure 22. *Plekocheilus (Eurytus)* species. **A–C, i** *P. (E.) pulicarius* (Pfeiffer, 1848), lectotype NHM 1975281 (H = 31.5) **D–F, ii** *P. (E.) roseolabrum* (E.A. Smith, 1877), lectotype NHM 1975135 (H = 42.0).

Plekocheilus (Plekocheilus) speciosus (Pfeiffer); Breure 1978: 8 (lectotype designation); Breure 1979: 29.
Plekocheilus (Eurytus) plectostylus (Pfeiffer); Borrero and Breure 2011: 28.

Type locality. [Colombia] "Sierra Nevada de S. Marta (*Schlim*)".

Label. "Sierra Nevada de S. Marta / Schlim" [almost faded], taxon label in Pfeiffer's handwriting. M.C. label type IV.

Dimensions. "Long. 58, diam. 30 mill."; lectotype H 58.0, D 35.0, W 4.5.

Type material. NHM 1975300, lectotype, Schlim leg. (Cuming coll.).

Remarks. This taxon was placed in the synonymy of *Plekocheilus (Eurytus) plectostylus* (Pfeiffer, 1848) by Borrero and Breure (2011). During the prolonged time this paper was in press, the material of both taxa could be studied in the NHM. Both the size of the shell and the sculpture is markedly different (cf. Figs 20D and 25D). The previous subgeneric classification of *P. speciosus* is thus retained.

Current systematic position. Amphibulimidae, *Plekocheilus (Plekocheilus) speciosus* (Pfeiffer, 1854).

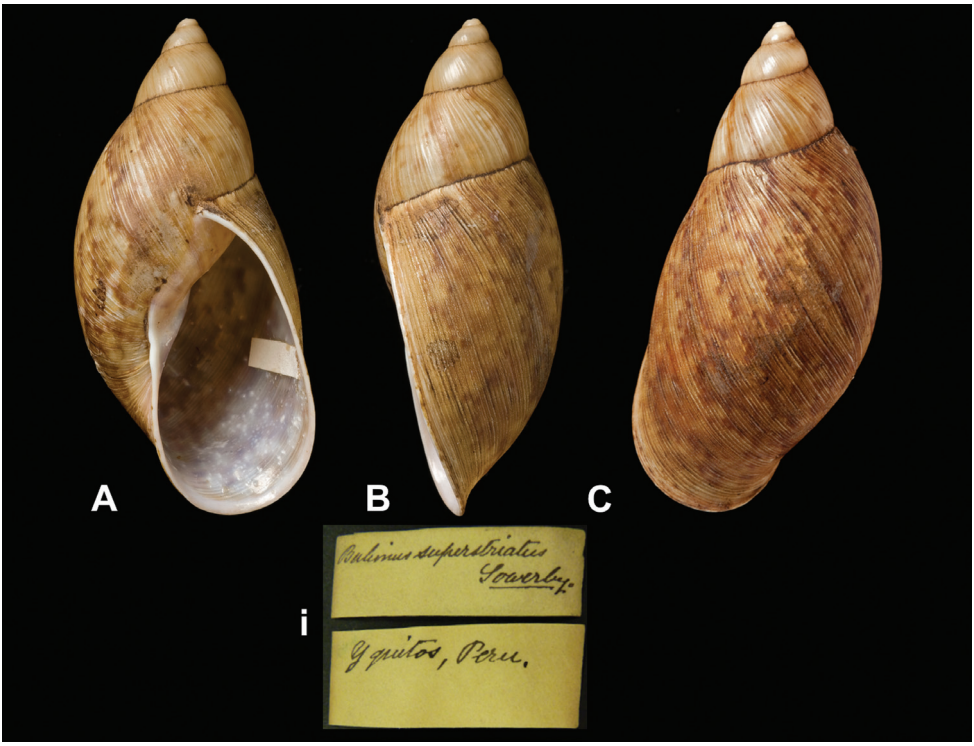

Figure 23. A–C, i *Plekocheilus (Eurytus) superstriatus* (Sowerby III, 1890), lectotype NHM 1889.11.19.1 (H = 64.5).

***Bulimus superstriatus* Sowerby III, 1890**
http://species-id.net/wiki/Bulimus_superstriatus
Figs 23A–C, 23i

Bulimus superstriatus Sowerby III 1890: 578, pl. 56 fig. 9.
Plekocheilus (Eurytus) superstriatus (Sowerby); Breure 1978: 16 (lectotype designation); Breure 1979: 31.

Type locality. [Peru] "Yquitos, Peruviae".
Label. "Yquitos, Peru".
Dimensions. "Long. 54, diam. 29 mill."; lectotype H 64.5, D 31.0, W 4.8.
Type material. NHM 1889.11.19.1, lectotype.
Remarks. As Breure (1978) already remarked, the original dimensions of Sowerby were clearly in error.
Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) superstriatus* (Sowerby III, 1890).

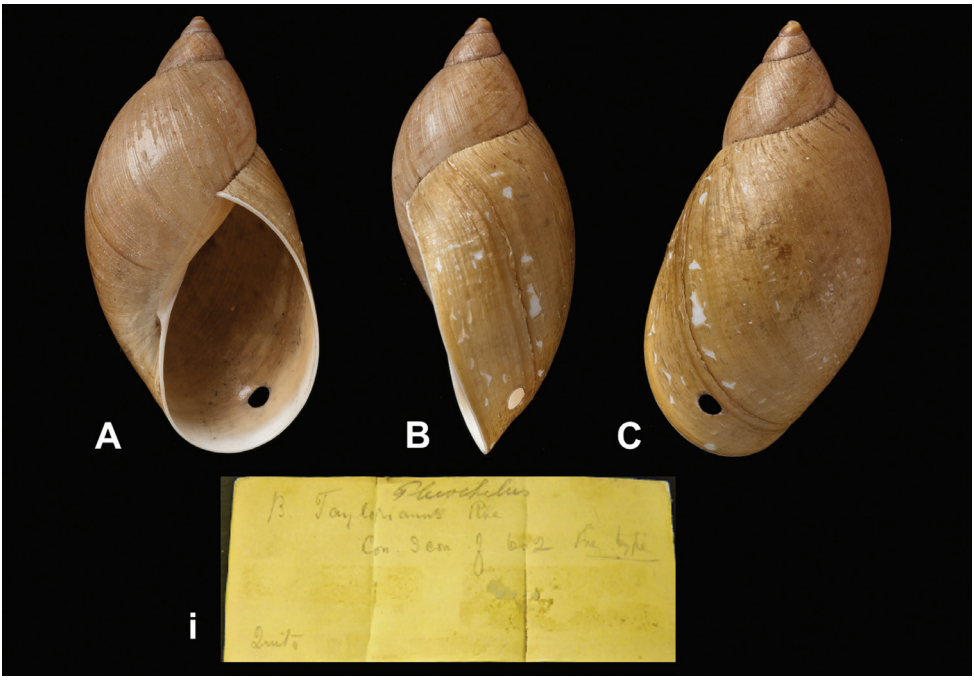

Figure 24. A–C, i *Plekocheilus (Eurytus) taylorianus* (Reeve, 1849), lectotype NHM 1874.12.11.271 (H = 58.5).

***Bulimus taquinensis* Pfeiffer, 1855**
http://species-id.net/wiki/Bulimus_superstriatus
Figs 26E–G, 26i

Bulimus taquinensis Pfeiffer 1855a: 290.
Plekocheilus (Eurytus) taquinensis (Pfeiffer); Crowley and Pain 1958: 234, pl. 7 fig. 1 (lectotype designation); Breure 1979: 31.
Plekocheilus (Plekocheilus) taquinensis (Pfeiffer); Borrero and Breure 2011: 24, figs 8G–I, 9D.

Type locality. "Taquina, Sierra Nevada de S. Marta; 9000' elevation (*Schlim*)".

Label. "Sierra Nevada De S. Martha / [...] Schlim / 9000 ft high", taxon label in Pfeiffer's handwriting. M.C. label type IV.

Dimensions. "Long. 40, diam. 18 mill."; lectotype H 40.1, D 20.5, W 4.3.

Type material. NHM 1957.6.3.1, lectotype; 1957.6.3.2–3, two paralectotypes, Schlim leg.

Current systematic position. Amphibulimidae, *Plekocheilus (Plekocheilus) taquinensis* (Pfeiffer, 1855).

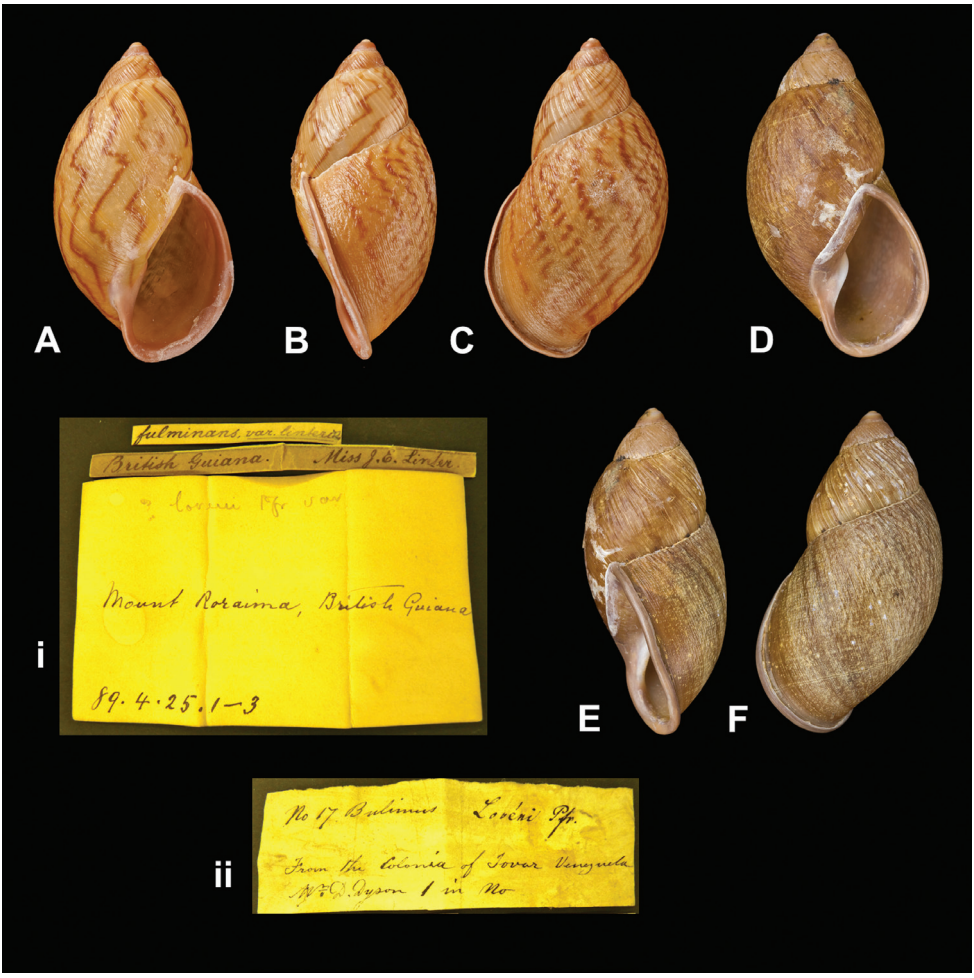

Figure 25. *Plekocheilus (P.)* species. **A–C, ii** *P. (P.) loveni* (Pfeiffer, 1848), lectotype NHM 1975285 (H = 43.5) **D–F, i** *P. (P.) linterae* (Sowerby III, 1890), lectotype NHM 1889.4.25.1 (H = 43.8).

***Bulimus taylorianus* Reeve, 1849**
http://species-id.net/wiki/Bulimus_taylorianus
Figs 24A–C, 24i

Bulimus taylorianus Reeve 1849 [1848–1850]: pl. 81 fig. 602.
Plekocheilus (Eurytus) taylorianus (Reeve); Breure 1978: 16 (lectotype designation); Breure 1979: 31; Borrero and Breure 2011: 42, figs 15C–D.

Type locality. [Ecuador] "Environs of Quito".
Label. "Quito Ecuador".

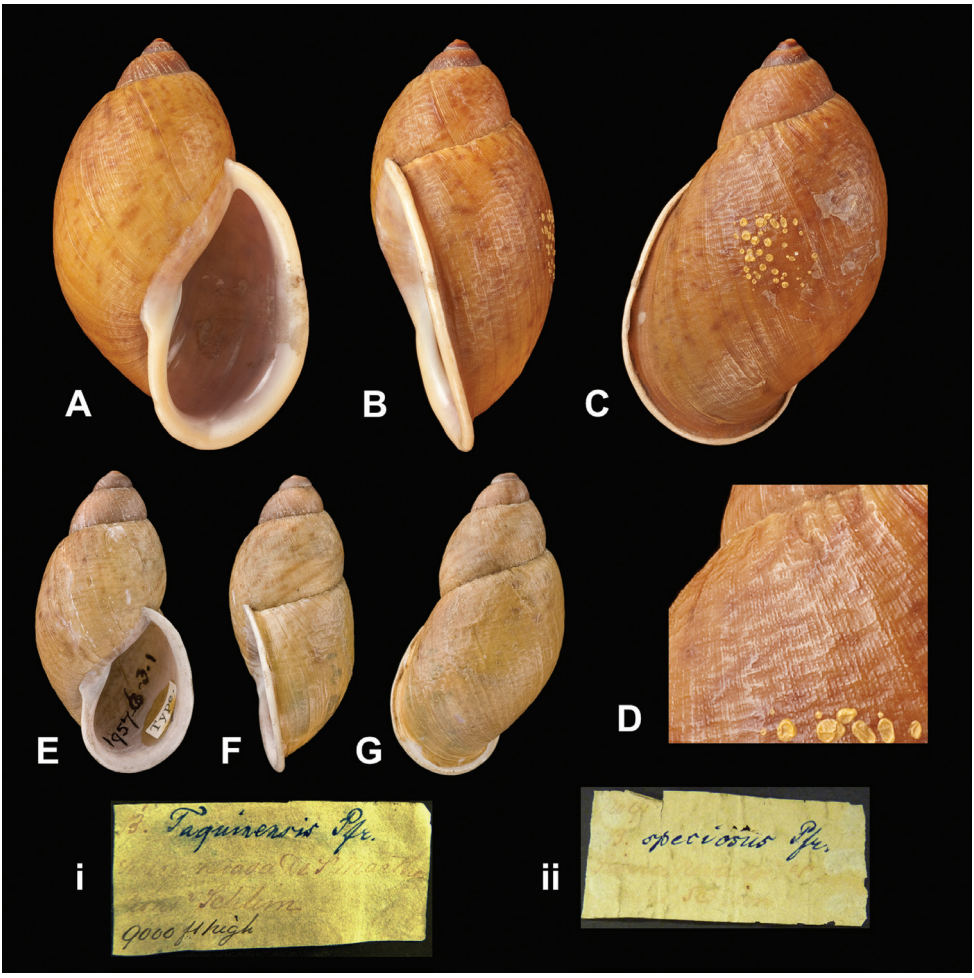

Figure 26. *Plekocheilus (P.)* species. **A–D, ii** *P. (P.) speciosus* (Pfeiffer, 1855), lectotype NHM 1975300 (H = 58.0); **D** sculpture of dorsal side of last whorl **E–G, i** *P. (P.) taquinensis* (Pfeiffer, 1855), lectotype NHM 1957.6.3.1 (H = 40.1).

Dimensions. Not given. Lectotype H 58.5, D 31.0, W 4.7.

Type material. NHM 1874.12.11.271, lectotype, ex Mus. T. Lombe Taylor.

Remarks. The voucher number NHM 1975142 (Breure 1978) is here corrected to the number given above. The specimen is not accompanied by a printed label as usually found with Reeve's type material in Cuming's collection, but has a handwritten label and has reached the NHM collection via the donation by Mrs Lombe Taylor in 1875.

Current systematic position. Amphibulimidae, *Plekocheilus (Eurytus) taylorianus* (Reeve, 1849).

Figure 27. *Plekocheilus (Eudolichotis)* species **A–C, ii** *P. (E.) aurissciuri* Guppy, 1866, syntype NHM 1866.1.3.6 (H = 36.6) **D–F, i** *P. (E.) otostomus* (Pfeiffer, 1855), lectotype NHM 1975307 (H = 31.5) **G–I, iii** *P. (E.) dillwynianus* (Pfeiffer, 1853), lectotype NHM 1975144 (H = 39.5).

***Bulimus veranyi* Pfeiffer, 1848**
http://species-id.net/wiki/Bulimus_veranyi
Figs 12D–F, 12ii

Bulimus veranyi Pfeiffer 1848: 230; Reeve 1848 [1848–1850]: pl. 42 fig. 262; Philippi 1849 [1847–1851]: 37, pl. 8 fig. 9.
Plekocheilus (Aeropictus) veranyi (Pfeiffer); Breure 1978: 21, pl. 9 fig. 6 (lectotype designation); Breure 1979: 32; Borrero and Breure 2011: 12.

Type locality. [Venezuela] "Chachopo, Province of Merida, New Granada (*Funck*)".

Label. "From Chachopo province / of Merida New Granada / M^{r} Funck", taxon label in Pfeiffer's handwriting. M.C. label type IV.

Dimensions. "Long. 33, diam. 15 mill."; lectotype H 33.0, D 19.5, W 4.3.

Type material. NHM 1975297, lectotype; 1975298, two paralectotypes, Funck leg. (Cuming coll.).

Remarks. The 'airpockets' typical for this subgenus are more conspicuous on the paralectotype than on the lectotype.

Figure 28. *Plekocheilus (Eudolichotis)* species A–C, i P. *(E.) lacerta* (Pfeiffer, 1855), lectotype NHM 1975303 (H = 33.5) D–F, ii *P. (E.) perdix* (Pfeiffer, 1848), lectotype NHM 1975305 (H = 33.5).

Current systematic position. Amphibulimidae, *Plekocheilus (Aeropictus) veranyi* (Pfeiffer, 1848).

***Plekocheilus (Aeropictus) zilchi* Breure, 1977**
http://species-id.net/wiki/Plekocheilus_(Aeropictus)_zilchi
Fig. 13E

Plekocheilus (Aeropictus) zilchi Breure 1977: 260, figs 2, 21–22; Breure 1979: 32; Neubert and Janssen 2004: 235, pl. 1 fig. 5.
Plekocheilus (Aeropictus) succineoides zilchi Breure; Borrero and Breure 2011: 17, fig. 9B.

Type locality. "Colombia, Dept. Boyacá, SW Labranza grande (5°33'N 72°35'W; 1140 m), Quebrada Comijoque".

Label. "Colombia".

Dimensions. "Shell height 40.5, diam. 25.0 (mm)"; paratype H 39.0, D 24.0, W 3.7.

Type material. NHM 1975496, paratype, ex MacAndrew coll., ex Rolle.

Current systematic position. Amphibulimidae, *Plekocheilus (Aeropictus) succineoides zilchi* Breure, 1977.

Excluded from the Orthalicoidea.

