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A survey of scale insects in soil samples from Europe (Hemiptera, Coccomorpha)

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Abstract

In the last decades, several expeditions were organized in Europe by the researchers of the Hungarian Natural History Museum to collect snails, aquatic insects and soil animals (mites, springtails, nematodes, and earthworms). In this study, scale insect (Hemiptera: Coccomorpha) specimens extracted from Hungarian Natural History Museum soil samples (2970 samples in total), all of which were collected using soil and litter sampling devices, and extracted by Berlese funnel, were examined. From these samples, 43 scale insect species (Acanthococcidae 4, Coccidae 2, Micrococcidae 1, Ortheziidae 7, Pseudococcidae 21, Putoidae 1 and Rhizoecidae 7) were found in 16 European countries. In addition, a new species belonging to the family Pseudococcidae, *Brevennia larvalis* Kaydan, **sp. n.** and a new species of Ortheziidae, *Ortheziola editae* Szita & Konczné Benedicty, **sp. n.** are described and illustrated based on the adult female stage. Revised keys to the adult females of *Brevennia* and *Ortheziola* are presented.

Keywords

Hypogeal scale insects, faunal surveys, Berlese

Introduction

Several expeditions were organized since the 1950's mainly within mainland Europe by the Hungarian Natural History Museum to collect snails, aquatic insects and soil animals (mites, springtails, nematodes, and earthworms). More recently, these studies were focused on the Balkan Peninsula and the Carpathian Region (Csuzdi et al. 2011; Dányi 2010; Kontschán 2010; Mahunka and Mahunka-Papp 2010; etc.). For these studies, a total of 2970 soil samples were collected from different habitats such as forest litter, moss, agricultural areas etc. in 16 European countries. Although visual sampling is a widely used method and often very effective for collecting scale insect species (Hemiptera: Coccomorpha), other collecting methods such as Berlese funnel and D-Vac are also useful as both provide plenty of scale insect species living in leaf litter, soil and under moss (Kozár 2004; Kozár and Konczné Benedicty 2007).

Scale insects are small, sap-sucking true bugs, sister to Aphidoidea, Aleyrodoidea and Psylloidea (Gullan and Martin 2009). Scale insect taxonomy is generally based on the microscopic cuticular features of the adult female which are paedomorphic, maturing in a juvenile form (Kosztarab and Kozár 1988). García et al. (2015) indicated that more than 8000 species have been described up to now. Among these are many agricultural pests (Miller and Davidson 1990) and invasive species (Miller et al. 2005, Ouvrard et al. 2013).

It has been argued (Koteja 1985) that the evolution of the scale insects occurred in two stages. In the first stage, the scale insects split from the homopteran stock (in the Carboniferous or Permian) prior to the appearance of flowering plants (Jurassic), living in the forest litter on a "mixed" diet and feeding on the sap of various plants at the surface and from living and decaying plant tissues. The legs became modified as a digging organ (one claw, one segmented tarsus, functional tibiotarsus), the females lost their wings and became paedomorphic and the males became dipterous. They also diverged into numerous groups at that time. The second evolutionary trend commenced with the appearance of the flowering plants in the Jurassic and continues to the present. As a result of these latter trends, the coccoids became true plant parasites and most scale insect groups started to live on the aerial parts of the plants and acquired their own endosymbionts (Koteja 1996). As a result, the level of specialization in the recent scale insects is great although some species still continue the primary, hypogeal mode of life, e.g. in the families Ortheziidae (Nipponortheziinae, Newsteadinae, Ortheziolinae) and Rhizoecidae (Koteja 1986; Vea and Gimaldi 2012).

Our knowledge on the scale insect fauna of European countries is very variable (García et al. 2015; Kozár et al. 2013b). Despite the great heterogenity of habitat types and the zoogeographical importance of the area due to climate change, none of the countries of Europe could be considered as being well explored. Several investigations have been published on the economically important species (Argyriou et al. 1976; Masten Milek et al. 2008; Masten Milek and Simala 2008b; Masten Milek and Simala 2009; Santas 1989; Tomov et al. 2009; Trencheva et al. 2009; Trencheva et al. 2010), but much less attention has been paid to the native scale insect fauna living in natural habitats. The countries from which most species have been recorded are: France (381 species – Foldi 2001), Italy (390 species – Pellizzari and Russo 2004), Hungary (274 species – Kozár et al. 2013b), Bulgaria (145 species – Trencheva et al. 2012), Romania (207 species – Fetykó et al. 2010) Croatia (132 species – Masten Milek and Simala 2008a; Schmidt 1956; Zak-Ogaza 1967); and Greece (207 species – Pellizzari et al. 2015).