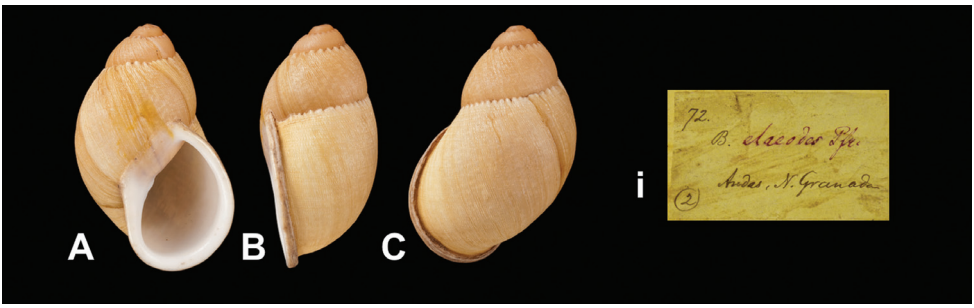

Figure 29. *Chileborus* species. **A–C, i** Syntype of *Bulimus elaeodes* Pfeiffer, 1853 NHM 19991536 (H = 33.2).

***Bulimus elaeodes* Pfeiffer, 1853**
http://species-id.net/wiki/Bulimus_elaeodes
Figs 29A–C, 29i

Bulimus elaeodes Pfeiffer 1853: 256.
Plekocheilus (Eurytus) elaeodes (Pfeiffer); Borrero and Breure 2011: 53.

Type locality. "in Andibus Novae Granadae".

Label. "Andes, N. Granada", taxon label in Pfeiffer's handwriting. M.C. label type I.

Dimensions. "Long. 36, diam. 18 mill."; figured specimen H 33.2, D 20.6, W 4.3.

Type material. NHM 19991536, three possible syntypes (Cuming coll.).

Remarks. These specimens are not accompanied by a label in Pfeiffer's handwriting and their measurements do not correspond with those published by Pfeiffer. They are treated here as possible syntypes but prove not to belong to the genus *Plekocheilus* to which this taxon was hitherto referred.

Current systematic position. Strophocheilidae, *Chileborus* species?.

Acknowledgements

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RESEARCH ARTICLE

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A new species of hydrobiid snails (Mollusca, Gastropoda, Hydrobiidae) from central Greece

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Abstract

A new minute valvatiform species belonging to the genus *Daphniola* Radoman, 1973, *Daphniola eptalophos* **sp. n.**, from mountain Parnassos, Greece is described. The new species has a transparent valvatiform-planispiral shell, wide and open umbilicus, grey-black pigmented soft body and head and a black penis with a small colorless outgrowth on the left side near its base. A comparative table of shell dimensions and a key to the species known for this endemic genus for Greece are provided.

Keywords

Caenogastropoda, Hydrobiidae, *Daphniola eptalophos* sp. n., Greece

Introduction

Greece is a hot spot for hydrobioid gastropods both in terms of species richness and endemism (Glöer and Maassen 2009, Glöer et al. 2010). Hydrobioid gastropods include the family Hydrobiidae and several other families of Rissooidea that resemble these gastropods in general features (Hershler and Ponder 1998). To date, 72 hydrobioid species and subspecies belonging to 24 genera have been recorded in Greece (Bank 2006,

Glöer et al. 2007; Reischütz and Reischütz 2008, Reischütz et al. 2008, Glöer and Maassen 2009, Glöer et al. 2010, Szarowska and Falniowski 2011a). It is notable that 90% of these species and subspecies and 26% of the genera are endemic for Greece.

The hydrobiid gastropods (family Hydrobiidae) of Greece have been studied by several authors during the 19th, 20th and 21th century (e.g., Westerlund 1886, Boettger 1892, Käufel 1930, Schütt 1980, Gittenberger 1982, Radoman 1983, Falniowski and Szarowska 2000, Bank 2006, Frogley and Preece 2007, Albrecht et al. 2009, Reischütz et al. 2010, Benke et al. 2011, Falniowski and Szarowska 2011, Szarowska and Falniowski 2011a); nevertheless, our knowledge still remains incomplete. The IUCN Red List of Threatened Species includes 42 hydrobiid species from Greece. One of them is classified as Extinct; 19 are classified as Critically Endangered, three as Endangered, one as Near Threatened, four as Vulnerable, eight as Data Deficient and the rest as Least Concern.

Daphniola Radoman, 1973 (type species *Daphniola graeca* Radoman, 1973) is an endemic genus from Greece. According to Schütt (1980), *Daphniola graeca* Radoman 1973 is a junior synonym of *Valvata exigua* Schmidt, 1856 and according to Reischutz and Sattman (1993) a junior synonym of *Valvata (Cincinna) hellenica* Westerlund, 1898.

Two of the three currently known species of this genus, namely *D. exigua* (A. Schmidt 1856) and *D. louisi* Falniowski & Szarowska 2000 are included in the category Endangered and Critically Endangered respectively (Radea and Falniowski 2009, Radea 2011) of the Red List mentioned above. A third taxon, *D. graeca* was synonymized with *D. exigua* by Falniowski et al. (2007).

Recently, Falniowski and Szarowska (2011) identified a valvatiform hydrobiid gastropod found in the Peloponnisos, Greece as *Horatia hadei* Gittenberger, 1982, a species, which currently is listed as *Islamia hadei* (Gittenberger, 1982) according to Bank (2011). This gastropod was found in a distance of 40 km from the type locality of *H. hadei*, which probably has been destroyed (Szarowska and Falniowski 2004, Szarowska 2006). According to the above authors, the protoconch sculpture, female reproductive organs, penis morphology and a maximum likelihood phylogenetic analysis based on COI (cytochrome oxidase subunit I) fragments of mtDNA proved that this gastropod belongs to the genus *Daphniola*. Subsequently, Falniowski and Szarowska (2011) transferred the species *hadei* from *Islamia* to *Daphniola*. However, the identification of the hydrobiid gastropod found in Peloponnisos as *H. hadei* was only based on the resemblance of shell shape and protoconch sculpture and it was not supported by detailed morphological, morphometric and anatomical comparisons. Consequently, this identification as well as the new combination should be carefully re-examined.

The morphology and anatomy of the genus *Daphniola* have extensively been described by Radoman (1973), Radoman (1983) and Bodon et al. (2001). Morphometric variables, soft body pigmentation, male and female genitalia are widely used for the distinction of species and subspecies of this genus (Schütt 1980, Reischütz 1984, Falniowski and Szarowska 2000, Falniowski et al. 2007, Falniowski and Szarowska 2011). According to Radoman (1973), Schütt (1980), Radoman (1983), Reischütz (1984), Reischütz (1988), Falniowski and Szarowska (2000), Bodon et al. (2001), and Falniowski et al. (2007), Falniowski and Szarowska (2011) this crenobiont genus

inhabits most of mainland Greece, i.e., Peloponnesos, Attica except its easternmost part, the western part of Euboea, southeast Thessalia and east Macedonia.

Here a new *Daphniola* species is described from central Greece, i.e. Sterea Ellada, and compared with its congeners.

Materials and methods

Specimens of a minute valvatoid hydrobiid gastropod from a spring nearby Agoriani (Eptalophos, mountain Parnassos, Sterea Ellada, Greece), were collected alive. Since population abundance of this species seems to be low in the spring where it was found only eighteen specimens were collected. Thirteen of them were stored in 70% ethanol for morphological and anatomical studies and five specimens in deep freezing for future molecular analyses.

Shell morphometric variables (namely shell height and width, aperture height and width) were measured of all specimens collected using the micrometer of a Stemi 2000-C, Zeiss stereomicroscope. The ratios of shell variables were calculated as well.

The structure of protoconch and teleoconch of the shells were studied using scanning electron microscopy (Jeol JSM-35 operating at 25 kV) after being dehydrated in a gradient of ethanol dilution series (10–100%) and finally in pure acetone, critical point dried and spray coated in gold-palladium.

Six randomly chosen specimens were dissected (four of them were found to be mature males, one mature female and one immature female).

Shells and penes were photographed with a Canon Eos 1000D digital camera attached on a stereomicroscope Stemi 2000-C, Zeiss, Germany.

Abbreviations: ZMUA, Zoological Museum, National and Kapodistrian University of Athens.

Systematics

Hydrobiidae Troschel, 1857
Genus *Daphniola* Radoman, 1973
Type species *Daphniola graeca* Radoman, 1973

***Daphniola eptalophos* sp. n.**
urn:lsid:zoobank.org:act:BF2C6C3F-5EF0-4375-802D-37D5529ED3E5
http://species-id.net/wiki/Daphniola_eptalophos
Figs 1–6, 7–10, 11, 14, Tabs 1, 2

Diagnosis. Shell valvatiform to planispiral; operculum circular to ovate without peg, paucispiral with subcentral nucleus; umbilicus open and very wide; male genitalia with

a slender black penis having a colorless outgrowth located near its base; female genitalia with a well-developed bursa copulatrix and two rather small receptaculum seminis.

Description. Shell minute (Tab. 1), valvatiform to planispiral, light horn-colored to whitish, transparent, glossy, finely striated (Figs 1, 7, 9).

Protoconch microsculpture composed of a dense net of irregularly shaped pores (Fig. 8), teleoconch with fine pores among the growth lines (Fig. 10).

Spire very low and blunt; 3–3.5 convex whorls, regularly growing, divided by a moderately deep suture, last whorl strongly developed.

Umbilicus open and very wide, the earlier whorls being visible inside.

Aperture prosocline, almost circular with a sharp continuous peristome and thin margins, the upper part of columellar margin slightly leaned against to the shell wall, the outer margin simple.

Operculum (Fig. 3) ovate, dark orange, thin, thicker and more colored at the nucleus, thinner and colorless at the edges, circular to ovate with weakly convex inner face, paucispiral with subcentral nucleus without any outgrowth on inner face.

In living specimens epithelium of mantle darkly grey-black pigmented, the color being clearly visible under the transparent shell, head grey-black pigmented, large eye spots present and tentacles with a median longitudinal black stripe up to the half of their length.

Penis (Figs 4–6) black pigmented except the apex and the base, long, slender, gradually tapered towards the tip with a prolonged pointed apex, sometimes like an awl (Fig. 5), with a small unpigmented outgrowth on left side near its base (Fig. 6). Occasionally, this outgrowth is not well visible.

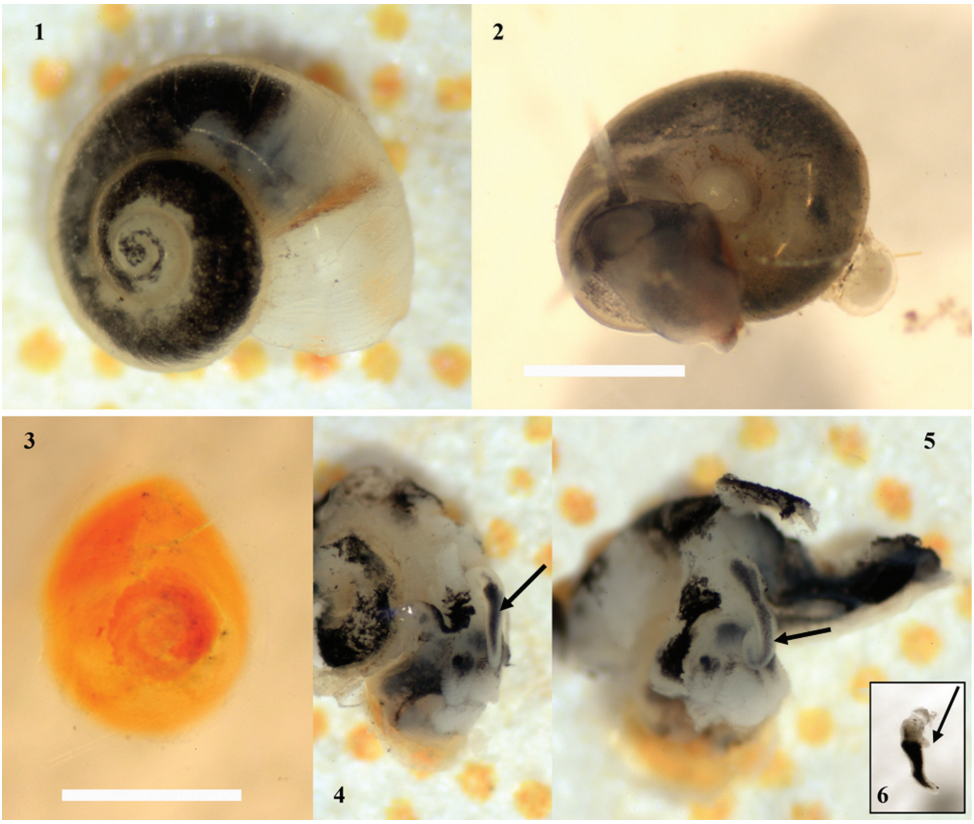
Bursa copulatrix ovate and well-developed, renal oviduct developed and unpigmented. Receptaculum seminis rs_1 rather small, receptaculum seminis rs_2 somewhat vestigial (Fig. 11).

Types. Holotype, shell height 0.90 mm, shell width 1.50 mm, aperture height 0.70 mm, aperture width 0.60 mm, collected alive (March 18, 2011), preserved in ethanol and deposited in ZMUA 4087. Paratypes 1–2, 1: shell height 1.00 mm, shell width 1.35 mm, aperture height 0.60 mm, aperture width 0.60 mm, 2: shell height 1.10 mm, shell width 1.40 mm, aperture height 0.65 mm, aperture width 0.65 mm, collected alive (March 18, 2011), preserved in ethanol and deposited in ZMUA 4088.

Type locality. Agoriani (Eptalophos), mountain Parnassos, Sterea Ellada, Greece, 22°3013.5"N, 38°35'35.5"W, 950 m a.s.l. All the specimens were found on the surface of small stones and dead leaves accumulated on the bottom of a spring covered by a thick snow layer. None other freshwater gastropod species was found to share the same spring.

Further localities. Known only from Agoriani (Eptalophos), Sterea Ellada, Greece.

Etymology. The specific name is a noun in apposition taken from the type locality.

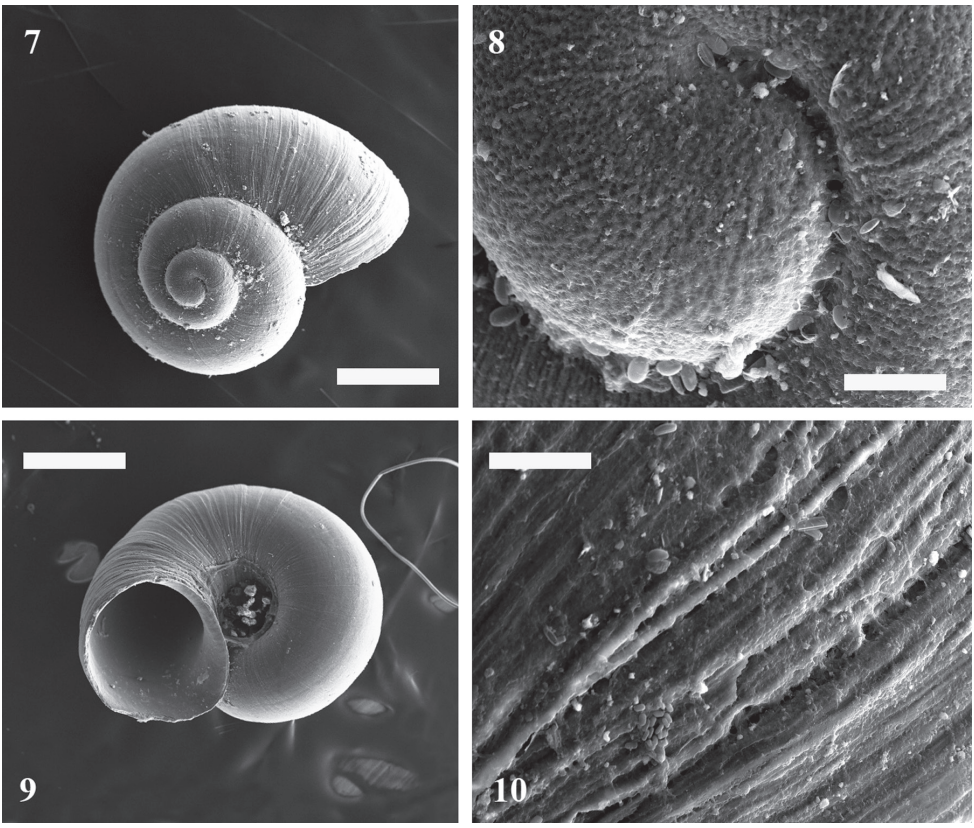


Figures 1–6. *D. eptalophos* sp n. photographed in ethanol. Apical view **1**, alive specimen carrying egg capsules with an embryo on last body whorl and inside umbilicus (photographed in water) **2** operculum **3** soft body, head with tentacles and penis in situ **4–5** penis **6**. A background square represents 1 mm^2 in Figs 1, 4, 5. Scale bar 1 mm and 0.5 mm in Figs 2 and 3 respectively. Black arrow points the penis in Figs 4-5 and the outgrowth of penis in Fig. 6.

Discussion

The new species collected in the Parnassos Mts. belongs to the genus *Daphniola* because it has the characteristics of this genus as defined by Radoman (1973), Schütt (1980), Radoman (1983) and Bodon et al. (2001): 1) shell very small valvatiform 2) operculum without peg 3) penis narrow, slender and elongated with a prominent apex and one outgrowth on left side 4) female genitalia with two seminal receptacles, oviduct loop and ovate bursa copulatrix well-developed.

The macrosculpture of protoconch and teleoconch of *D. eptalophos* is quite similar to those described by Szarowska (2006) and Falniowski et al. (2007) for *D. exigua* and *D. louisi* respectively.



Figures 7–10. *D. eptalophos* sp. n. shell images from SEM Shell habitus **7**, **8** protoconch **9** teleoconch **10** Scale bar 0.5 mm in Figs 7, 9 and 0.05 mm in Figs 8,10.

The shell shape of *D. eptalophos* resembles that of *D. hadei* (Figs 14–16, Falniowski and Szarowska 2011, page 133, Fig. 2–7), and its operculum resembles that of *D. exigua* depicted by Bodon et al. (2001: page 108, Fig. 10).

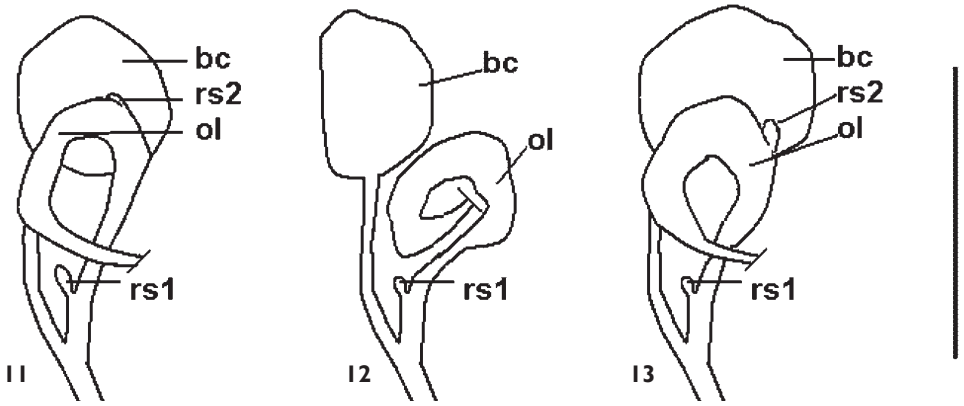
Several characteristics differentiate *D. eptalophos* from the other known species of this genus, i.e. *D. exigua* and *D. louisi* and *D. hadei*.

The shell of *D. eptalophos* is light horn-colored to whitish in contrast to the shell of *D. louisi*, which is brightly yellowish (Falniowski and Szarowska 2000), and of *D. exigua*, which is whitish to greenish-whitish (Schütt 1962).

D. eptalophos has a flatter valvatoid shell with lower spire if compared to those of *D. exigua* and *D. louisi* (Figs 14–16, Falniowski and Szarowska 2000). Additionally, the dimensions of its shell are different if compared to those of the other known species and subspecies of *Daphniola* (Tables 1–2).

The color of the operculum in *D. eptalophos* is dark orange while in *D. exigua* is yellowish brown (Schütt 1980) and in *D. louisi* light yellowish.

The umbilicus of *D. eptalophos* is open and wide such as the umbilicus of *D. louisi* (Falniowski & Szarowska, 2000) and *D. hadei* (Falniowski and Szarowska, 2011). In



Figures 11-13. Female genitalia of *Daphniola* species. *D. eptalophos* sp. n. female genitalia drawn from the only one female individual found among dissected specimens **11** *D. louisi* female genitalia re-drawn from Falniowski and Szarowska (2000) **12** *D. exigua* female genitalia re-drawn from Radoman (1983) **13** Scale bar 0.5 mm.

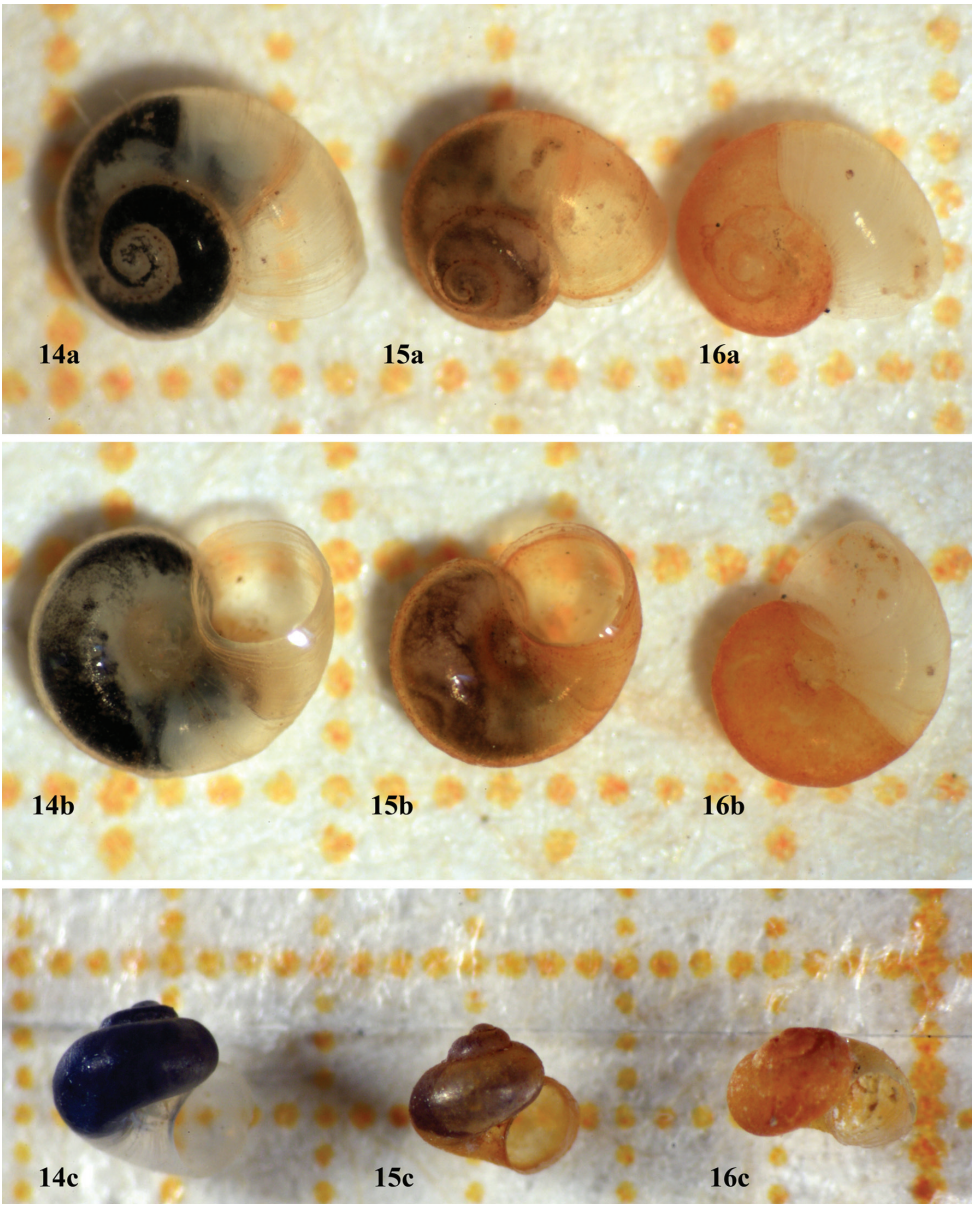
contrast, the umbilicus of *D. exigua* is open but narrow (Schütt 1980; Reischütz 1984; Bodon *et al*. 2001) or semi-opened (Radoman 1973; Radoman 1983).

Body and head of *D. eptalophos* are dark pigmented like that of *D. exigua* (Falniowski et al. 2007); in *D. louisi*, the pigmentation of the soft parts is limited to the delicate spots on the visceral sac covering the digestive gland and gonad while the head is unpigmented (Figs 14–16, Falniowski and Szarowska 2000). The soft body of *D. hadei* is pigmentless (Falniowski and Szarowska 2011).

The eye spots of *D. eptalophos* are large like in *D. louisi* (Falniowski and Szarowska 2000), whereas the eye spot of *D. hadei* are rather small (Falniowski and Szarowska 2011).

The penis of *D. eptalophos* is more slender and elongate than that of *D. louisi* (Falniowski and Szarowska 2000: page 184, Figs 18–25). *D. eptalophos* differs from its congeners in the lateral outgrowth on the left side of penis: this outgrowth is small, rather triangular and located near its base in *D. eptalophos*, it is long, slender and located at half the penis length in *D. exigua* (Radoman 1983: page 84, Fig. 45) and it is small, blunt and located at half the penis length in *D. louisi* and *D. hadei* (Falniowski and Szarowska 2000: page 184, Figs 18–25, and Falniowski and Szarowska 2011: page 135, Figs 16–18). Finally, the penis of *D. eptalophos* is almost entirely black pigmented, a characteristic not observed in any other *Daphniola* species.

Some of the specimens collected were observed to be carrying a single hemispherical egg capsule inside the umbilicus or attached to the body whorl with an embryo at different stage of maturation (Fig. 2). The attachment of egg capsules to the shells of the same species has not been referred in literature for any other *Daphniola* species but it has been recorded in some other hydrobiid taxa with wide umbilicus such as *Tarraconia gasulli* (Boeters, 1981) and *Boetersiella wolfi* Boeters & Glöer, 2007 (Ramos et al. 2000, Boeters and Glöer 2007 respectively).



Figures 14-16. Shells of *Daphniola* species. a, apical view, b, ventral view, c. frontal view *D. eptalophos* sp. n. (Agoriani) **14** *D. exigua* (Marathonas, Attica) **15** *D. louisi* (Kessariani, Attica) **16** A background square represents 1 mm^2.

To date, *Daphniola eptalophos* sp. n. has been found in only one spring. This fact in combination with its low population density indicates that the new species will be highly sensitive towards any kind of change of its biotope. Obviously, a monitoring of the new species is immediately required and the assessment of its population status and trends is of high priority.

Table 1. *Daphniola eptalophos* sp. n. shell morphometry. Measurements in mm. Coefficient of variation (CV) in percent =(SD*100/$\bar{X}$), $\bar{X}$=mean, SD= standard deviation, n=number of specimens measured.

		sh	sw	ah	aw	sh/sw	ah/aw	sh/ah	sw/aw
D. eptalophos sp. n. n=18	Min	0.90	1.10	0.50	0.50	0.53	0.75	1.38	1.87
	Max	1.25	1.90	0.80	0.75	0.91	1.33	2.00	3.17
	$\bar{X}$	1.09	1.46	0.66	0.65	0.75	1.03	1.65	2.28
	SD	0.09	0.21	0.08	0.07	0.10	0.13	0.19	0.34
	CV	8.26	14.38	12.12	10.77	13.33	12.62	11.51	14.91

Table 2. Shell morphometry of *Daphniola* species. Measurements in mm.

***Daphniola* species**		**sh**	**sw**	**ah**	**aw**
Daphniola louisi	Min	1.09	1.17	0.59	0.59
Falniowski and Szarowska (2000), Falniowski et al. (2007)	Max	1.45	1.69	0.98	0.85
Daphniola exigua	Min	0.99	1.00	0.63	0.60
Schütt (1962) [*], Schütt (1980) [**], Radoman (1983) [***], Reischütz (1984) [****], Falniowski et al. (2007)	Max	1.58	1.40	0.87	0.87
D. hadei	Min	0.84	1.14	0.55	0.52
Falniowski and Szarowska (2011)	Max	0.85	1.15	0.57	0.54
D. eptalophos sp. n.	Min	0.90	1.10	0.50	0.50
Present study	Max	1.25	1.90	0.80	0.75

[*]As *Horatia (Horatia) exigua*, [**] as *Horatia (Daphniola) exigua*, [***] as *D. graeca*, [****]as *Horatia (Daphniola) exigua pangaea*.

Unfortunately "hydrobioid" localities in Greece, most of them springs, are prone to changes (Szarowska and Falniowski 2004, Szarowska and Falniowski 2011b) due to urbanization, water pollution, waste accumulation, tourism and agricultural practices. Many of these localities have been destroyed, and a decline or even loss of endemic hydrobiid taxa has already been recorded (Ryan and Griffiths 2001, Szarowska and Falniowski 2004, Albrecht et al. 2006, Regnier et al. 2009, Szarowska and Falniowski 2011a).

Effective conservation measures must be urgently taken to protect "hydrobioid" localities in Greece, among them the spring nearby Agoriani, before their unique gastropod fauna disappears.

Key to the *Daphniola* species

1 Shell valvatiform or valvatiform to planispiral, umbilicus open and wide, body unpigmented **2**

– Shell valvatiform or valvatiform to planispiral, body and head pigmented... **3**

2 Shell valvatiform, penis big and massive with triangular shape and a small blunt outgrowth at the middle of its length..... ***D. louisi***

– Shell valvatiform to planispiral, penis with long and narrow filament and a small blunt outgrowth at the middle of its length ..... ***D. hadei***

3 Shell valvatiform, umbilicus partly covered by peristome, penis pigmentless, narrow and slender with a long outgrowth at the middle of its length..... ..... ***D. exigua***

– Shell valvatiform to planispiral penis very dark-colored, narrow, slender with a prolonged pointed apex and a small outgrowth near its base .... ***Daphniola eptalophos***

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RESEARCH ARTICLE

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A new species of *Diochus* from Baltic amber (Coleoptera, Staphylinidae, Diochini)

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Abstract

The first fossil of the staphylinine tribe Diochini Casey is described and figured from an inclusion in mid-Eocene (Lutetian) Baltic amber. *Diochus electrus* **sp. n.** is distinguished from its congeners and the diversity of rove beetles (Staphylinidae s.l.) is summarized briefly.

Keywords

Tertiary, Eocene, Lutetian, fossil, Staphylininae, Diochini, taxonomy

Introduction

More so than any other amber deposit in the world, the fossiliferous resin from the blaue Erde of northern Europe has garnered the attention of researchers, artists, and amateurs. For literally millennia Baltic amber has been the focus, if not obsession, of innumerable individuals and as such its included flora and fauna is one of the most

completely understood paleoecosystems. Despite this fascination and intense activity, there remains huge swaths of the fauna to revise and newly document. Among those groups requiring significant attention are the beetles of the family Staphylinidae (sensu Bouchard et al. 2011). Most species, largely of the subfamilies Scydmaeninae and Pselaphinae, were described more than a century ago by Schaufuss (1888, 1890a, 1890b, 1890c, 1892, 1896) and are in need of revision and figuring, should new material eventually be located (*vide* Appendix). Fortunately, several new works during the last 35 years, particularly the last decade, have added significantly to this fauna and provided a more modern perspective on staphylinid diversity in Baltic amber (*vide* Appendix). Unfortunately, the diverse subfamily Staphylininae has not been recorded formally since Schaufuss (1888) described *Bembicidiodes inaequicollis*, a species more recently considered of uncertain subfamilial affinity (Herman 2001).

In this paper we describe the first fossil species of *Diochus* Erichson from middle Eocene Baltic amber and as the first, definitive fossil staphylinine. The tribe Diochini Casey includes the genera *Antarctothius* Coiffait and Saiz, *Coomania* Cameron, and *Diochus*. The tribe has not received much taxonomic attention and the boundaries between these genera are not clear. Newton (1985) suggested that *Antartoctothius* might be co-generic with *Diochus*, which is the genus with the highest number of species (40) in the tribe. *Diochus* has a worldwide distribution but the majority of species are found in the New and Old World tropics. There are ten species of *Diochus* in the Palearctic region (Smetana 2004; western Palearctic species revised by Assing 2003) and only one in the Nearctic (Smetana 1982). Smetana (1982) noted that *Diochus* is in dire need of systematic revision and that it is extremely hard to differentiate between species.

Material and methods

Measurements were made using an ocular micrometer on an Olympus SZX-12 stereomicroscope and all measurements refer to maximum width or length of a particular structure. Total length is measured from the anterior margin of the clypeus to the posterior margin of abdominal segment VIII. Due to the placement of the fossil in amber, not all typical measurements were possible. Photomicrographs where prepared with a Nikon D1x digital camera attached to an Infinity K-2 long-distance microscope lens.

The age, origin, and biotic diversity of Baltic amber has recently been summarized by Weitschat and Wichard (2010). Material discussed herein is deposited in the Fossil Insect Collection of the Division of Entomology, University of Kansas Natural History Museum, Lawrence, Kansas, USA.

Systematic placement

The fossil is placed in the tribe Diochini (and the genus *Diochus*) based on the following characters (from Smetana 1982): antennae not geniculate; maxillary palpus (P_2

and P_3) finely pubescent; neck narrow, only about a forth as wide as head and frons between antennal insertions truncate. The direct comparison of the fossil described here with *Coomania* was not possible due to the lack of *Coomania* specimens, however, in the published description of *Coomania* (Cameron 1939) the neck is much narrower than in *Diochus*, only a fifth as broad as the head.

Systematic paleontology

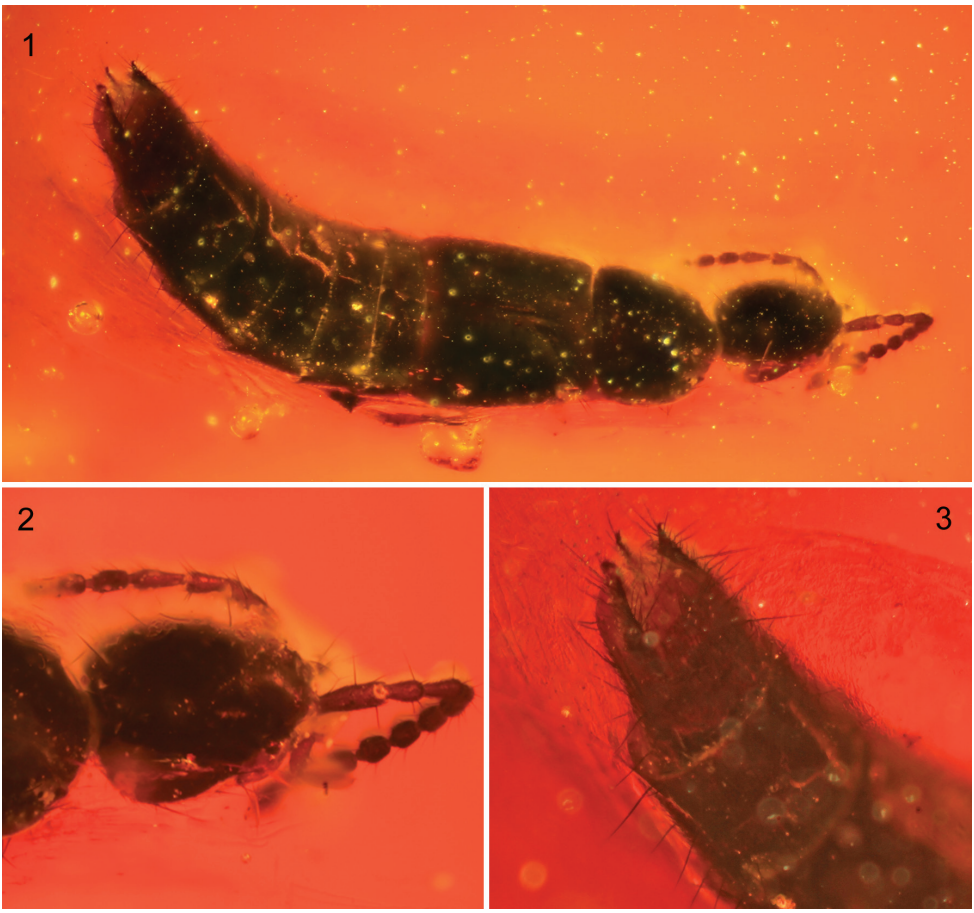
Family Staphylinidae Latreille, 1802
Subfamily Staphylininae Latreille, 1802
Tribe Diochini Casey, 1906
Genus *Diochus* Erichson, 1839

***Diochus electrus* Chatzimanolis & Engel, sp. n.**
urn:lsid:zoobank.org:act:C24A1C8A-B27B-48EC-8100-2FE43C4913E6
http://species-id.net/wiki/Diochus_electrus
Figs 1–3

Holotype. ♀; KU-NHM-ENT, B-244 (Fig. 1); with labels: "Amber: Baltic, middle Eocene (Lutetian), blaue Erde, Northern Europe, KU-NHM-ENT-B244" // "HOLOTYPE *Diochus electrus* Chatzimanolis and Engel, des. Chatzimanolis and Engel 2011". Deposited in Fossil Insect Collection, Division of Entomology, University of Kansas Natural History Museum, Lawrence.

Diagnosis. *Diochus electrus* can be distinguished from otherwestern Palearctic species of the genus by the differences in the relative proportion of elytra to pronotum (elytra longer than pronotum in *D. electrus*; shorter than elytra in other species) and the proportions of the head (head much more elongate in the extant species than in *D. electrus*).

Description. Total length 3.5 mm; body coloration brown to black except antennae somewhat orange and abdominal segment VIII light brown. Head ovoid, length 0.56 mm, width 0.48 mm, slightly longer than wide (Fig. 2); compound eye length 0.18 mm, postoccular region convex, about twice as long as compound eyes; head with large macrosetae near posterior margin; head with transverse microsculpture and sparse small punctures. Antennomeres 1–5 longer than wide; antennomeres 6–10 subquadrate, antennomere 11 longer than wide; antennomere 1 as long as twice length of antennomere 2; antennomere 3 1.5 times longer than antennomere 2; antennomere 4 slightly shorter than antennomere 3; antennomere 5 slightly shorter than antennomere 4; antennomeres 6–9 subequal in length; antennomere 10 slightly longer than previous antennomeres but shorter than antennomere 11. Mouthparts not visible except right maxillary palp; maxillary palpomere I (P_1) not visible, P_2 longer than wide, club-like, about as long as P_3; P_3becoming wider distally; P_4 extremely small, slender, conical, about seven times smaller than P_3. Pronotum subquadrate, wider than head; pronotal length 0.64 mm, width 0.49 mm; anterolateral corners curved ventrally and not vis-



Figures 1–3. Photomicrographs of holotype female of *Diochus electrus* Chatzimanolis & Engel, sp. n. (B-244). **1** Dorsal view **2** Details of head **3** Details of abdominal apex.

ible from above; pronotum smooth with sparsely scattered small, shallow punctures. Elytra longer than pronotum; elytra length 0.75 mm, elytra width 0.67 mm; elytra with dense macrosetae, expanding posteriorly; elytra sculptured as on pronotum. Legs (forelegs not visible) with slender tibiaecovered in long spurs distally; tarsi elongate, metatarsi almost as long as metatibia; metatarsomeres I and II greatly expanded. Abdomen with dense macrosetae (Figs. 1, 3); segment VI longer than preceding segments; segment VII about twice as long as segment V; sternum VIII without any secondary sexual structures.