Although the pest scale insect species found on the aerial parts of agricultural and horticultural plants are well studied in Europe, there is a great gap in the knowledge on the hypogeal scale insect fauna in Europe. The aim of this study was to investigate the hypogeal scale insect fauna of Europe by studying the scale insect specimens found in the soil and litter samples of the Acarology Collection of HNHM, because hypogeal species are indicators of the ecological richness and biodiversity of the soils and provide useful information about the comparative ecologies of the regions, and about the evolution of soil animals.

Material and methods

The specimens described and recorded in this study were all obtained from the soil samples in the Hungarian Natural History Museum (HNHM) collection (2970 samples in total). The samples were extracted by Berlese funnel. This is an apparatus widely used to extract living organisms, particularly arthropods. It works by creating a temperature gradient over the sample such that mobile organisms will move away from the higher temperatures and fall into a collecting vessel, where they are preserved for examination (Southwood and Henderson 2000). The Berlese funnel is a suitable device with which to collect and sort hypogeal and ground-dwelling animals, and also those which live in the lower herb layer of different habitats. It will also occasionally collect species living on higher aerial parts of plants that have fallen to the ground on plant material, such as leaves, twigs, etc.

Specimens were prepared for light microscopy using the slide-mounting method discussed by Kosztarab and Kozár (1988). The morphological terminology used follows Kozár (2004), Kozár et al. (2013a), Kozár and Konczné Benedicty (2007), and Williams (2004).

All measurements and counts were taken from all the available material, and the values are given as a range for each character.

Holotypes of the new species are deposited in the Hungarian Natural History Museum (HNHM). Paratypes are deposited in the HNHM and in the Plant Protection Institute, Centre for Agricultural Research, Hungarian Academy of Sciences (PPI).

Detailed locality and collection data have been provided for the new and some rare species only. For a host plant list of each species see García et al. (2015). Distribution data for each species have been provided, with new country records in bold. However must take into consideration, that these new country records are all relative to García et al. (2015) and latest available checklists (Fetykó et al. 2010; Masten Milek and Simala 2008a; Pellizzari et al. 2015; Trencheva et al. 2012), as to create new country checklists is out of the scope of this work.

Results and discussion

Among 2970 soil samples, 280 samples (approximately 10%) contained scale insect specimens. Of these, 4 species are Acanthococcidae, 2 are Coccidae, 7 are Ortheziidae and 7 are Rhizoecidae, 21 are Pseudococcidae and there was 1 species of Micrococcidae and Putoidae. One new pseudococcid, namely *Brevennia larvalis* Kaydan, sp. n. and one new species of Ortheziidae, *Ortheziola editae* Szita & Konczné Benedicty, sp. n. are described and illustrated based on the adult female stage.

Acanthococcidae

Anophococcus insignis Newstead

Material examined. Croatia: 1 ♀ – Njivice.

Distribution. United States of America, Armenia, Austria, Bulgaria, former Czechoslovakia, Denmark, France, Germany, Hungary, Iraq, Italy, Kazakhstan, Netherlands, Norway, Poland, Romania, Russia, Sicily, Sweden, Ukraine, United Kingdom (Channel Islands, England, Scotland) (García et al. 2015); **Croatia**.

Kaweckia glyceriae (Green)

Material examined. former Czechoslovakia: 2 ♀♀ – unknown locality.

Distribution. Austria, China, former Czechoslovakia, France, Germany, Hungary, Italy, Kazakhstan, Latvia, Poland, Romania, Russia, South Korea, Ukraine, United Kingdom (England), former Yugoslavia (García et al. 2015).

Pseudochermes fraxini (Kaltenbach)

Material examined. Serbia: 2 ♀♀ – Braničevo District, Homoljske planina, Žagubica.

Distribution. Austria, Belgium, Bulgaria, China, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iran, Italy, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Russia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom (England, Wales), former Yugoslavia (García et al. 2015); **Serbia**.

Rhizococcus reynei (Schmutterer)

Material examined. Croatia: 2♀♀ – Njivice.

Distribution. Germany, Hungary, Iran (García et al. 2015); **Croatia**.

Coccidae

Lecanopsis turcica (Bodenheimer)

Material examined. Greece: 1 ♀ – Florina regional unit, Lehovo village.