Etymology. The specific epithet is an adjective derived from the Latin noun for amber (electrum).

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Appendix

Checklist of described Baltic (including Bitterfeld and Rovno) amber Staphylinidae-arranged by subfamily (sensu Bouchard et al. 2011); older records also exist for the subfamilies Euaesthetinae, Micropeplinae, Osoriinae, Oxytelinae, Phloecharinae, Proteininae, and Scaphidiinae but based on unidentified or undescribed material (e.g., Klebs 1910; Larsson 1978; Spahr 1981, Puthz 2006, 2008).

Subfamily Aleocharinae Fleming
- *Adinopsis groehni* Zerche, 1999
- *Aleochara* (*Aleochara*) *baltica* Paśnik & Kubisz, 2002
- *Atheta* (*Datomicra*) *jantarica* Paśnik, 2005
- *Baltioligota electrica* Paśnik, 2005
- *Dictyon antiquus* Paśnik & Kubisz, 2002
- *Electrogymnusa baltica* Wolf-Schwenniger, 2004
- *Leptusa* (*Protoleptusa*) *defuncta* Semenov et al., 2001 [Rovno]
- *Phymatura electrica* Paśnik & Kubisz, 2002

Subfamily Omaliinae MacLeay
- *Pseudolesteua insinuans* Schaufuss, 1890b

Subfamily Oxyporinae Fleming
- *Oxyporus blumenbachii* Gravenhorst, 1806

Subfamily Paederinae Fleming
- *Lathrobium ambricum* Paśnik & Kubisz, 2002
- *Lathrobium balticum* Paśnik & Kubisz, 2002
- *Lathrobium jantaricum* Paśnik & Kubisz, 2002
- *Lathrobium succini* Paśnik & Kubisz, 2002
- *Lathrobium* (*Palaeolobrathium*) *whitei* Abdullah & Abdullah, 1968

Subfamily Pselaphinae Latreille
- *Barybryaxis lata* Schaufuss, 1890a
- *Batrisus antiquus* Schaufuss, 1890a
- *Batrisus pristinus* Schaufuss, 1890a
- *Bythinus foveopunctatus* Schaufuss, 1890a

Bythinus schaufussi Reitter, 1891 (*nom.nov. proB. caviceps* Schaufuss, 1890a)
Bythinus tenuipes Schaufuss, 1890a
Bythinus typicus Schaufuss, 1890a
Ctenistodes claviger Schaufuss, 1890a
Cymbalizon tyroides Schaufuss, 1890a
Dantiscanus costalis Schaufuss, 1890a
Deuterotyrus redivivus Schaufuss, 1890a
Euplectus lentiferus Schaufuss, 1890a
Euplectus mozarti Schaufuss, 1890a
Euplectus quadrifoveatus Schaufuss, 1890a
Euspinoides glabrellus Motschulsky, 1856
Faronus porrectus Schaufuss, 1890a
Faronus tritomicrus Schaufuss, 1890a
Greys conciliator Schaufuss, 1890a
Hagnometopias pater Schaufuss, 1890a
Hetereuplectus retrorsus Schaufuss, 1890a
Monyx spiculatus Schaufuss, 1890a
Nugaculus calcitrans Schaufuss, 1890a
Nugator stricticollis Schaufuss, 1890a
Pammiges spectrum Schaufuss, 1890a
Pantobatrisus cursor Schaufuss, 1890a
Rybaxis glabrella (Schaufuss, 1890a)
Rybaxis patris (Schaufuss, 1892)
Rybaxis veterum (Schaufuss, 1890a)
Tmesiphoroides cariniger Motschulsky, 1856
Tychus avus Schaufuss, 1890a
Tychus radians Schaufuss, 1890a
Tyrus electricus Schaufuss, 1890a

Subfamily Scydmaeninae Leach
Aenictosoma doenitzi Schaufuss, 1892
Clidicus balticus Schaufuss, 1896
Cryptodiodon corticaroides Schaufuss, 1890c
Electroscydmaenus pterostichoides Schaufuss, 1890c
Euconnus fossilis Franz, 1976
Euconnus liedtkei Franz, 1976
Euconnus sucini Franz, 1976
Euconnus wunderlichi Franz, 1983
Hetereuthia elegans Schaufuss, 1890c
Heuretus coriaceus Schaufuss, 1890c
Neuraphes fossilis Franz, 1983
Palaeomastigus helmi Schaufuss, 1890c
Palaeothia tenuitarsis Schaufuss, 1890c
Scydmaenoides nigrascens Motschulsky, 1856

Semnodioceras halticaeforme Schaufuss, 1890c
Stenichnus (*Cyrtoscydmus*) *capucinus* (Schaufuss, 1890c)
Stenichnus (*Cyrtoscydmus*) *carinulatus* (Schaufuss, 1890c)
Stenichnus (*Cyrtoscydmus*) *laticlavus* (Schaufuss, 1890c)
Stenichnus (*Cyrtoscydmus*) *titubans* (Schaufuss, 1890c)

Subfamily Staphylininae Latreille
Bembicidiodes inaequicollis Schaufuss, 1888 (subfamily questioned: Herman 2001)
Diochus electrus Chatzimanolis & Engel, sp. n.

Subfamily Steninae MacLeay
Stenus (*Hemistenus*) *priscus* Benick, 1943
Stenus abraham Puthz, 2010
Stenus archetypus Puthz, 2010
Stenus atavus Puthz, 2010
Stenus avus Puthz, 2010
Stenus groehni Puthz, 2010
Stenus ketura Puthz, 2010
Stenus methusalem Puthz, 2010
Stenus noach Puthz, 2010

Subfamily Tachyporinae MacLeay
Bolitobius groehni Schülke, 2000
Palaeosepedophilus succinicus Paśnik & Kubisz, 2002
Sepedophilus balticus Paśnik & Kubisz, 2002
Tachyporus bicoloratus Paśnik, 2005

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Iranotrichia gen. n., a new genus of Scenopinidae (Diptera) from Iran, with a key to window fly genera of the world

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Abstract

An unusual new genus of Scenopinidae, *Iranotrichia* gen. n., comprising two newly discovered species (*I. insolita* **sp. n.** and *I. nigra* **sp. n.**), is described from Iran. *Iranotrichia* **gen. n.** are scenopinine window flies with a habitus reminiscent of certain bee fly genera (Bombyliidae), based on colouration and elongate mouthparts and antennae. The phylogenetic placement of this distinctive new genus is discussed and a dichotomous key to world genera is presented. The genus name *Kelseyana* **nom. n.** is proposed to replace *Caenoneura* Kröber, 1924, which was found to be preoccupied by Thomson (1870: 270) (Hymenoptera) and Kirby (1890: 136) (Odonata).

Keywords

Therevoid clade, Asiloidea, Scenopinidae, key

Introduction

Window flies (Diptera: Scenopinidae) are a small family (ca. 420 species in 26 genera) of flies with an adult body size rarely exceeding 5.0 mm. Scenopinids are distributed

throughout all major biogeographical regions, and with few exceptions, most genera are confined to a single biogeographical region (Kelsey, 1973). This family is placed in the therevoid clade, comprising families such as Therevidae (stiletto flies), Apsilocephalidae and Evocoidae (Winterton, 2008; Trautwein et al., 2010). A close relationship between Scenopinidae and Therevidae has been previously identified based on the secondarily segmented characteristic of the larval abdomen (Woodley, 1989).

Iranotrichia gen. n. is described herein from northern Iran, comprising two species, *I. insolita* sp. n. and *I. nigra* sp. n. This new genus is morphologically very similar to other scenopinine genera such as *Metatrichia* Coquillett, 1900, *Kelseyana* nom. n. (= *Caenoneura* Kröber, 1923) and *Pseudomphrale* Kröber, 1913. This group of genera is differentiated by other scenopinine genera based on the following characteristics: wing vein M_1 fused to vein R_5 before wing margin, mouthparts well developed, scutum with extensive pile (often scale-like), abdomen broad and flattened in both sexes with limited sexual dimorphism, male genitalia with gonocoxal apodemes relatively broad, and female acanthophorite spines absent. *Metatrichia* is a cosmopolitan genus containing 16 extant and one fossil species. (Kelsey 1969; Krivosheina and Krivosheina 1999; Winterton and Woodley, 2009; Yeates and Grimaldi, 1995). The morphological differences between *Metatrichia* and *Pseudomphrale* are not clear, and the validity of this distinction has been questioned previously (Krivosheina and Krivosheina, 1996; Winterton and Woodley 2009). *Iranotrichia* gen. n. is easily differentiated from all other scenopinine genera based on the characters above, as well as the elongate antennae and mouthparts, subterminal antennal style and greatly elongate distiphallus in the male genitalia. This new genus is described and figured herein, with a key to the 25 extant scenopinid genera of the world presented. The genus name *Kelseyana* nom. n. proposed to replace *Caenoneura* Kröber, which was found to be is preoccupied by Thomson (1870: 270) (Hymenoptera) and Kirby (1890: 136) (Odonata).

Materials and Methods

Genitalia were macerated in 10% KOH at room temperature for one day to remove soft tissue, then rinsed in distilled water and dilute acetic acid, and dissected in 80% ethanol. Preparations were then placed into glycerine, with images made with the aid of a digital camera mounted on a stereomicroscope. Genitalia preparations were placed in glycerine in a genitalia vial mounted on the pin beneath the specimen. Terminology follows Winterton (2005) and Winterton and Woodley (2009). In contrast to the scenopinid subfamilies Proratinae and Caenotinae, the male terminalia of Scenopininae are rotated 180°. To avoid confusion with terminology and comparative homology, structures are described and labeled as they are in related flies with terminalia not rotated; therefore the ventral apodeme of the aedeagus described herein is physically located dorsally. The following collection acronyms are cited in the text: California Academy of Sciences, San Francisco, California, USA (CAS), California State Collection of Arthropods, Sacramento, California, USA (CSCA), Iranian Research Institute

of Plant Protection, Tehran, Iran (IRIPP), and the National Museum of Natural History, Smithsonian Institution, Washington DC, USA (NMNH). Specimen images were taken at different focal points using a digital camera and subsequently combined into a serial montage image using Helicon Focus software. High-resolution digital images were deposited into Morphbank with embedded URL links within the document between descriptions and Morphbank images. All new nomenclatural acts and literature are registered in Zoobank (Pyle and Michel, 2008).

Taxonomy

Key to therevoid clade families and Scenopinidae genera of the world:
Note: *Metatrichia* and *Pseudomphrale* cannot be separated at this time and are included together in couplet 21.

1 Wing with vein CuA_1 arising from apex of cell *bm*; connected to discal cell by cross-vein m-cu; three medial veins present; male epandrium not medially divided..... **2**

– Wing with vein CuA_1 integrated into at least part of posterior margin of discal cell; one or two (rarely three) medial veins present; male epandrium medially divided **3**

2 Antennal style elongate and filamentous ..... **Apsilocephalidae**

– Antennal style very short, often barely evident ..... **Therevidae**

3 Antennal flagellum comprised of bulbous base fused with a terminal filamentous style; vein CuA_2 separate from A_1 to wing margin..... **Evocoidae**

– Antennal flagellum shape variable, but never with an elongate terminal filament; vein CuA_2 joining to A_1, petiolate to wing margin .... **Scenopinidae: 4**

4 Wing with two veins originating posteriorly from discal cell (M_1 and CuA_1); male genitalia rotated 180° ..... **Scenopininae: 11**

– Wing with three (or rarely four) veins originating posteriorly from discal cell (M_1, M_2, M_3 and CuA_1); male genitalia not rotated **5**

5 Costal vein extending around wing; sensory area on tergite 2 made up of two hemispherical regions of short setae; male genitalia with aedeagus and gonocoxal apodemes short (Nearctic) ..... ***Caenotinae:*** **Caenotus Cole, 1923**

– Costal vein ending at vein R_5; male genitalia with aedeagus and gonocoxal apodemes greatly elongate..... **Proratinae: 6**

6 Abdominal tergite 2 setal patch absent; antennal flagellum abruptly turbinate with a tuft of apical setae; thickening of costal margin ending at or just beyond R_4; abdomen largely white with brown terminalia (Nearctic) .... ***Caenotoides*** **Hall, 1972**

– Abdominal tergite 2 setal patch present; antennal flagellum cylindrical or tapered, without tuft of apical setae; thickening of costal margin ending at or just beyond R_5; abdomen typically uniform black, brown or pale yellow..... **7**

7 Mouthparts elongate; antennal flagellum cylindrical; elongate setae along posterior margin of female abdominal tergite 8; male wing with M_1 much shorter than M_2; male gonocoxites with medial spine projecting posteriorly; gonocoxal apodemes and aedeagus barely projecting anteriorly from gonocoxites (Neotropical: Argentina)..... ***Jackhallia*** **Nagatomi & Liu, 1994**

– Mouthparts length variable; antennal flagellum usually tapered, although sometimes cylindrical; setae along posterior margin of female abdominal tergite 8 short; male wing with M_1 longer than or equal length of M_2; male gonocoxites without medial spine; gonocoxal apodemes and aedeagus project anteriorly well beyond gonocoxites, sometimes greatly elongated **8**

8 Abdominal tergite 2 setal patch rounded with very slight medial separation into two hemispheres; female tergite 8 with erect, elongate setae arranged in ring-like pattern; male aedeagus folded dorsally onto itself so that ejaculatory apodeme is projecting posteriorly (Afrotropical: Namibia) .... ***Cyrtosathe*** **Winterton & Metz, 2005**

– Abdominal tergite 2 setal patch as a single rounded or elongate patch; female tergite 8 without erect, elongate setae; male aedeagus extending anteriorly and not folded on itself..... **9**

9 Antennal flagellum gradually narrowed apically, with thick apical style that is wider than apex of preceding segment; anterior margin of female eye not emarginate (Nearctic) ..... ***Acaenotus*** **Nagatomi & Yanagida, 1994**

– Antennal flagellum only slightly tapered, with narrow apical, or more commonly subapical, style that is not wider than apex; anterior margin of female eye often triangularly emarginate just dorsal to base of antennae..... **10**

10 Antennal flagellum with single segment (excluding apical style) (Palaearctic) ..... ***Alloxytropus*** **Bezzi, 1925**

– Antennal flagellum two segmented (excluding apical style), apical segment is minute and similar shaped to style in some species (e.g. *P. frommeri* Hall, 1972) (Nearctic) ..... ***Prorates*** **Melander, 1906**

11 Wing vein M_1 separate from vein R_5 to wing margin (cell r_5 open) **12**

– Wing vein M_1 fused to vein R_5 before wing margin (petiolate closed cell r_5) **16**

12 Wing vein M_1 incomplete or terminating before wing margin **13**

– Wing vein M_1 complete to wing margin..... **14**

13 Male epandrium as two relatively short lobes; female with reduced spines on acanthophorite; female sternite 8 longer than tergite 8 (Australasian) .... ***Riekiella*** **Paramonov, 1955 (part)**

– Male epandrium as four elongate lobes; female acanthophorite spines elongate, slender; female tergite 8 and sternite 8 subequal (Australasian) .... ***Paramonova*** **Kelsey, 1970 (part)**

14 Vein CuA_1 terminating just beyond cell d; female sternite 8 with comb-like band of elongate setae (Afrotropical, Oriental)..... ***Seguyia*** **Kelsey, 1980**

– Vein CuA_1 reaching or terminating just prior to posterior wing margin; female sternite 8 without distinct comb-like band of elongate setae **15**

15 Head length generally longer than height (sometimes subequal); body elongate; abdomen elongate and cylindrical; reared from wood-boring beetle galleries (Afrotropical, Palaearctic, Oriental) ..... ***Prepseudatrichia*** **Kelsey, 1969**

– Head length generally shorter than height; body relatively short; abdomen wide; reared from various habitats but not known from wood-boring beetle galleries (cosmopolitan) ..... ***Scenopinus*** **Latreille , 1802**

16 Mouthparts atrophied (Nearctic) ..... ***Belosta*** **Hardy, 1944**

– Mouthparts well developed **17**

17 Head generally longer than high; body glossy black with verrucous surface microsculpturing, without extensive setal pile; abdomen greatly elongate and cylindrical along entire length; reared from wood-boring beetle galleries or vertebrate nests **18**

– Head generally shorter than high; body glossy black or frequently with extensive pubescence, surface microsculpturing absent, often with extensive setal pile; abdomen short and flat, sometimes greatly elongate and tapered in female, never cylindrical along entire length; not known from wood-boring beetle galleries **19**

18 Male epandrium approximately as long as high (lateral view); posterior margin of sternite 6 unmodified, without processes; male gonostyli with comb-like band of elongate setae; female cerci without tuft of strong spines; apex of cell r_5 blunt (Nearctic, Neotropical) ..... ***Pseudatrichia*** **Osten Sacken, 1877**

– Male epandrium distinctly shorter than high, band like (lateral view); truncated process along posterior margin of sternite 6; male gonostyli without elongate setae; female cerci with tuft of strong, ventrally directed spines; apex of cell r_5 acute (Australasian) ..... ***Neopseudatrichia*** **Kelsey, 1969**

19 Relatively robust bodied flies with broad, flat abdomen in both sexes (frequently large sized); sexes approximately equal sized **20**

– Relatively delicate flies with narrow tapered abdomen (usually with relatively small body size), particularly in female; abdomen much longer in female, displaying distinct sexual size dimorphism **22**

20 M_1 and composite R_5+M_1 vein abruptly bent anteriorly to join wing margin subapically along costa (Palaearctic) ..... ***Kelseyana*** **nom. n. (= Caenoneura Kröber, 1923)**

– M_1 and composite R_5+M_1 vein not bent anteriorly (Fig. 1A), joining margin at wing apex **21**

21 Antennae greatly elongate and cylindrical; flagellum broadly rounded to truncate apically but not notched, style subterminal (Figs 1B-C); mouthparts greatly elongate; male distiphallus greatly elongate and coiled (Figs 4A-D); body reminiscent of bee fly (Bombyliidae) (Palaearctic: Iran) ..... ***Iranotrichia*** **gen. n.**

– Antennae not elongate; flagellum ovate to quadrangular, notched apically with style terminal in notch; mouthparts rarely elongate; male distiphallus short and straight, rarely protruding beyond genitalic capsule; body not resembling bee fly ..... ***Metatrichia*** Coquillett, 1900 (Cosmopolitan) and ***Pseudomphrale*** Kröber, 1913 (Palaearctic)

22 Glossy black flies without pubescence; antennal flagellum pointed, not notched; female cerci with tuft of strong ventrally projecting setae (Palaearctic) ..... ***Stenomphrale*** **Kröber, 1937**

– Body variously coloured with dense pubescence (rarely glossy black); antennal flagellum broad, notched apically; female cerci without tuft of strong setae **23**

23 Wing with vein R_4 branching from R_5 along the basal half of cell r_5; female acanthophorite spines well developed **24**

– Wing with vein R_4 branching from R_5 at halfway or along distal half of cell r_5; female acanthophorite spines present, or reduced in size or shape, sometimes absent **25**

24 Male distiphallus short and straight; male subepandrial sclerite not modified; female sternite 8 straight or slightly emarginate apically (Neotropical) .... ***Heteromphrale*** **Kröber, 1937**

– Male distiphallus relatively long and thread-like, highly reflexed basally so that basiphallus and ejaculatory apodeme are projecting dorsally or posteriorly; subepandrial sclerite with anterior projecting, blade-like extensions serving as aedeagal guides; female sternite 8 with rounded posterolateral lobes (Nearctic, Neotropical) ..... ***Brevitrichia*** **Hardy, 1944**

25 Female acanthophorite spines well developed (Afrotropical) .... ***Propebrevitrichia*** **Kelsey, 1969**

– Female acanthophorite spines absent, or greatly reduced in length or thickness (Australasian, Neotropical) **26**

26 Female sternite 8 apically trilobate; male epandrium unmodified, without posterior or medial processes (Neotropical) ..... ***Irwiniana*** **Kelsey, 1971**

– Female sternite 8 apically rounded or bilobate; male epandrium typically with multiple lobes and posterior or medial processes (Australasian) **27**

27 Male epandrium with flange-like lobes internally .. ***Paratrichia*** **Kelsey, 1969**

– Male epandrium without flange-like lobes internally **28**

28 Male epandrium as two relatively short lobes; female sternite 8 longer than tergite 8, apically pointed ..... ***Riekiella*** **Paramonov, 1955 (part)**

– Male epandrium as four elongate lobes; female sternite 8 length subequal to tergite 8 ..... ***Paramonova*** **Kelsey, 1970 (part)**

***Iranotrichia* gen. n.**
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http://species-id.net/wiki/Iranotrichia

Type species: *Iranotrichia insolita* sp. n.

Diagnosis. *Body length:* 4.0–5.5 mm [male], 4.5–5.0 mm [female]. Head higher than long, sub-spherical, female with broad, raised postocular ridge; antenna elongate, cylindrical, length 0.6–1.2× head length; antennal style subterminal, flagellum broadly rounded to truncate apically, not notched; frons relatively flat, not protruding anteriorly; mouthparts greater than head length, projecting anteriorly; scutum with dense pile of semi-appressed, silver-white lanceolate setae, all directed towards a single posteromedial point (Figs 2–3, 6); wing vein M_1 joining with R_5 (Fig. 1A), cell r_5 petiolate to wing margin; wing vein M_2 absent; costal margin ending at vein R_5; abdomen broad, width equal to thorax; tergite 2 sensory setae well defined and two circular patches. Male genitalia: rotated 180°; tergite 7 and sternite 7 broad and separate, not ring-like; male epandrium split medially as two sclerites, halves sub-circular or sub-triangular; epandrium not covering gonocoxites ventrally; hypandrium as, paired sclerites, narrow paddle-shape with short setae along posterior margin; gonostylus well developed, irregular shaped, dark sclerotized and irregular spinose marginally; aedeagus protruding anteriorly from epandrium only a relatively short distance; gonocoxite irregularly shaped and mostly reduced; gonocoxal apodeme relatively thickened, broadly triangular with medial braces joining with aedeagus; aedeagus with lateral aedeagal bulb present, sometimes well developed; distiphallus bifid, recurved dorsally at base then greatly elongate and coiled. Female genitalia: tergite 9+10 narrow and band-like, acanthophorite spines absent; sternite 8 slightly longer than tergite 8, broadly acuminate posteriorly; furca a dark-sclerotized ring with narrow posterolateral arm, connected posteromedially with 'Y'-shaped sclerotized bridge between furca and anterior margins of tergite 9+10; two sclerotized spherical spermathecae; spermathecal sac simple, connected to bursa medially immediately anterior to spermathecal ducts.

Etymology. The genus name is derived from the type location of members of this genus; Iran, *-trichia* (Greek: hair), referring to the setal pattern and has frequently been used historically to formulate to scenopinid generic names.

Included species. *Iranotrichia insolita* sp. n., *I. nigra* sp. n.

Comments. This genus is placed in Scenopininae based on the rotated genitalia, wing venation and shape of the tergite two setal patches. The general habitus of members of this new genus is very reminiscent of certain genera of Bombyliidae. *Iranotrichia* gen. n. is morphologically very similar to *Metatrichia* and *Pseudomphrale*, but can be separated from these and other Scenopinidae based on the greatly elongate and often coiled bifid

distiphallus, elongate antennae and mouthparts, flagellum not notched apically and with style subapical on outer surface. The elongate antennae and mouthparts and distiphallus are characteristic of *Iranotrichia*; although such elongation of these structures is sometimes found in proratine genera such as *Prorates* and *Jackhallia*, it is not found elsewhere in Scenopininae. Some species of *Pseudomphrale* and *Metatrichia* have elongated mouthparts (e.g. *M. palaestinensis* (Kröber, 1937), *M. freidbergi* Krivoshiena and Krivosheina, 1999, and *P. longirostris* Becker, 1913) (Krivosheina and Krivosheina 1999; Kelsey 1969) about half as long as species of *Iranotrichia* gen. n. Possibly of little phylogenetic significance, but useful for differentiating *Pseudomphrale* from *Iranotrichia* gen. n. and *Metatrichia* is that all specimens of *Pseudomphrale* species are between 1.6 and 4.0 mm body length, while specimens of *Iranotrichia* and *Metatrichia* are rarely less than 4.0 mm (Kelsey 1969; Krivosheina and Krivosheina 1996, 1999; Winterton and Woodley 2009). A greatly elongate, coiled distiphallus is also present in *M. palaestinensis* (*cf.* Kröber 1937 and Kelsey 1969). Both species of *Iranotrichia* gen. n. are known only from a single collecting event in Ghazvin province, Iran where *I. insolita* sp. n. is apparently far more abundant than *I. nigra* sp. n.

Key to *Iranotrichia* gen. n.

1 Head, thorax, abdomen and legs with extensive areas of yellow and white; terminalia yellow; distiphallus of male as long or longer than body when uncoiled..... ***I. insolita* sp. n.**

– Head, thorax, abdomen and legs dark, with limited areas of yellow and white; terminalia dark; distiphallus of male less than length of body when uncoiled.. .....***I. nigra* sp. n.**

***Iranotrichia insolita* sp. n.**
urn:lsid:zoobank.org:act:1567D17A-C21B-48F9-9029-F451F6A9A603
http://species-id.net/wiki/Iranotrichia_insolita
Figs 1–4A, B, 5

Type material. Holotype male, IRAN: **Ghazvin province:** 17 km NE Ghazvin, Abazar village road, rangeland, 36.2916º 50.1583º, white pan trap, 19.vi.2010, B. Gharali (NMNH). (excellent condition).

Paratypes. IRAN: 55 males, 9 females, **Ghazvin province:** 17 km NE Ghazvin, Abazar village road, rangeland, 36.2916º 50.1583º, white pan trap, 19.vi.2010, B. Gharali (CSCA (3 males), CAS (10 males 2 females), NMNH (10 males, 2 females), IRIPP (10 males, 2 females), personal collection of BG (20 males, 3 females)).

Diagnosis. Head, thorax, abdomen and legs with extensive areas of yellow and/or white; combined length of scape and pedicel equal to length of flagellum; scutellum white with yellow suffusion anteromedially; terminalia yellow; epandrium elongate and sub-triangular; distiphallus of male as long or longer than body when uncoiled; distiphallus arms without spinose process.

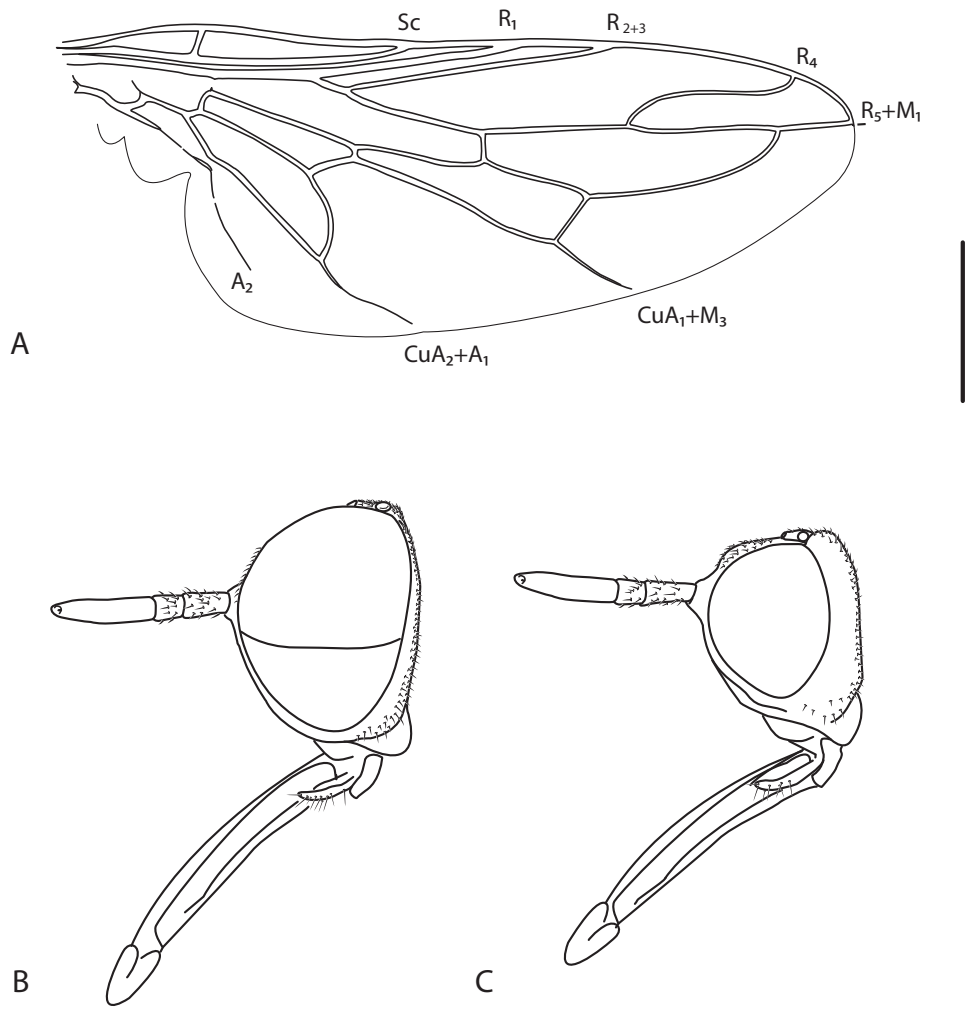

Figure 1. *Iranotrichia insolita* sp. n.: **A.** wing; **B.** male head, lateral; **C**, female head, lateral. Scale line = 0.2 mm.

Description. Body length: 4.0–4.5 mm [male], 4.5–5.0 mm [female]. *Head*. Male frons glossy black, dark yellow around base of antennae; female frons white with broad dark brown stripe medially extending ventrally from ocellar tubercle, suffused near base of antennae; frons of both sexes with short setae, setae white near base of antennae; ocellar tubercle black, raised in male, flat in female; occiput glossy black (male) or white-yellow with black medially around occipital foramen (female); occiput with sparse, short yellowish setae; gena yellow, raised as ridge along eye margin, sparse short pale setae; parafacial white to yellow, oral cavity with dark yellow sclerotized plates either side of dark medial strip; mouthparts elongate, dark brown, labellum narrow, proboscis flattened laterally (in dried specimen); palpus dark brown, short; antenna slightly longer than head length, dark yellow basally, dark brown distally; short white setae on scape and pedicel; scape 2–3X

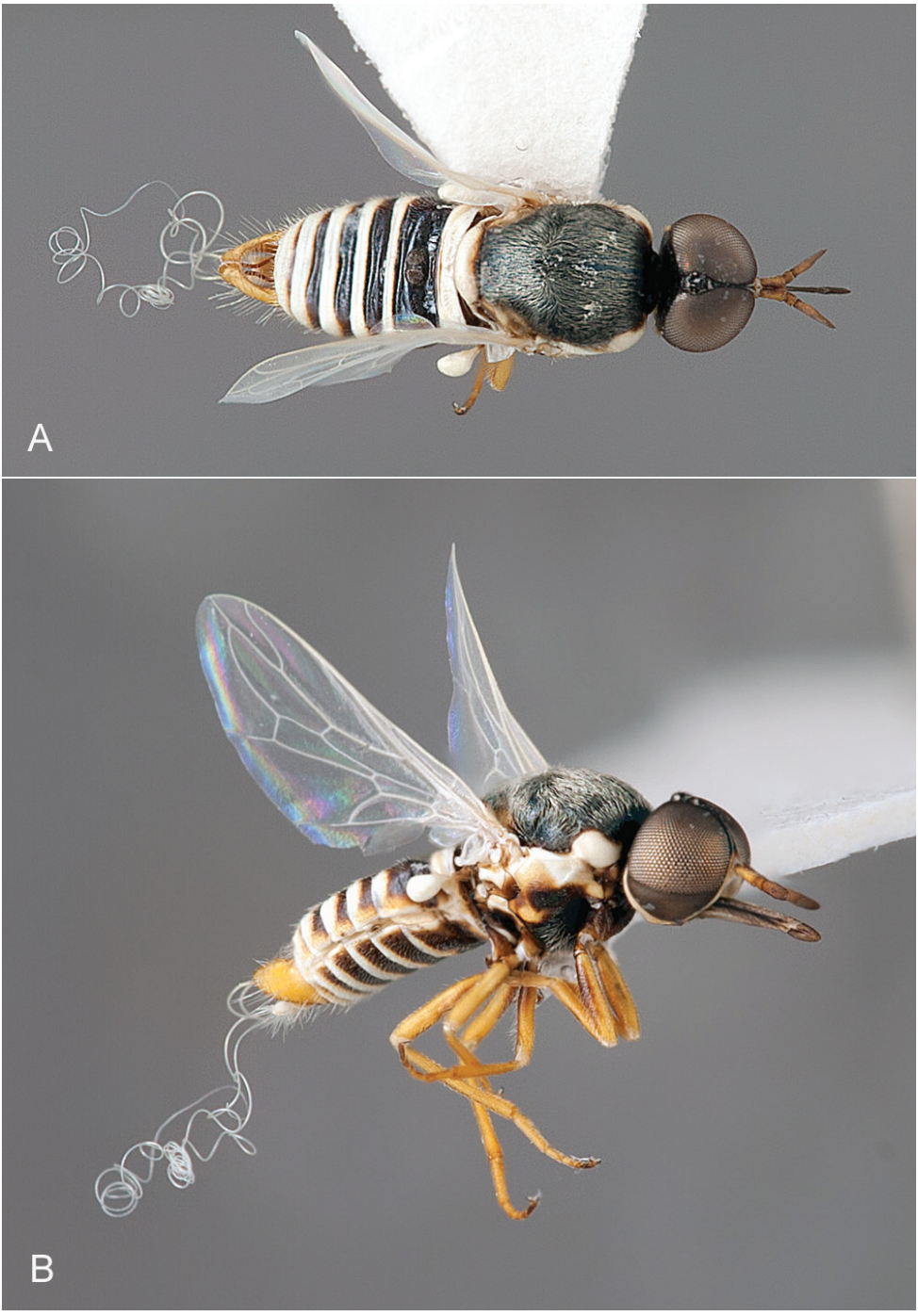

Figure 2. *Iranotrichia insolita* sp. n.: A. male, dorsal view [Morphbank 693172]; **B**, same, anterolateral view [Morphbank 693173]. Body length = 4.0 mm.

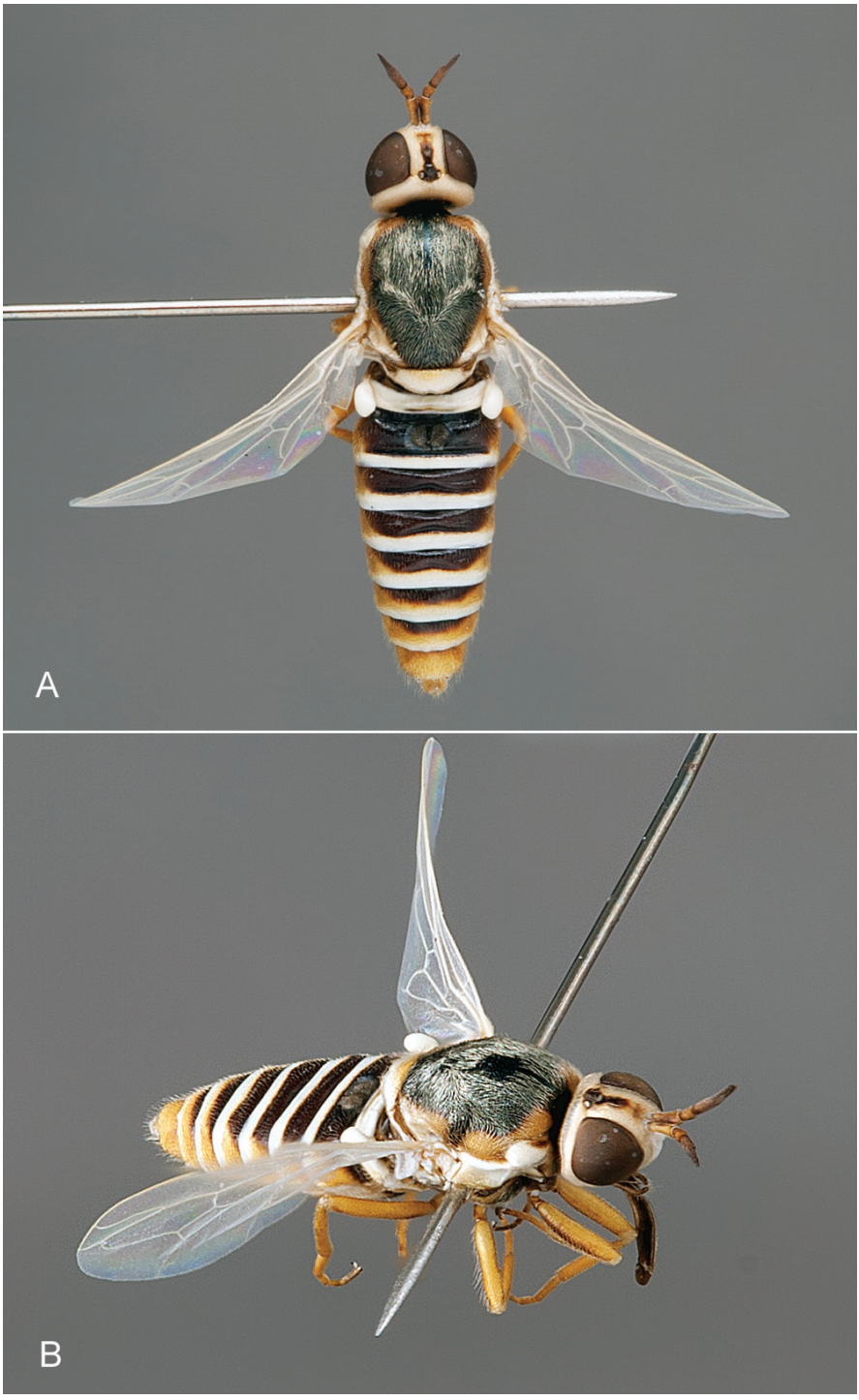

Figure 3. *Iranotrichia insolita* sp. n.: A. female, dorsal view [Morphbank 693174]; **B**, same, anterolateral view [Morphbank 693175]. Body length = 4.6 mm.