Distribution. Armenia, Cyprus, Georgia, Greece, Hungary, Romania, Russia, Slovenia, Turkey, Ukraine, former Yugoslavia (García et al. 2015).

Luzulaspis dactylis Green

Material examined. Romania: 1 ♀ – Harghita County, Praid (Parajd).

Distribution. Czech Republic, Germany, Greece, Italy, Poland, Russia, Slovakia, United Kingdom (England) (García et al. 2015); Romania (Fetykó et al. 2010).

Micrococcidae

Micrococcus confusus Miller & Williams

Material examined. Greece: 2 ♀♀ – West Greece, Aetolia-Acarnania regional unit, Akarnania Mts., Trifos village.

Distribution. Algeria, Greece, Morocco (García et al. 2015).

Ortheziidae

Arctorthezia cataphracta (Olafsen)

Material examined. Bulgaria: 1 ♀ – Borovets; 2 ♀♀ – Rila Mts., Struma basin, Rilomanastirska Gora Reserve, Stream Djavolska. Slovakia: 2 nymphs – Low Tatras, Stare Hory; 1 ♀ – 2 nymphs – Mutne; 3 nymphs – Pieniny Natural Park, Červený Kláštor; 1 nymph – Slovenský Raj NP, Vel'ký Sokol gorge, Kamenné vráta. Sweden: 2 ♀♀ – unknown locality.

Distribution. Austria, Belgium, Canada, Corsica, Croatia, Czech Republic, Faeroe Islands, Finland, France, Georgia, Germany, Iceland, Ireland, Italy, Norway, Poland, Romania, Russia, Spain, Sweden, Switzerland, United Kingdom (England, Scotland), United States of America (García et al. 2015).

Arctorthezia helvetica Kozár & Szita, 2015

Material examined. Albania: 2 nymphs –Leskovik. Greece: 2 nymphs – Epirus, Ioannina regional unit, Melia village; 1 ♀ – Larissa regional unit, Ossa Mts.; 2 nymphs –

West Greece, Aetolia-Acarnania regional unit, Kamaroula village. Serbia-Montenegro: 1 nymphs – Raška District, Pazariste village.

Distribution. Switzerland (Szita et al. 2015); **Albania, Greece, Serbia**.

Newsteadia floccosa (De Geer)

Material examined. Albania: 1 ♀ – Has District, Pashtrik Mts., Salghinë village; 1 ♀ –Leskovik; 1 ♀ –Malësi District, Qafa e Valbones; 1 ♀ – Kukës District, Mali i Gjalica e Lumës; 1 ♀ – Shkodër District, Prokletije Mts., Kir village. Bosnia-Herzegovina: 1 ♀ – Ozren Mts., Vilić; 1 ♀ – Sutjeska valley. Bulgaria: 2 ♀ – Borovetz; 3 ♀ – Rodope Mts., Musala; 1 ♀ – Sinemorec; 1 ♀ – Stara Planina, Stidovska Mts. Croatia: 1 ♀ – Ivanšćica; 1 ♀ – Krk Island, Glavotok; 1 ♀ – Psunj Mts., Sisak-Moslavina county, Novska; 1 ♀ – Rab Island. Greece: 1 ♀ – Arcadia regional unit, Korfes village; 1 ♀ – Arkadia regional unit, Elliniko; 1 ♀ – Central Greece, Evrytania regional unit, Anatoliki Fragkista village; 1 ♀ – Epirus, Ioannina regional unit, Melia village; 1 ♀ – Florina regional unit, Verno Mts., Pisoderi village; 1 ♀ –Ioannina regional unit, Metsovo; 1 ♀ – Larisa regional unit, Ossa Mts.; 1 ♀ – Messinia regional unit, Haravgi, Polilimnio village; 1 ♀ – Thesprotia regional unit, Vrosina. Macedonia: 1 ♀ – Vinica Municipality, Obozna Planina Mts., Laki. Romania: 1 ♀ – Bihor County, Vlădeasa, Săcuien; 1 ♀ – Bihor County, Bihor Mts., Cetătile Rădesei; 1 ♀ – Bukovina County, Iedu; 1 ♀ – Bukovina County, Stratioara; 2 ♀♀ – Bukovina County, Valea Stânei; 1 ♀ – Caraş-Severin County, Semenic Mts., Văliug; 1 ♀ – Caraş-Severin County, Semenik Mts., Gărâna; 1 ♀, 1 nymph – Cluj County, Havasrekettye; 1 ♀ – Harghita County, Kis Beszterce; 1 ♀ – Harghita County, Sâncrăieni (Csíkszentkirály); 1 ♀ – Harghita County, Băile Homorod (Homoródfürdő); 1 ♀ – Harghita County, Băile Tuşnad (Tusnádfürdő); 3 ♀ – Maramureş County, Maramureşului Basin, Rona de Sus (Rónaszék); 1 ♀ – Maramureş County, Rodna Mts., Săcel (Izaszacsal); 1 ♀ – Maramureş County, Maramureş Mts., Vişeu de Sus; 1 ♀ – Maramureş County, Ignis, Mts., Plesca village; 1 ♀ – Maramureş County, Ignis Mts., Kőhát, Săpânța (Szaplonca); 1 ♀ – Maramureş County, Gutin Mts., Breb (Bréb); 1 ♀ – Maramureş County, Baia Mare (Nagybánya), Valhani plateau, Rozsály Mt.; 1 ♀ – Maramureş county, Maramureş Mts., Borşa-Băile Borşa, Vinişor valley; 1 ♀ – Oltenia, Leleşti; 2 ♀ – Oltenia, Runcu; 1 ♀ – Oltenia; Poiana Mărnlui; 1 ♀ – Sibiu District, Bradu (Fenyőfalva); 1 ♀ – Sibiu District, Cisnădioara (Kisdisznód); 1 ♀ – Hunedoara County, Petroşani (Petrozsény); 1 ♀ – Hunedoara County, Obersia. Serbia-Montenegro: 1 ♀ – Kosovo, Novo Selo; 1 ♀ – Maljen Mts., Ražana; 1 ♀ – Savino Polje, Đalovica klisura; 3 ♀♀ – Vojnik Mts., Mokro, Šavnik; 4 ♀♀ – Žabljak Municipality, Durmitor National Park, Crno Jezero. Slovakia: 1 ♀ – Becherov, Nizke Beskydy); 1 ♀ – Úhorná; 2 ♀ – Javorina (Jávoros); 1 ♀ – Košice District, Smolník; 1 ♀ – Liptovsky Osada; 4 ♀♀ – Slovenský Raj National Park; 1 ♀ – Stratehná; 1 ♀ – Tatranska Poliana; 1 ♀ – Závadka, Hronom Muvaska Plania. Slovenia: 1 ♀ – Triglav National Park, Koča pri Peričniku. Sweden: 1 ♀ –Hagfors; 4 ♀ – Ilsbo; 2 ♀ – Lapland Prov., Kiruna; 1 ♀ – Lysvik. Turkey: 1 ♀ – Kuru, Kuru Mts.

Distribution. Austria, Belgium, Bulgaria, Corsica, Croatia, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Lithuania, Netherlands, Poland, Romania, Russia, Spain, Sweden, United Kingdom (England, Scotland) (García et al. 2015).

Comments. *N. floccosa* is the most common species in the collection. Although there is some variability in the number of antennal segments and in the size of the individuals examined in this study, all specimens above are considered to be part of the morphological variation of *N. floccosa*.

Newsteadia susannae Kozár & Foldi

Material examined. Albania: 1 ♀ – Sarandë District, Borsh; 1 ♀ – Tepelenë District, Griba Mts., Bënçë. Greece: 1 ♀ – Ioannina regional unit, Kalpaki, Vellas Monasteri. Serbia: 1 ♀ – Đerdap Mts., Mosna.

Distribution. France (Corsica), Greece (Kozár 2004); **Albania, Serbia**.

Comments. *N. susannae* is closest to *N. floccosa* but differs (i) in having hair-like setae on most antennal segments; (ii) a higher number of quadrilocular pores on venter and dorsum, and (iii) complete wax plate bands on mid dorsum (Kozár 2004).

Ortheziola Šulc, 1895

Type species. *Ortheziola vejdovskyi* Šulc, 1895, 1.

Diagnosis of genus. Adult female in life with a series of marginal, mediolateral and medial waxy protrusions, corresponding to wax plates on slide-mounted specimens. The distribution of these protrusions and wax plates (Fig. 1) differs between species in the genus (Kozár 2004).