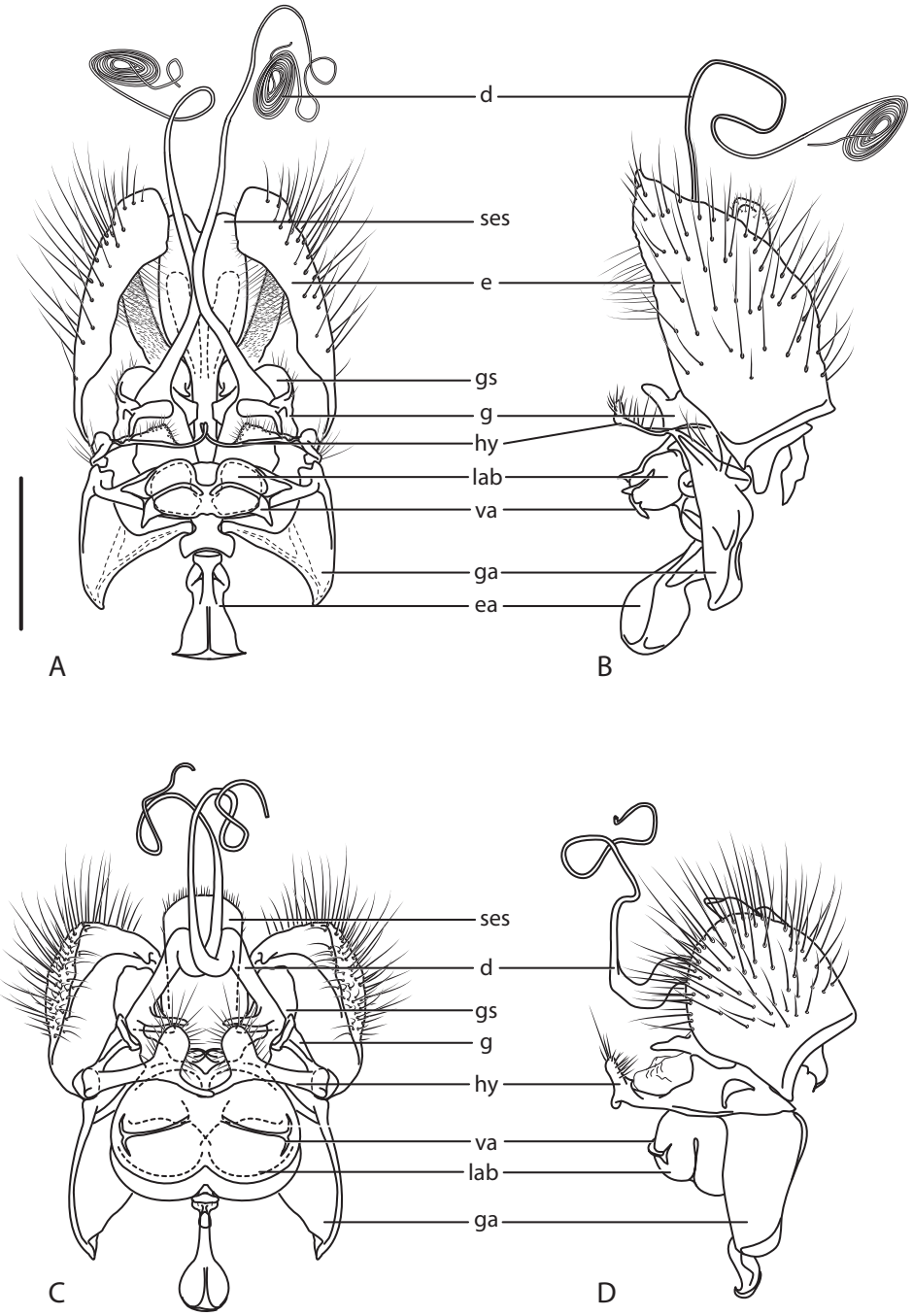

Figure 4. *Iranotrichia* spp. Male genitalia: **A** *I. insolita* sp. n.: dorsal view **B** same, lateral view **C** *I. nigra* sp. n.: dorsal view **D** same, lateral view. Scale line = 0.2 mm. Abbreviations: *d*, distiphallus; *e*, epandrium; *ea*, ejaculatory apodeme; *g*, gonocoxite; *ga*, gonocoxal apodeme; *gs* gonostylus; *ses,* subepandrial sclerite; *hy*, hypandrium; *lab*, lateral aedeagal bulb; *va*, ventral apodeme of parameral sheath.

pedicel length, combined scape and pedicel length equal to length of flagellum; flagellum truncated apically. *Thorax*. Scutum black, pale white to dark yellow areas marginally (i.e. postpronotal lobe and post-alar callus), more extensive in female and additionally with yellow on anterior part of scutum adjacent to postpronotum and medially on posterior part of scutum; scutal pile dense with three indistinct vittae anteriorly on prescutum formed by unidirectional parting of setae; scutellum matte white, yellow anteromedially, sparse pale setae covering marginally; pleuron black with white to dark yellow dorsally on anepisternum and katepisternum, and around base of wing (pale area more extensive in female); white setae on katepisternum; coxae black to brown; legs yellow, femora frequently with brown suffusion basally on posterior surface; short pile of white-yellow setae on legs, longer on posterior surface of femora; distal tarsomeres suffused with brown; haltere stem brownish, knob white; wing milky hyaline from sparse microtrichia; venation cream-white. *Abdomen*. Glossy black, each segment with dark yellow laterally and thick white band along posterior margin, segments 6-8 with dark yellow more extensive along posterior margin, replacing white band; white setae on all segments, longer laterally; terminalia dark yellow with long pale setae. *Male genitalia* (Fig. 4A–B). Epandrium lobes elongate and sub-triangular, dark sclerotized margins around bases of cerci; subepandrial sclerite extending posteriorly beyond cerci, emarginate posteriorly; hypandrium lobes relatively small and paddle-like with posterior margin of setae; gonocoxite with dark sclerotized, dorsal process immediately ventral to subepandrial sclerite; gonocoxal apodeme broadly flattened, curved medially; ejaculatory apodeme relatively elongate, directed anteriorly; lateral aedeagal bulbs round; distiphallus extremely elongate, arms thick and separate basally, recurved dorsally, arms proximal before end of epandrium, distal portion greatly narrowed and highly coiled, easily longer than body length when uncoiled. *Female genitalia* (Fig. 5A). Sternite 8 with posterior edge broadly acuminate; spermathecal ducts with valves associated with large membranous sacs.

Etymology. The specific epithet is derived from the Latin, *insolitus*– unusual, strange, and refers to the unusual appearance of this species.

Comments. *Iranotrichia insolita* sp. n. is a highly distinctive species with contrasting black and white-yellow markings; characteristics, which differentiate this species from *I. nigra* sp. n., among others, include the extremely elongate distiphallus and lack of spinose processes at the base of the distiphallus. The antennae and mouthparts are the longest of any scenopinid and are presumably associated with feeding at flowers.

***Iranotrichia nigra* sp. n.**
urn:lsid:zoobank.org:pub:066C7733-FC95-4532-9465-8B123D0BEB33
http://species-id.net/wiki/Iranotrichia_nigra
Figs 4C–D, 6

Type material. Holotype male, IRAN: **Ghazvin province:** 17 km NE Ghazvin, Abazar village road, rangeland, 36.2916º 50.1583º, white pan trap, 19.vi.2010, B. Gharali (NMNH). (excellent condition).

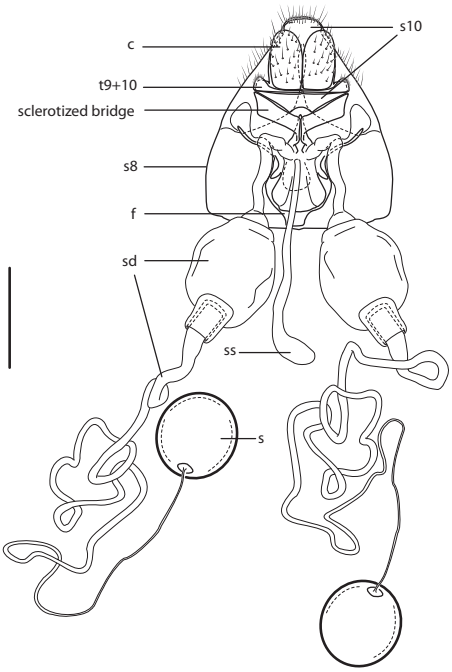

Figure 5. *Iranotrichia insolita* sp. n.: Female genitalia: lateral view, with tergite 8 cut away. Scale line = 0.2 mm. Abbreviations: *c*, cercus; *f*, furca; *s*, spermatheca; *sd*, spermathecal duct; *ss*, spermathecal sac; *s8*, sternite 8; s*10*, sternite 10; *t8,* tergite 8; *t9+10*, tergites 9 and 10.

Paratype. IRAN: **Ghazvin province:** 1 male, 17 km NE Ghazvin, Abazar village road, rangeland, 36.2916º 50.1583º, white pan trap, 19.vi.2010, B. Gharali (personal collection of BG/IRIPP)

Diagnosis. Head, thorax, abdomen and legs black, with limited areas of yellow; combined length of scape and pedicel approximately 2/3 length of flagellum; scutellum black with yellow-white marginally; male terminalia dark; epandrium sub-circular; distiphallus of male sub equal to length of abdomen when uncoiled; distiphallus arms with spinose process basally.

Description. Body length: 4.5 mm [male]. *Head*. Male frons glossy black, dark yellow below base of antennae, short white setae above base of antennae; ocellar tubercle black, raised in profile; occiput glossy black with sparse, short yellowish setae; gena cream-white, raised as ridge along eye margin, sparse short pale setae; parafacial white to yellow with brown suffusion; oral cavity with dark yellow sclerotized plates either side of dark medial stripe; mouthparts elongate, dark brown, labellum narrow, proboscis flattened laterally (in dried specimen); palpus short, dark brown; antenna 0.6× head length, uniform dark brown; short white setae on scape and pedicel; scape 2× pedicel length, combined scape and pedicel length less than length of flagellum; flagellum tapered slightly apically. *Thorax*. Scutum black, yellow areas marginally (postpronotal lobe and post-alar callus); scutal pile dense; scutellum black, yellow-white marginally; pleuron black with white suffusion dor-

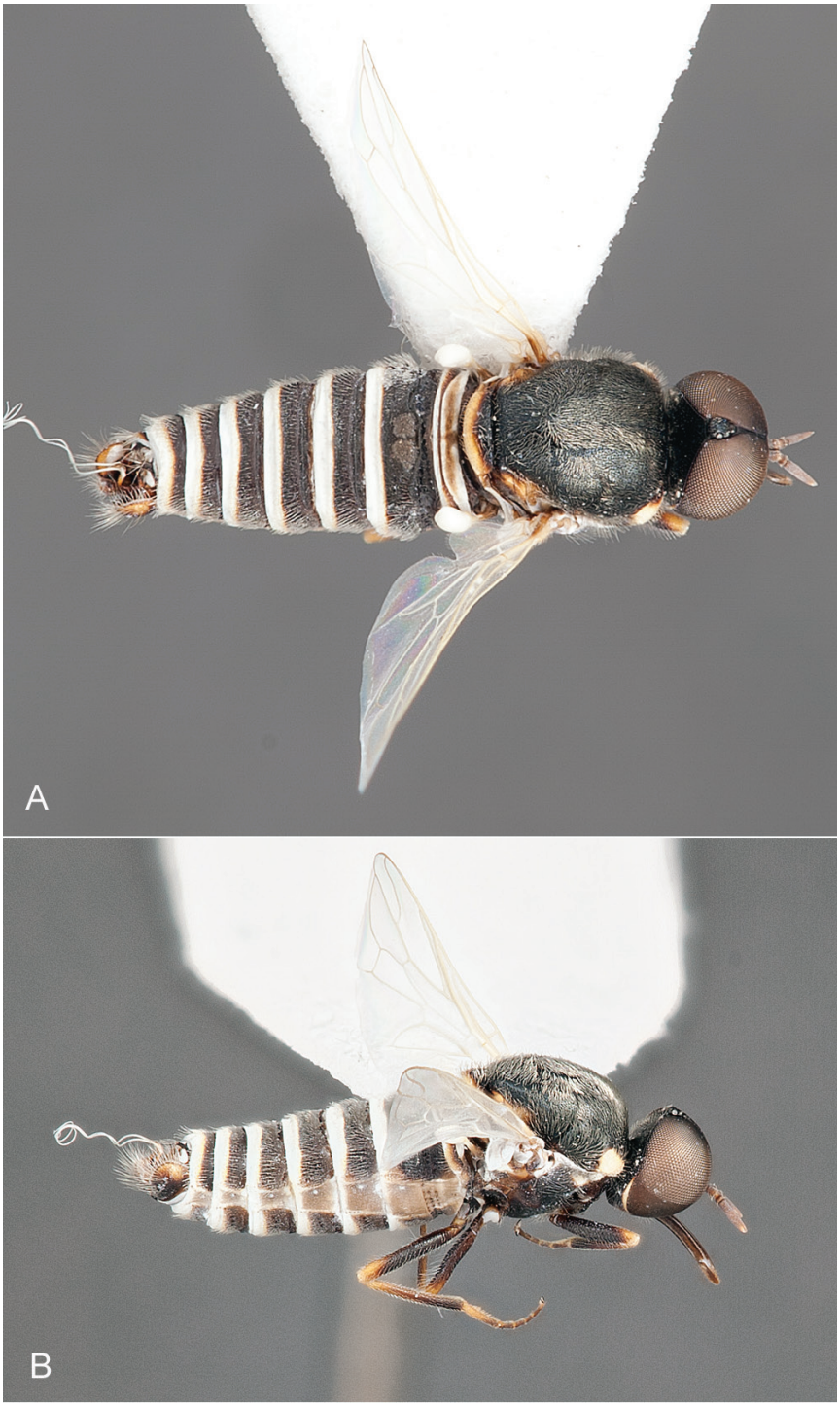

Figure 6. *Iranotrichia nigra* sp. n.: **A** male, dorsal view [Morphbank 693176] **B** same, lateral view [Morphbank 693177]. Body length = 4.5 mm.

sally on anepisternum, and around base of wing; white setae on anepisternum and katepisternum; coxae black to brown with white setae; legs black, yellow apically on femora, basally on tibiae and basitarsi; short pile of white-yellow setae on legs, longer on posterior surface of femora; haltere stem brownish, knob white; wing milky hyaline from sparse microtrichia; venation cream-white. *Abdomen*. Glossy black, each segment with a thick white band along posterior margin, segments 6-8 with dark yellow more extensive along posterior margin, replacing white band; white setae on all segments, longer laterally; terminalia black with dark brown on epandrium, with long pale setae. *Male genitalia* (Fig. 4C–D). Epandrium lobes rounded and sub-circular, dark sclerotized margins around bases of cerci; subepandrial sclerite quadrangular; hypandrium lobes relatively well developed, paddle-like narrower anterior medial process, posterior margin with pale setae; gonocoxite dark sclerotized, with dorsal process immediately medial to subepandrial sclerite; gonocoxal apodeme very broadly, curved medially; ejaculatory apodeme spatulate, directed anteriorly; lateral aedeagal bulbs relatively large, each subdivided dorsoventrally into two chambers; distiphallus elongate, arms thick and separate basally, recurved dorsally, with ventromedially directed spinose process at base, arms overlap before end of epandrium, distal portion narrowed and coiled, not longer than body length when uncoiled.

Etymology. The specific epithet is derived from the Latin, *nigra*– black, dark, and refers to the overall dark colour of this species.

Comments. *Iranotrichia nigra* sp. n. is differentiated from *I. insolita* sp. n. by the shorter antennae, rounded epandrial lobes, shorter male distiphallus, secondarily subdivided lateral aedeagal lobes and presence of spinose processes at the base of the distiphallus. The female of this species is unknown.

Kelseyana nom. n.

Caenoneura Kröber, 1924: 75. – Thomson 1870: 270. – Kirby 1890: 136. – Kelsey 1969: 162. – Hassan & El-Hawagry 2001: 2.

Type species. *Caenoneura robusta* Kröber, 1924: 75.

Included species. *Kelseyana nigra* (Kelsey, 1969) comb. n., *Kelseyana robusta* (Kröber, 1924) comb. n.

Acknowledgements

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ber 0614213. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of NSF.

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www.zookeys.org

RESEARCH ARTICLE

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On a new *Dictyna* species (Araneae, Dictynidae) from the northern Palaearctic confused with the East Siberian *D. schmidti* Kulczyński, 1926

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Abstract

A new species, *Dictyna palmgreni* **sp. n.**, is described from Finland and Russia on the basis of both sexes. Most of the earlier records of *D. schmidti* Kulczyński, 1926 from the northern Palaearctic refer to this new species. *D. shilenkovi* Danilov, 2000, **syn. n**. from Cisbaikalia is synonymised with *D. schmidti*. The general appearances and copulatory organs of *D. palmgreni* **sp. n.**, *D. schmidti* and *D. major* Menge, 1869 are illustrated. The distribution of *D. palmgreni* **sp. n.** and *D. schmidti* is clarified. An unknown sac-like structure of the spermathecae of Dictyninae is briefly discussed.

Keywords

spiders, Siberia, Palaearctic, Russia, Finland, epigyne, receptaculum

Introduction

Dictynidae is a globally distributed medium-sized family with 566 chiefly cribellate species belonging to 50 genera (Platnick 2011). The largest dictynid genus is *Dictyna* Sundevall, 1833. It encompasses 123 species distributed mainly in the Holarctic Re-

gion (Platnick 2011). Although *Dictyna* is a fairly large genus and its representatives are rather common, this genus has never been revised on a wide scale. The only detailed revision made for the Nearctic fauna is that by Chamberlin and Gertsch (1958).

The family, and the genus *Dictyna* particularly, is relatively well studied in northern Europe and Asia. Nevertheless, several species occurring in Siberia and northern Europe remain inadequately studied and are known from the original descriptions or from one sex only. The Siberian Dictynidae have been treated by Kulczyński (1908, 1916, 1926), Marusik (1988), Danilov (1994, 2000) and Marusik and Koponen (1998).

The species *Dictyna schmidti* was described from Kamchatka by Kulczyński (1926) on the basis of a single male. Later this species was redescribed on the basis of Finnish specimens (Lehtinen 1967). Reasoning from Lehtinen's illustrations, this species was reported from other localities in Finland and adjacent Russia (Palmgren 1977) and Sweden (Pettersson 1996, Almquist 2006). *D. schmidti* was also reported from several localities in the Urals (see references in Esyunin and Efimik 1996) and Siberia (see Mikhailov 1997, Danilov 2000). While studying spiders of Siberia and Finland we have found specimens that match Lehtinen's (1967) and Palmgren's (1977) illustrations of *D. schmidti*. Yet, we have found a few specimens from eastern Siberia that clearly differ from *D. schmidti* sensu Lehtinen (1967) but well match Kulczyński's description. A comparison of these specimens led us to the conclusion that the widespread species (from Fennoscandia to eastern Siberia) known earlier as *D. schmidti* in fact belongs to a new species, the description of which is the main goal of this paper.