Slide-mounted adult female with three-segmented antennae; third antennal segment with a slender apical seta, flagellate sensory seta and small subapical seta; second segment with one sensory pore. Eye stalk protruding, thumb-like, fused with sclerotized area at base of each antenna (sometimes called the pseudobasal antennal segment). Legs well developed; leg setae robust, spine-like; trochanter and femur fused, tibia and tarsus fused; tibia with one sensory pore and at least one fleshy sensory seta; tarsus without digitules; claw digitules hair-like, claw without a denticle. Labium one-segmented, with many setae; labium with three long setae near apex, very close together, all situated in a single setal socket . Anal ring situated in a dermal fold on dorsal surface, ring bearing six setae. Sclerotized plate present on dorsum anterior to anal ring, wider than long. Modified pores, each with two, three or four loculi, scattered over surface, appearing like microtubular ducts. Thumb-like pores forming a cluster on each side of anal ring. Abdominal spiracles ventral on anterior segments, with at least

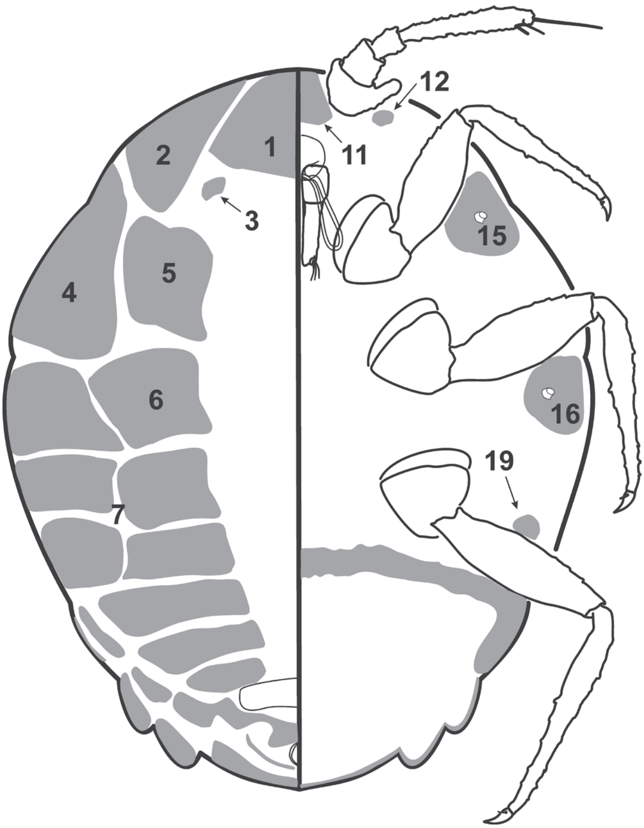

Figure 1. Distribution of waxplates in *Ortheziola* genus. Figure based on *Ortheziola britannica* Kozár & Miller, female; after Kozár 2004.

one present on each side of segments I, II or III; when present, posterior abdominal spiracles located on dorsum near anal ring, surrounded by a cluster of multilocular pores (Kozár 2004).

Distribution. The 13 species of *Ortheziola* are found in the Palaearctic and north-eastern part of the Oriental Regions. For detailed distribution data of the twelve previously known species, see ScaleNet (García et al. 2015). New locality records for several *Ortheziola* species were discovered during the study of the HNHM collection, which is listed below. The distribution patterns of the species may imply the existence of several other species in these regions, which would be worth further study.

Comments. The genus *Ortheziola* resembles the genera *Ortheziolacoccus* and *Ortheziolamameti* in having three-segmented antennae, with the basal part of the antenna fused to the eye. However, *Ortheziola* differs from *Ortheziolacoccus* and *Ortheziolamameti* in having only a single spine band inside the ovisac band, and these genera have different geographic distribution: *Ortheziola* species are distributed in the Palaearctic and north east part of Oriental Regions, *Ortheziolacoccus* species occur only in Ethiopian Region, while *Ortheziolamameti* species in the Oriental and Ethiopian Regions.

Key to species of *Ortheziola*, based on adult females

1	Dorsal wax plates 5 and 6 present, either fused or separate	**2**
–	Dorsal wax plates 5 and 6 absent	**11**
2	Dorsal wax plate 3 present (represented by at least a small spine group)	**3**
–	Dorsal wax plate 3 absent	**12**
3	Dorsal wax plates 5 and 6 fused with marginal spine bands	***O. matskasii* Kozár & Konczné Benedicty**
–	Dorsal wax plates 5 and 6 clearly separate from marginal spine band	**4**
4	Dorsal wax plate 3 reduced to a small spine group	**5**
–	Dorsal wax plate 3 fully developed	**7**
5	Ventral plate 19 present; anterior margin of ovisac band almost completely straight	***O. britannica* Kozár & Miller**
–	Ventral plate 19 absent; anterior margin of ovisac band with characteristic waves	**6**
6	Anterior margin of ovisac band with at least 8 waves; several multilocular pores present anterior to vulva	***O. marottai* Kaydan & Szita**
–	Anterior margin of ovisac band with six waves; one or two multilocular pores present anterior to vulva	***O. editae* sp. n.**
7	Multilocular pores present around vulva	**8**
–	Multilocular pores absent from around vulva	**9**
8	Multilocular pores present both anterior and posterior to vulva; dorsal 5-locular pores present throughout the last three abdominal segments	***O. szelenyii* Konczné Benedicty & Kozár**
–	Multilocular pores present only anterior to vulva; dorsal 5-locular pores concentrated around anal ring	***O. vejdovskyi* Šulc**
9	Ventral wax plates 11 and 19 present	***O. peregovitsi* Kozár & Konczné Benedicty**
–	Ventral wax plates 11 and 19 absent	**10**
10	Ventral wax plate 12 present; marginal wax plates on abdominal segments IV-VI clearly separated from each other and from medial plates	***O. hauseri* Konczné Benedicty & Kaydan**
–	Ventral wax plate 12 absent; marginal wax plates on abdominal segments IV-VI fused to each other and partly fused to medial plates	***O. mizushimai* Tanaka & Amano**
11	Ventral wax plates 11 and 12 present, longest seta on antenna ca. 10 µm long	***O. viti* Konczné Benedicty & Szita**
–	Ventral wax plates 11 and 12 absent; shortest seta on antenna ca. 19 µm long	***O. marginalis* Kozár & Konczné Benedicty**
12	Multilocular pores present around vulva	***O. vietnamiensis* Kozár & Konczné Benedicty**
–	Multilocular pores absent from around vulva	***O. fusiana* Shiau & Kozár**

Ortheziola editae **Szita & Konczné Benedicty, sp. n.**
http://zoobank.org/7098E617-0BD8-4927-B36E-3DC3DC4C9E7A
Fig. 2

Material examined. *Holotype*. Adult female. Bulgaria: Blagoevgrad province, Pirin Mts., Pirin, hazel bush towards Beljata Reka, N 41°35.968', E 23°32.809', 1280 m a.s.l., 26.x.2013, leg. Kontschán, Murányi, Szederjesi, litter and soil (PPI: 11912, HNHM: E-3079). *Paratypes*. Bulgaria: 3 ♀♀ on two slides: same data as holotype. *Other material examined*. Croatia: 1 ♀ – Papuk Mts., Drenovac, riverbank, 21.iv.2004, leg. Kontschán (PPI: 11911, HNHM: E-1864).

Diagnosis.

Description. *Unmounted adult female*. Not seen.

Slide mounted adult female. Body 1.5–2.0 mm long, 1.2–1.3 mm wide. Length of antennal segments: 1st 76–89 µm; 2nd 46–56 µm; 3rd 250–270 µm; 3rd segment parallel sided or weakly clubbed; apical seta 127–173 µm, subapical seta 30–46 µm; fleshy sensory seta near apical seta 28–31 µm; basiconic sensilla present near apex of antenna; all segments of antennae covered with moderate number of robust spine-like, straight, apically acute setae, longest seta 15 µm long.

Venter. Labium 120–148 µm long. Stylet loop about as long as labium. Leg segment lengths: front coxa 107–127 µm, middle 117–133 µm, hind 122–127 µm; front trochanter-femur 291–332 µm, middle 321–357 µm, hind 316–362 µm; front tibia-tarsus 357–372 µm, middle 357–388 µm, hind 438–454 µm; front claw 46–54 µm, middle 43–51 µm, hind 51–54 µm long; claw digitules spine-like, 7–12 µm long; legs with rows of robust setae; longest seta on trochanter-femur, each 12–14 µm long; with one flagellate sensory seta on each of femur and tibia, 10–12 µm long; each trochanter with four sensory sensilla on each surface. Wax plate 11 and 12 present at marginal areas of head; marginal wax band surrounding each thoracic spiracle (plates 15 and 16); wax plates in front of coxae absent (plates 13, 14, 17 and 18 absent), plate 19 absent; with scattered clusters of spines between hind legs and ovisac band. Anterior margin of ovisac band with three waves; with one band of spines within ovisac band, with quadrilocular pores predominant near anterior edge of spine bands and scattered within the spinebands, each pore 3.5–4 µm in diameter. Thoracic spiracles each with scattered quinquelocular pores loosely associated with spiracle opening, each group contains 10–13 pores, each pore 5–6 µm in diameter (several of these pores present on dorsum); diameter of opening of anterior thoracic spiracle 13–20 µm. Setae few, scattered in medial areas of thorax, with several setae present near anterior margin of ovisac band (some capitate), several associated with anterior and posterior multilocular pore rows, several more associated with posterior multilocular pores surrounding vulva. Multilocular pores each 8–9 µm in diameter, with 7–9 (mainly 7) loculi around perimeter and one loculus in central hub; partial band of multilocular pores near anterolateral edge of spine band, also scattered around vulva and near ovisac band, almost forming a row on the apical abdominal segment. Abdominal spiracles present, two pairs on each side of body anterior to ovisac band and one pair situated inside ovisac band, near anterolateral angle; each abdominal spiracle with sclerotized vestibule.