Material and methods

Specimens were photographed using either a JEOL JSM-5200 scanning electron microscope or an Olympus E-520 camera attached to an Olympus SZX16 stereomicroscope at the Zoological Museum, University of Turku. Drawings were made either by using a grid method with a MBS-9 stereomicroscope or a Leitz stereomicroscope with a camera lucida. Macerated epigynes were temporarily coloured with Chlorazol Black to make some parts more visible. Photographs were taken with specimens in dishes with alcohol and paraffin on the bottom. Holes of different sizes were made in the paraffin to keep the specimens in the appropriate position. The epigynes were macerated either with KOH solution or lactic acid. All measurements are in mm.

Acronyms for depositories: Zoological Museum, University of Turku, Finland (ZMT); Zoological Museum, University of Helsinki, Finland (ZMH); Zoological Museum of the Moscow State University, Russia (ZMMU); Swedish Museum of Natural History, Stockholm, Sweden (NHRS); Perm State University, Russia (PSU); Institute for Biological Problems of the North, Magadan, Russia (IBPN); Institute for Systematic and Ecology of Animals, Novosibirsk, Russia (ISEA); private collection of the second author, Vasa, Finland (NRF).

Species survey

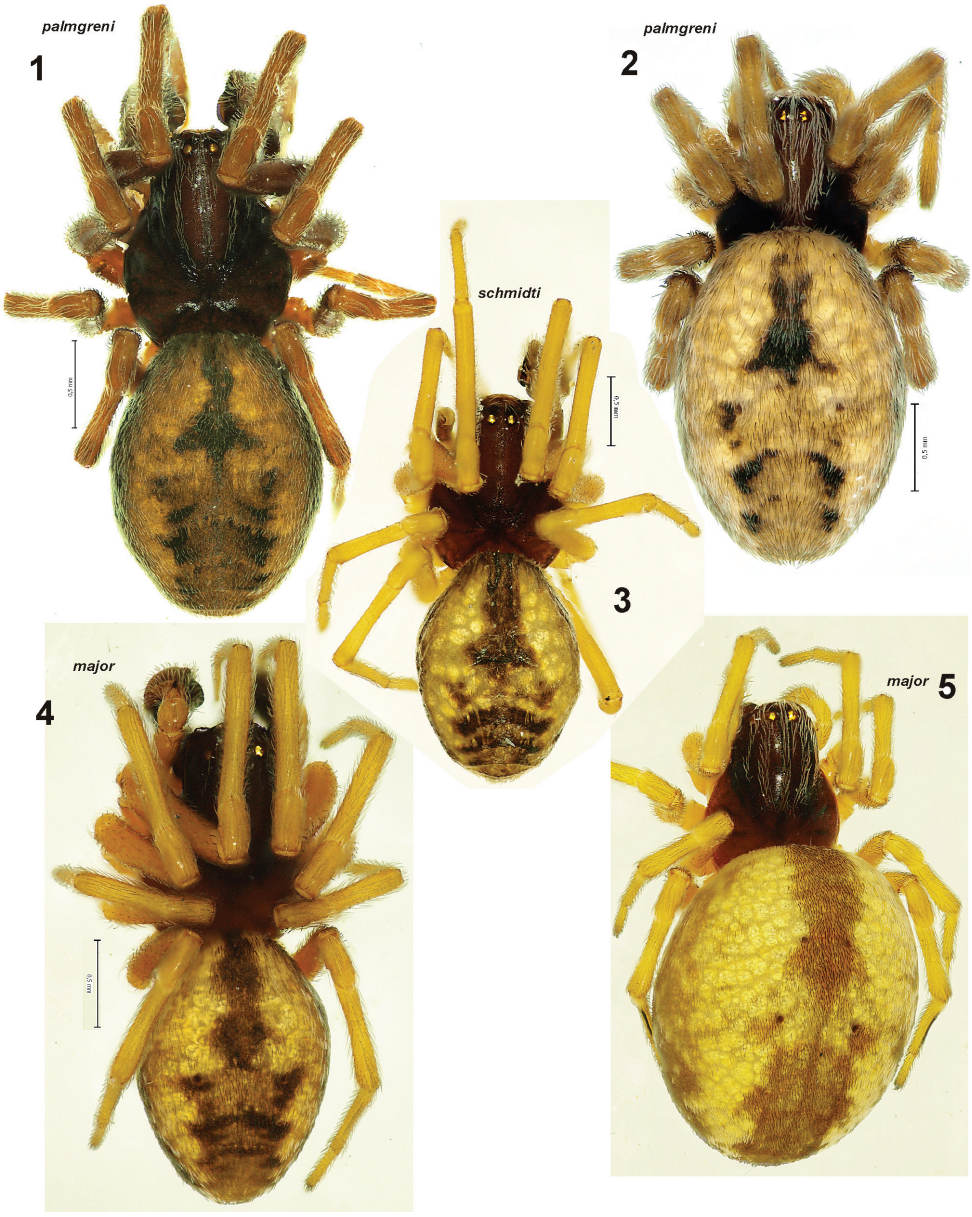
***Dictyna palmgreni* sp. n.**
urn:lsid:zoobank.org:act:EE0F36A3-845C-4667-A447-84C10B75AF2F
http://species-id.net/wiki/Dictyna_palmgreni
Figs 1–2, 6–9, 12–13, 18–19, 22–23, 28–30, 32–33, 40

D. schmidti: Lehtinen 1967: 451, f. 292, 306; 452, f. 321 (♂♀).
D. schmidti: Palmgren 1977: 21, f. 4.7-9 (♂♀).
D. schmidti (sensu Lehtinen): Danilov 2000: 42, f. 15-16 (♀).

Faunistic references
D. cf. major: Marusik et al. 1992: 137.
Dictyna sp.: Marusik et al. 1993: 71.
D. schmidti (sensu Palmgren): Esyunin & Efimik 1996: 136.
D. schmidti (sensu Lehtinen): Pettersson 1996: 224.
D. schmidti (sensu Lehtinen): Logunov et al. 1998: 131.
Dictyna cf. schmidti: Marusik et al. 2000: 21.
D. schmidti: Almquist 2006: 315 (possibly misidentification).

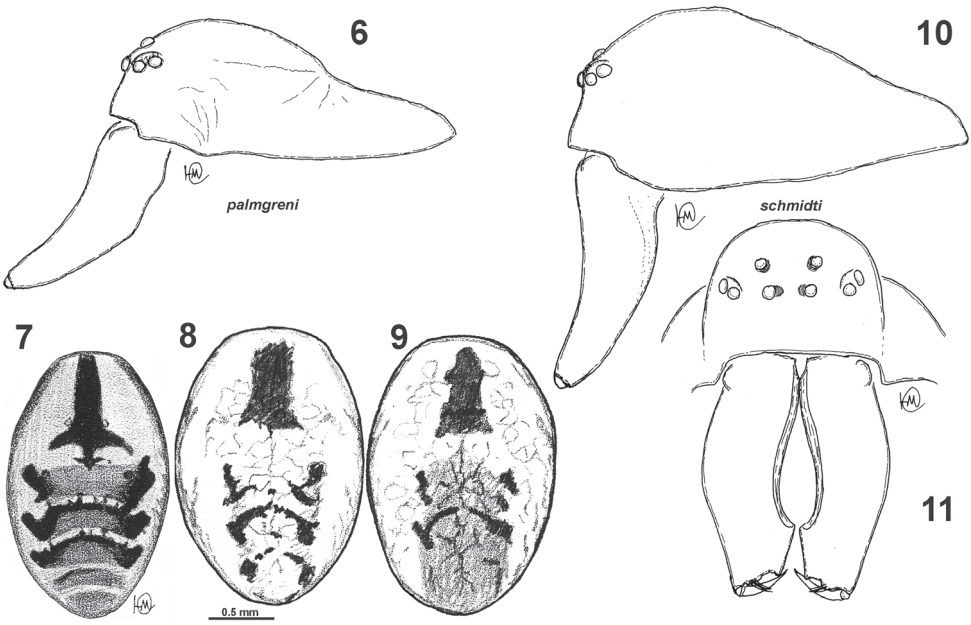
Etymology. The specific name is a patronym in honour of the late Prof. Pontus Palmgren (1907–1993) who made a great contribution to studies of Finnish spiders.

Material examined. FINLAND: Holotype ♂ (ZMT), Muonio, Pallastunturi national park (np), SE slope of Laukukero, 68°02'53"N 24°03'25"E, 31.05.2008, beaten from lower spruce branches at alpine tree line (N.R. Fritzén). **Paratypes:** 1♀ 4j (ZMT), same data as holotype; 2♂ 3♀ 9j (ZMT), Muonio, Pallastunturi np, 67°58'50"N 24°04'23"E, 29.05.2007, spruce fen, at the border of a small open bog, beaten from lower spruce branches (N.R. Fritzén); 1♂ (ZMT), Muonio, Pallastunturi np. 67°58'47"N 24°04'23"E, 29.05.2007, small semi open bog, sweeping (N.R. Fritzén); 2♂ 1♀ 4j (ZMT), Muonio, Pallastunturi np, SE slope of Laukukero, 68°02'52"N 24°03'35"E, 27.05.2007, beaten from lower spruce branches near alpine tree line (N.R. Fritzén); 1♀ (ZMT/VR90), Kittilä, Alakylä, 67°21'N 24° 53'E, 17.06.1963 (P.T. Lehtinen) (referred to as allotype of *D. schmidti* in Lehtinen (1967) and Palmgren (1977); 1♀ 1j (ZMH), Muonio, kirkonkylä, 67°56'N 23°41'E, 14.07.1943, swampy forest (P. Palmgren); 1♂ (ZMH), Kittilä, 67° 39'N 24° 54'E, ?1857 (Nylander & Gadd) (labelled as *D. schmidti* ssp. *abieticola* ♂ holotype by P.T. Lehtinen); 1♂ (ZMH), Kalajoki, Pentti isl., 64°11'14"N 23°41'53"E, 8.07.1999, pitfall trap in mesic heath forest with dense stand of *Picea abies*, (M. Sievänen). **RUSSIA**: ***Murmansk*** Area: 3♀ 5j. (ZMH) (Lt) Lotta river, 50 km E of Finnish frontier, 9.08.1967 (M. Meinander). ***North Urals***: 2♀ (NHRS), Vishorski Reserve, Ol'khovka River, forest, 13.7.1994 (O. Garkunova). ***Middle Urals*:** 6♀ (PSU), Basegi Mnt., for-



Figures 1–5. Habitus of *Dictyna palmgreni* sp. n. **1–2** from Pallastunturi, *D. schmidti* **3** from Yakutia and *D. major* **4–5** from Pyhtää. **1, 3–4** male; **2, 5** female.

est, branches of *Picea*, 1.09.1990 (S.L. Esyunin). ***Yamal Peninsula*:** 3♀ (2 with missing epigynes) (PSU), *South Yamal*, Khadyta-Yakha River, mixed forest, 06.1982 (S.L. Esyunin). ***Krasnoyarsk*** Province: 1♂ (ISEA), West Sayany, south macroslope of Oiskiy Mt. range, 11 km S of Oiskoye Lake, Buiba River valley, 52°47'N 93°18'E, 1200-1230 m, 20-21.06.1995 (A. Abramov). ***Yakutia*:** 1♂3♀ (ZMMU), Yakutia, Lena River, 10

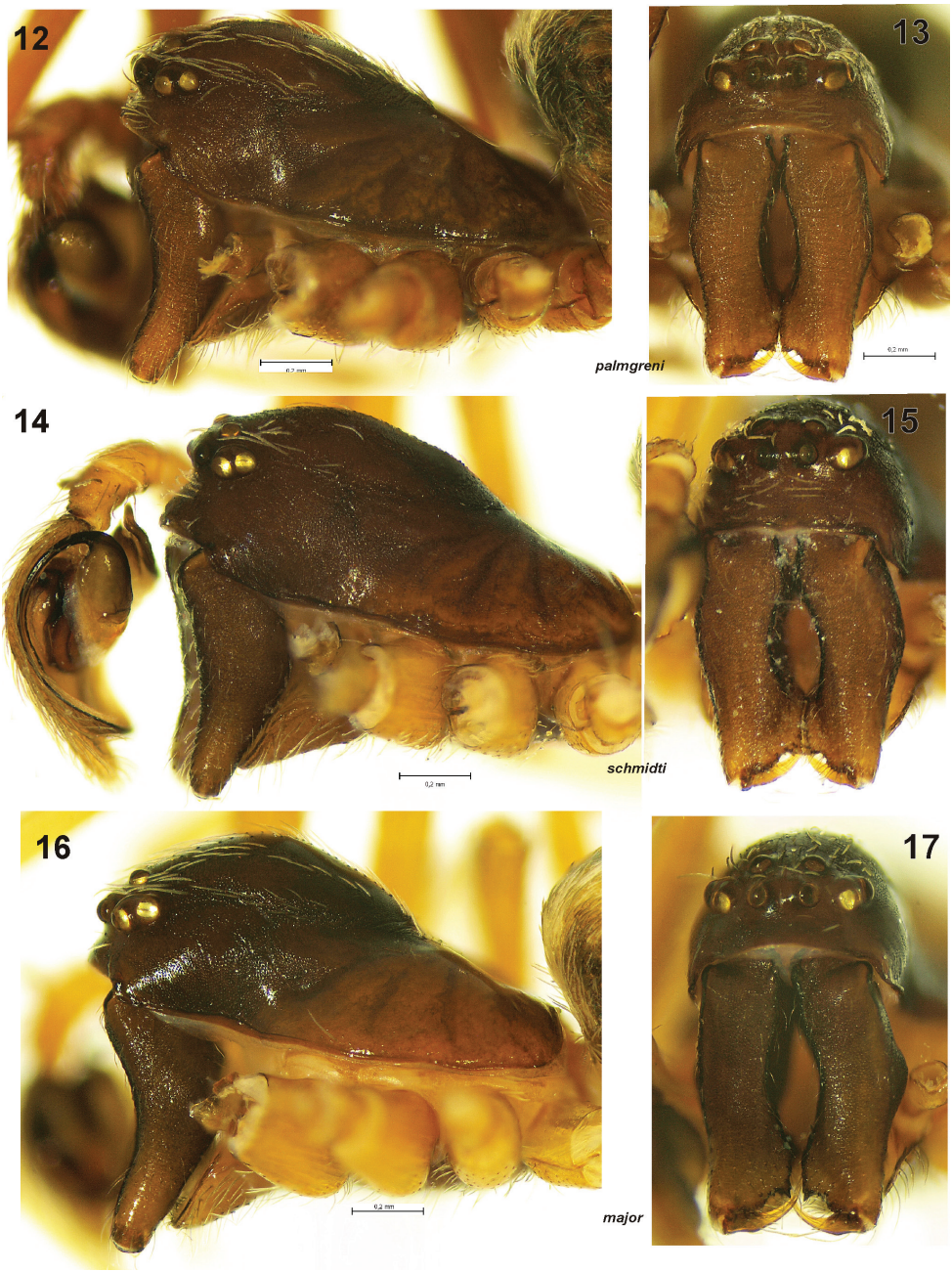


Figures 6–11. Prosoma and abdomen of *Dictyna palmgreni* sp. n. **6–9** and *D. schmidti* **10–11**. **6, 10** – male carapace, lateral **7** male abdomen, dorsal **8–9** female abdomen, dorsal **11** prosoma, frontal **6 10–11** from the Upper Kolyma **7** from Krasnoyarsk Province **8–9** from Basegi (Ural).

km downstream off Zhigansk, mouth of Ynyr Khaya Spring, stony bank and meadows, 4-8.07.1989 (K.Yu. Eskov). ***Magadan*** Area: 1♂ (ZMMU), Upper Kolyma flow, Sibit Tyellakh River basin, Olen' River valley, environs of "Aborigen" Field Station, on ice field, 600 m, 7.06.1985 (Yu.M. Marusik).

Diagnosis. *Dictyna palmgreni* sp. n. resembles *D. major* and *D. schmidti*, from which it can be easily separated by the shape of the apical portion of the conductor (broadening and then abruptly tapering, not gradually tapering like in the other two species), the relatively short cymbium, the thick and spiralled epigynal ducts and also by the presence of a digitiform process (accessorial gland). In the male palp, the combination of short length and basal placement of the tibial apophysis also distinguishes it from the two other species.

Description. Male. Total length 2.63-3.00. Carapace: 1.10-1.30 long, 0.88-0.95 wide, cephalic part 0.60 wide, clypeus 0.14, chelicerae 0.79. Abdomen 1.75 long, 1.20 wide. Cymbium 0.69-0.79 long, 0.40-0.43 wide, length/width ratio 1.70-1.80. Leg I segments: femur 1.17, patella+tibia 1.36, metatarsus 0.86, tarsus 0.57. Carapace brown, cephalic part raised, well separated from thoracic part by 'furrow', cephalic portion with 5 longitudinal 'furrows' with sparse whitish hairs, thoracic part with radial stripes. Abdomen light to dark brown with dark grey-brownish pattern (Figs 1, 7), somewhat variable and sometimes with cardiac mark posteriorly trifid. Palp as in Figs 18-19, 22-23, tibia short, apophysis carrying ctenidia short (about 2 lengths of



Figures 12–17. Male prosoma of *Dictyna palmgreni* sp. n. **12–13** from Pallastunturi, *D. schmidti* **14–15** from Yakutia and *D. major* **16–17** from Pyhtää **12, 14, 16** lateral **13, 15, 17** frontal.

ctenidia) and positioned near base of tibia; conductor in one plain, upper arm of conductor abruptly cut, lower arm with bent thin tip directed retrolaterad.

Female. Total length 2.90-3.10. Carapace: 1.05-1.18 long, 0.91-0.94 wide, brown with dark-grey radial stripes, and light brown median band (behind posterior eye row). Cephalic portion with 5 longitudinal 'furrows' densely covered with whitish hairs. Clypeus 0.13, chelicerae 0.60. Leg I segments: femur 1.07, patella+tibia 1.14, metatarsus 0.69, tarsus 0.50. Abdomen light brownish with brown pattern as in Figs 2, 8-9, usually with cardiac mark posteriorly distinctly trifid, venter with median dark band. Epigyne as in Figs 28-30, 32-33 with thin septum and rather long margins. Vulvae with spiralled insemination ducts terminated by spiralled 'receptacula'. 'Receptacula' with digitiform cylindrical accessorial gland.

Distribution. The new species is known across almost the entire northern Palaearctic: from Fennoscandia to Magadan, north to 68° in Finland, and southward to about 53° in Krasnoyarsk Province of Russia. To date, there have apparently been no documented adult specimens from Sweden (L. Jonsson & R. Pettersson pers. comm.), which are needed for the confirmation of its occurrence there.