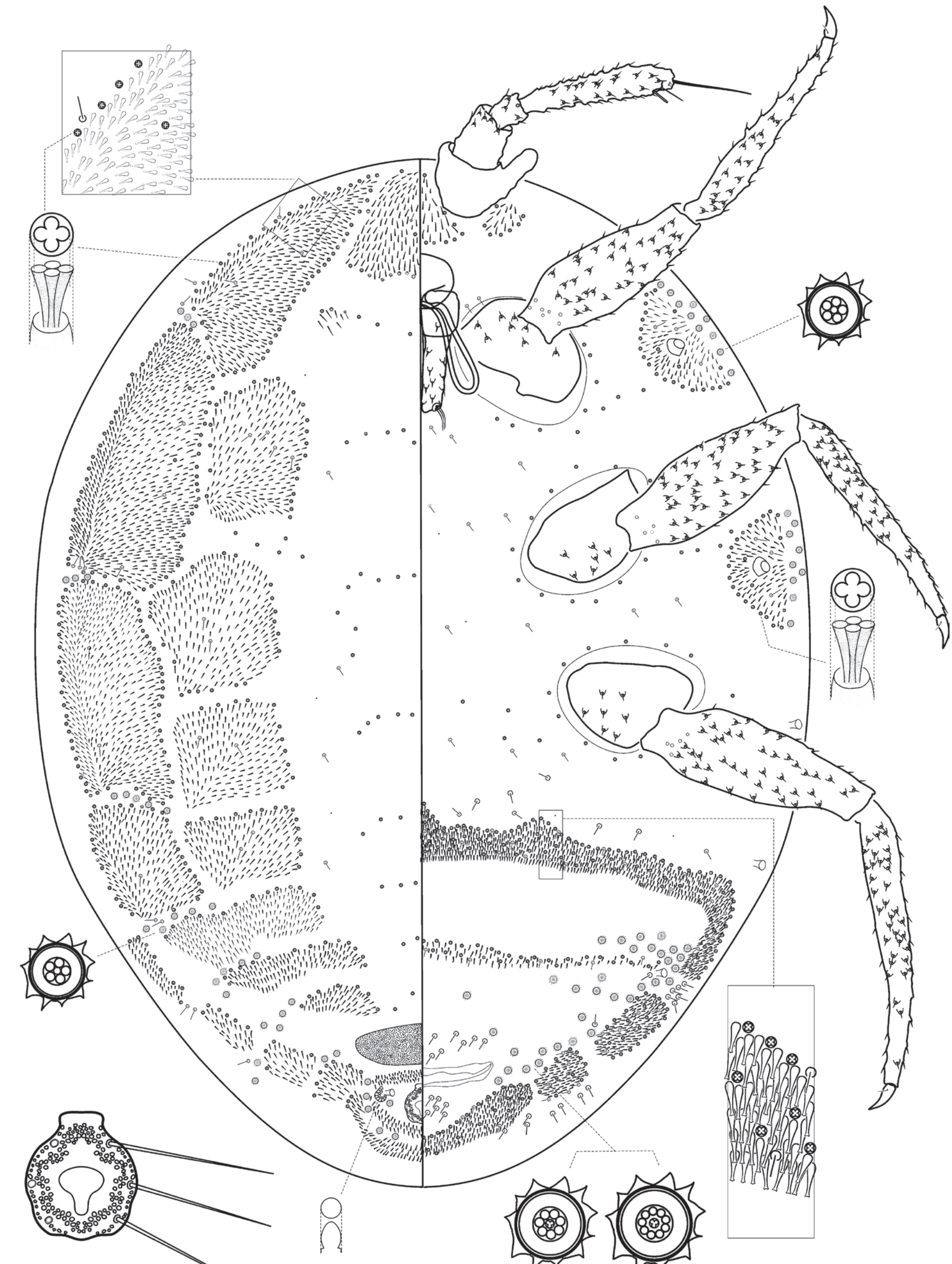

Figure 2. *Ortheziola editae* Szita & Konczné Benedicty, sp. n., adult female, holotype.