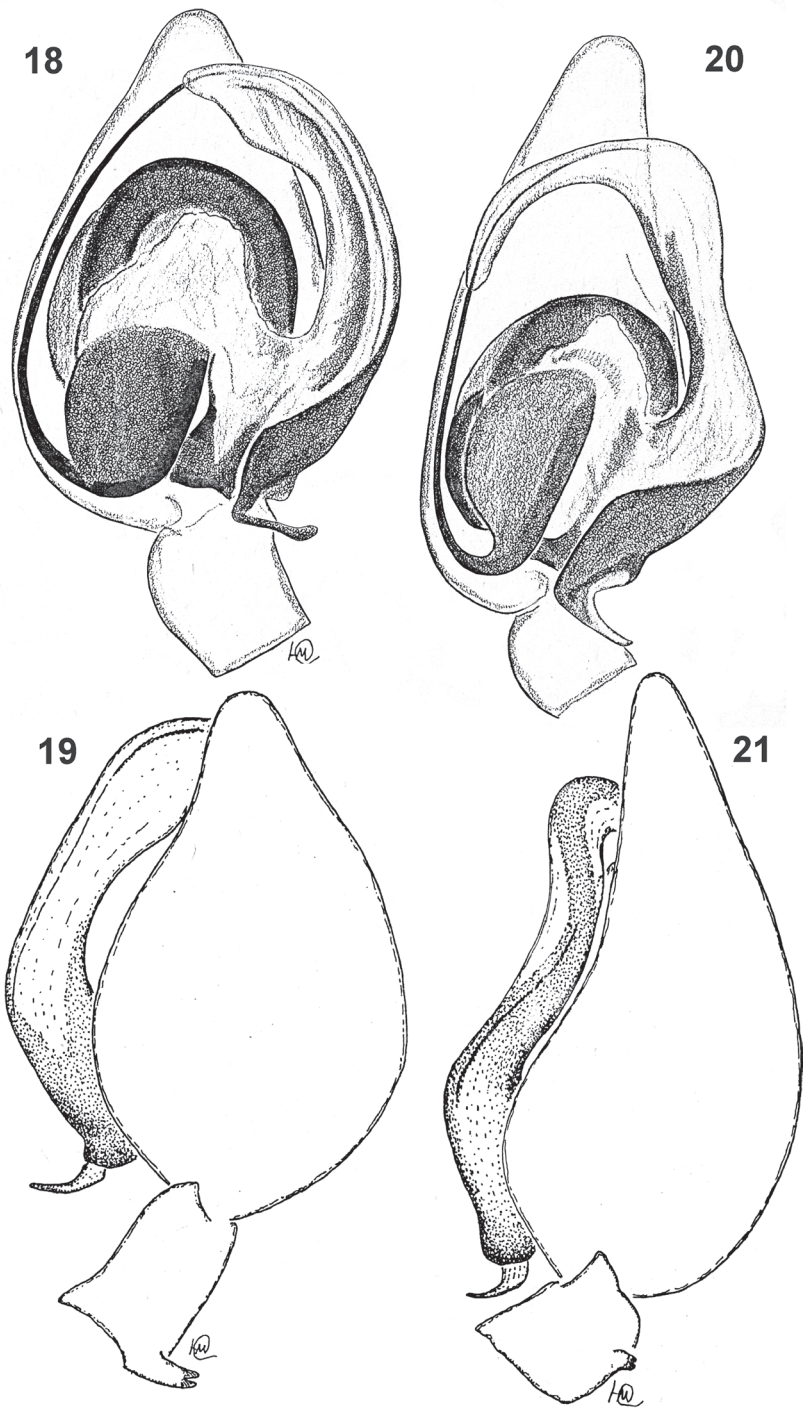
Natural history. Adult females occur from late May throughout the summer, males from late May to at least the beginning of July. Finnish specimens have mainly been collected from stands dominated by Norway spruce (*Picea abies*), and often on moist ground (swampy forest or mires). At least to some extent the species is arboreal, but some specimens have been caught using pitfall-traps and some apparently live in open habitats.

***Dictyna schmidti* Kulczyński, 1926**
http://species-id.net/wiki/Dictyna_schmidti
Figs 3, 10–11, 14–15, 20–21, 24–25, 31, 40

D. schmidti Kulczyński, 1926: 37, pl. 2, f. 1-3 (♂; the ♂ holotype not examined).
D. shilenkovi Danilov, 2000: 42, f. 17-20 (♂♀), syn. n. (the ♂ holotype not examined).

Faunistic references
D. schmidti: Marusik et al. 1992: 137.
D. schmidti: Marusik et al. 1993: 71.
D. schmidti: Marusik 1988: 1482; 2005a: 266; 2005b: 190.
D. shilenkovi: Trilikauskas 2008: 38.

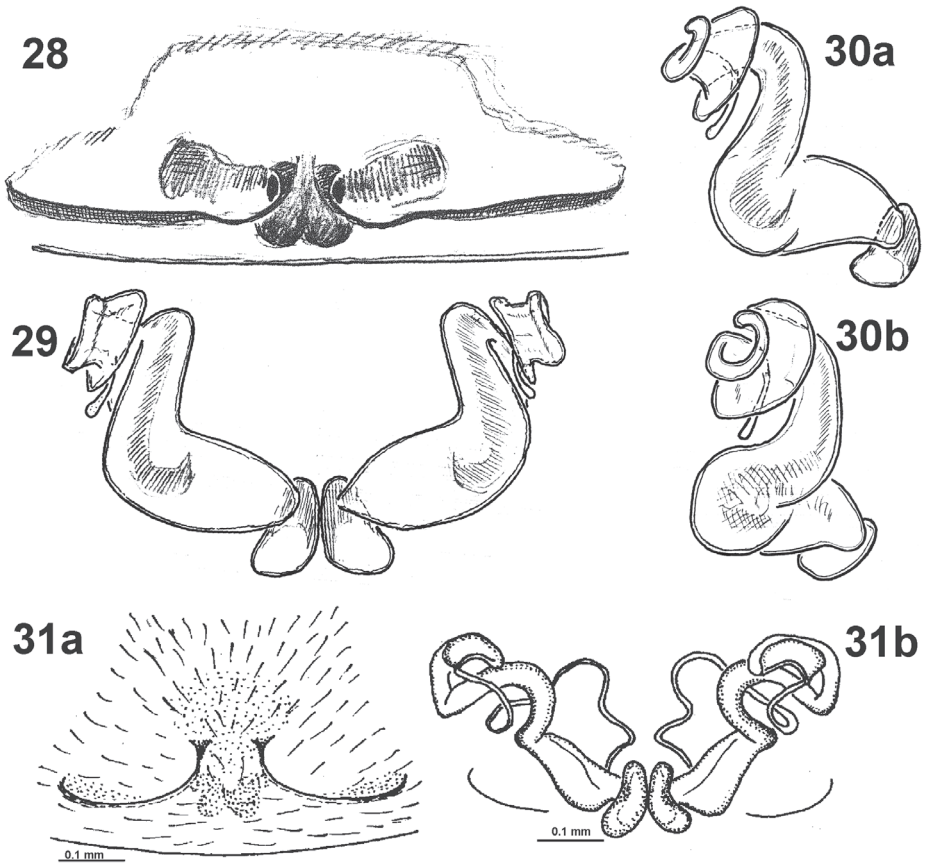
Remarks. The ♂ holotype from Klutschevskoje, Kamchatka retained in the Institute of Zoology PAN (Warsaw, Poland) has not been found. The ♂ holotype of *D. shilenkovi* and two ♀ paratypes indicated as being deposited in the Zoological Museum of the Moscow State University (see Danilov 2000) have not been found there.



Figures 18–21. Male palp of *Dictyna palmgreni* sp. n. **18–19** and *D. schmidti* **20–21** from the Upper Kolyma **18, 20** ventral **19, 21** retrolateral.

Figures 22–27. Male palp of *Dictyna palmgreni* sp. n. **22–23** from Pallastunturi, *D. schmidti* **24–25** from Yakutia and *D. major* **26–27** from Pyhtää **22, 24, 26** ventral **23, 25, 27** retrolateral.

Material examined. RUSSIA: ***Yakutia*:** 1♂ (IBPN), c. 10 km downstream of Zhigansk, mouth of Ynyr Khaya Spring, 4-8.07.1989 (K.Yu. Eskov). ***Magadan*** Area: 1♂, 50 km N of Magadan, Khasyn River valley near Splavnaya Village, 28.05.1988 (Yu.M. Marusik & S.A. Ryabukhin); 1♂ (IBPN), upper Kolyma River flow, Sibit Tyellakh River basin, Olen' River valley, environs of "Aborigen" Field Station, around ice field, sweeping grass near alder stand, h 650m, 27.07.1987 (Yu.M. Marusik); 1♂ (IBPN), 180 km W of Magadan, Cholomdzha River middle flow, 1988 (N.Y. Dokuchaev); 1♂, Taigonos Peninsula, Paren' River middle flow, 07.1985 (A. Meshcheryakov).



Figures 28–31. Epigyne of *Dictyna palmgreni* sp. n. **28–30** from Basegi (Ural) and *D. schmidti* **31. 28, 31a** epigyne, ventral **29, 31b** sclerotised part of receptacula **30a,b** left receptaculum, different aspects. **31** after Danilov (2000), sub. *D. shilenkovi*.

Description. Male. For details see Kulczyński (1926) and Danilov (2000: sub. *D. shilenkovi*). Carapace 1.35 long, 1.07 wide, cephalic part 0.52 wide. Chelicerae 0.75 long. Leg I segments: femur 1.15, patella & tibia 1.43, metatarsus 0.91, tarsus 0.58. Abdomen 1.60 long, 1.10 wide. Palp as in Figs 20-21, 24-25; process carrying ctenidia located in mid part of tibia, very small; conductor long, three-dimensional (not in one plain), its apical arm gradually tapering and terminating on prolateral side, lower arm small and directed retrolaterad-backward.

Female. Described by Danilov (2000: sub. *D. shilenkovi*). Paratypes have not been available for this study. Epigyne (Figs 31a-b) with thin sclerotized parts of receptacula.

Distribution. This species is known from East Siberia only (Fig 40): from Transbaikalia, northward to Zhigansk, southward to Ulan-Ude (Buryatia) and Bureinski Reserve (Khabarovsk Province) and eastward to Kamchatka.

Natural history. One specimen was collected by sweeping grasses on a north exposed slope in the Upper Kolyma. One male near Magadan was found under stones. The type specimens of *D. shilenkovi* were mainly collected from mixed forests (Danilov 2000).

***Dictyna major* Menge, 1869**
http://species-id.net/wiki/Dictyna_major
Figs 4–5, 16–17, 26–27, 34–39

D. m.: Wiehle 1953: 100, f. 218-221 (♂♀).
D. m.: Chamberlin & Gertsch 1958: 82, pl. 24, f. 2-4 (♂♀).
D. m.: Roberts 1985: 50, f. 14c (♂♀).
D. m.: Roberts 1995: 84, f. (♂♀).
D. m.: Roberts 1998: 86, f. (♂♀).
D. m.: Paquin & Dupérré 2003: 68, f. 563-565 (♂♀).
D. m.: Almquist 2006: 314, f. 274a-g (♂♀).
D. schmidti: Almquist 2006: 316, f. 276a-d (♂♀) (seems a misidentification).
For a complete list of references see Platnick (2011).

Material examined. FINLAND: 1♂ 8♀ 1j (NRF), Pyhtää, Kaunissaari 60°21'42"N 26°46'50"E, dune shore with sparse *Leymus arenarius*, 9.06.2009 (N.R. Fritzén); 1♂ (NRF), Lohtaja, Vattajanniemi 64°00'34"N 23°23'26"E, in vegetation on dune shore, 7.06.2010 (N.R. Fritzén); 1♂ Kalajoki, Letto 64°17'02"N 23°52'32"E, dune shore with sparse vegetation, 8.06.2010 (N.R.Fritzén); 1♂ 1♀ (ZMT) Utsjoki, Lohva, 12.07.1962 (P.T. Lehtinen). **CANADA**: **Yukon** Territory: 3♂ 4♀ (IBPN) Kluane Lake, environs of research station, south bank of the lake, 5-11.07.1993 (Yu.M.Marusik); 1♀ (IBPN) environs of Carmacks, 135°55'W 62°04'N, steppe slope and surroundings, 18.07.1993 (Yu.M.Marusik).

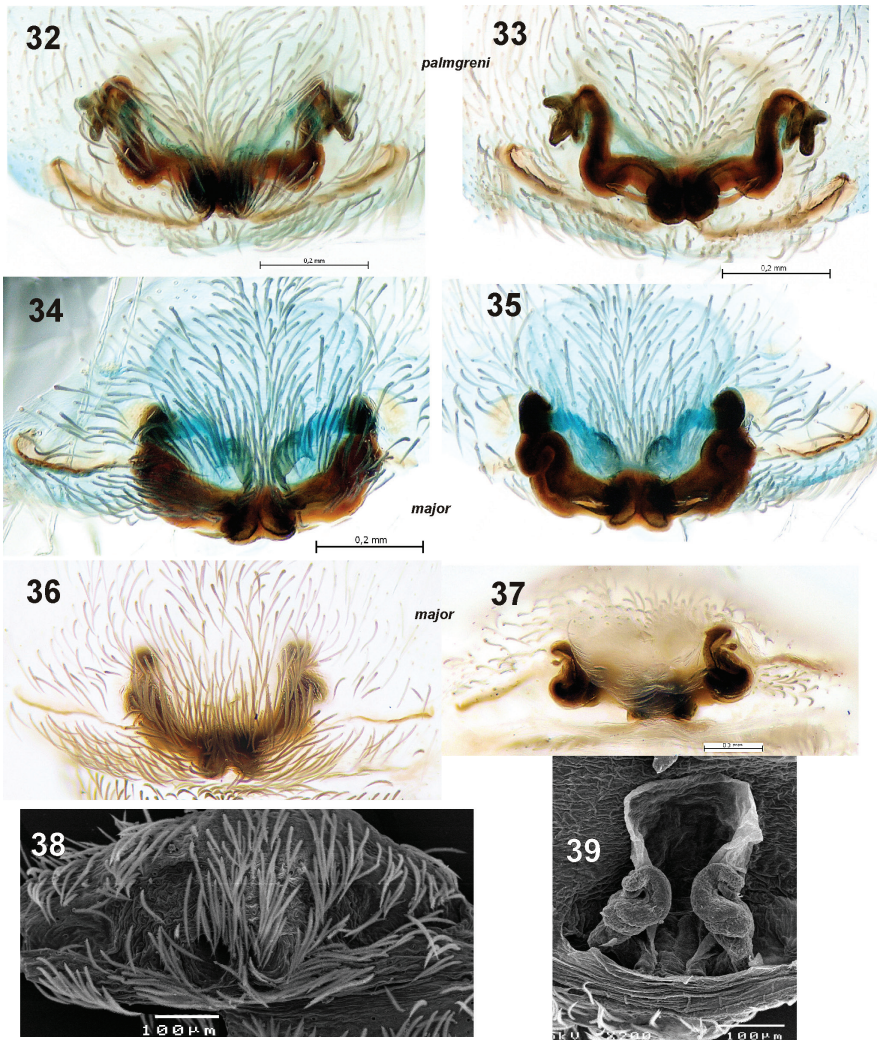
Numerous specimens from Tuva (Marusik et al. 2000), North-East Siberia (Marusik et al. 1992), Yakutia (Marusik et al. 1993), Greenland (Marusik et al. 2006) have also been examined.

Comments. It has not been possible to trace the Finnish specimens used for making the figures of *D. schmidti* in Almquist (2006). The illustrations are probably based on misidentified specimens and seem to refer to *D. major*.

Description. Thoroughly described by Wiehle (1953), Chamberlin & Gertsch (1958) and Almquist (2006). Here we provide only comparative figures of the copulatory organs in order to demonstrate differences between it and the similar-looking *D. palmgreni* sp. n. and *D. schmidti.*

Distribution. The species has a circum-Holarctic range and is known across the Palaearctic and Nearctic Regions.

Natural history. This species has different habitat preferences in Siberia and in Finland. In Magadan Area, it is the most common dictynid species, occurring in vari-



Figures 32–39. Epigyne of *Dictyna palmgreni* sp. n. **32–33** from Pallastunturi and *D. major* **34–39** from Pyhtää **32, 34, 36, 38** macerated epigyne, ventral **33, 35, 39** macerated epigyne, dorsal **37** macerated epigyne showing sac-like structure, frontal. Sac-like structure on Fig. **39** collapsed and sclerotised parts of epigyne became closer.

ous habitats within the forest belt and is most numerous on *Ledum* shrubs. In Finland, *D. major* is rare, has a scattered distribution and occurs exclusively on dune shores.

Relationships

Studying the relationships between *Dictyna* and the related *Emblyna* Chamberlin, 1948 faces certain difficulties. Both genera are species diverse, especially in the Nearc-

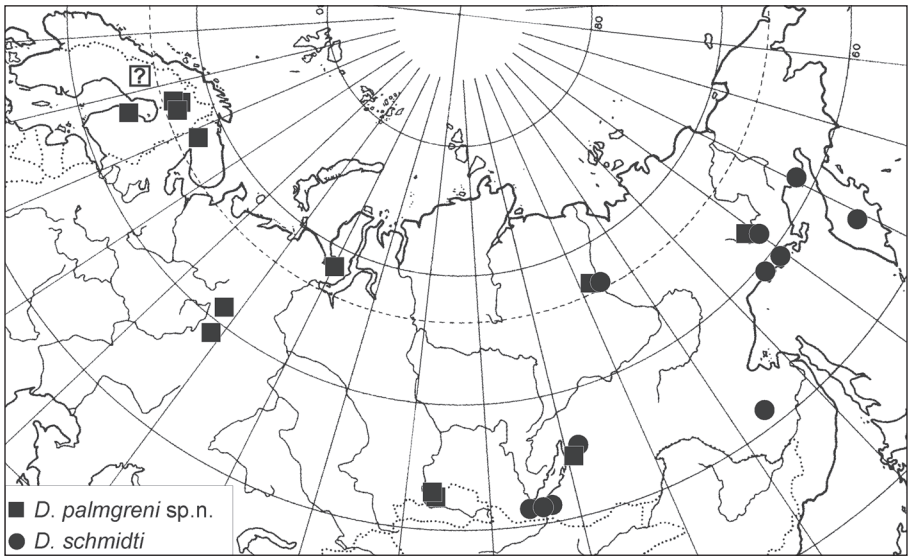


Figure 40. Distribution map of *D. palmgreni* sp. n. (square) and *D. schmidti* (dot).

tic, and their proper revisions in the Holarctic are lacking. Besides, data on the internal structure of the epigyne of the majority of Nearctic species is also lacking. Although males of the three species *D. major*, *D. palmgreni* sp. n. and *D. schmidti* have similar palps, it is not clear whether they are related or not. The epigynes of these species are rather different. The copulatory openings of *D. major* and *D. palmgreni* sp. n. are similar, but those of *D. palmgreni* sp. n. have a unique digitiform process of receptaculum which is absent in other *Dictyna* species known to us. The epigyne of *D. schmidti* differs significantly from both *D. major* and *D. palmgreni* sp. n. The male palp of *D. schmidti* and *D. szaboi* Chyzer, 1891 1891 (cf. Gajdos and Pekár 1999: figs. 1-4) is also rather similar, both having a very long 3-dimensional conductor and a small tibial dorsal process. The vulva of *D. szaboi* has never been illustrated.

Notes on the structure of the internal part of epigyne in Dictyninae

While studying the epigynes of *D. palmgreni* sp. n., *D. major* and some other *Dictyna* and *Ajmonia* species we have found large transparent sac-like structures (cf. Figs. 32-35, 37, 39; Figs. 5, 21 in Marusik and Koponen 1998; Fig. 2 in Marusik et al. 2006; Fig. 1i in Marusik & Esyunin 2010). Other authors have never reported on such structures. When we had prepared a specimen for making SEM photographs and transferred it from alcohol to a filter paper for drying up, the sac-like structure resembled a plastic bag, which immediately collapsed as soon as the filter paper was touched (cf. Fig. 39). Considering the very small size of the *Dictyna* receptacula, it seems that the sac-like structure serves as an additional unpaired receptaculum. We do not know any similar structures in other families belonging to the RTA-clade. Somewhat similar,

unpaired transparent receptacula are known in Dysderidae, Oonopidae and the related haplogyne families (Figs 830-835 in Forster and Platnick 1985), but these are situated below the epigastric furrow and behind the unpaired "receptaculum". In Dictyninae, the sac-like structure is situated between the integument and the paired receptacula.

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