Dorsum. Wax plates covering two-thirds of marginal area; mediolateral thoracic plates (3, 5 and 6) present; waxplate 3 small, containing only a few spines and pores; medial area of thorax and abdomen with a few scattered spines and pores. Spines at margin of wax plate 4 each 15–16 µm long, those in middle of wax plate each 16–18 µm long; spines truncate and expanded at apex. Flagellate setae present in very small numbers on each wax plates and in medial bare area, each seta 17 µm long. Quadrilocular pores, each 3.0–3.5 µm in diameter, with four loculi, present at the margins of all waxplates and scattered within the waxplates. Quinquelocular pores, each 5.5–6.0 µm in diameter, present in marginal areas of abdomen, between the waxplates; also present in a cluster near anal ring. Sclerotized plate on abdomen 63–77 µm long, 230–251 µm wide; with a few setae with pointed apices situated at posterior edge of plate. Anal ring with incomplete triple rows of circular pores, each pore 1.5–3.0 µm in diameter; longest anal ring seta 72–74 µm long; anal ring 60–67 µm long, 50–55 µm wide. Thumb-like pores, each 6 µm long. Abdominal spiracle present in center of multilocular pore cluster situated laterad to anal ring.

Host plant. Unknown.

Distribution. Bulgaria, Croatia.

Etymology. The new species is dedicated to Edit Horváth, who has worked as an assistant in the Acarology Collection of the Hungarian Natural History Museum, Budapest for many years and helped our work in extracting the specimens and finding locality data.

Comments. *Ortheziola editae* is characterized by the presence of (i) dorsal wax plate 3 being only slightly developed, (ii) ventral plates 11 and 12 present at the base of antennae, and (iii) plate 19 absent from near the body margin. This species is very close to *O. marottai* but differs in having (*O. marottai* values in brackets): (i) only one or two multilocular pores anterior to vulva (plenty of multilocular pores); (ii) multilocular pores near each thoracic spiracle, each pore with five loculi (four loculi) and (iii) anterior margin of ovisac band with six waves (at least eight waves).

Ortheziola marottai Kaydan & Szita

Material examined. Greece: 1 ♀ – Ioannina regional unit, Kalpaki, Vellas Monasteri. Macedonia: 2 ♀♀ – Prilep Municipality, Raec canyon. Romania: 3 ♀♀ – Alba County, Munții Apuseni Mts., Cheile Albioarei, Tarina village; 1 ♀ – Hunedoara County, Retyezát Mts., Campu lui Neag village.

Distribution. Croatia (former Yugoslavia), Cyprus, Greece, Iran, Turkey (Kaydan et al. 2014); **Macedonia, Romania**.

Ortheziola vejdovskyi Šulc

Material examined. Bosnia-Herzegovina: 1 ♀ – Prenj Mts., Borci. Croatia: 1 ♀ – Krapina Zagorje County, Ivansaica Mts., Stari Golubovec; 4 ♀♀ – Mala-kapela, Plitvice Lakes; 2 ♀ – Papuk, Štrmac. France: 1 ♀ – Midi Pyrenees, Arreau. Italy: 1 ♀ – Abruzzi, Mts. Maiella, Sulmona. Romania: 1 ♀ – Alba County, Runc (Aranyosronk), Runki-szoros; 6 ♀ – Alba

County, Rimetea (Torockó);1 ♀ – Bihor County, Bihor Mts., Vislo village; 1 ♀ – Bukovina County, Voievodeasa; 1 ♀ – Caraş-Severin County, Ţarcu Mts., Poiana Mărului; 1 ♀ – Cluj County, Sinfalva, Aranyos valley; 1 ♀ – Cluj County, Turda (Torda), Cheile Turzii (Tordai hasadék); 2 ♀ – Harghita County, Băile Homorod (Homoródfürdő); 1 ♀ – Maramureş County, Maramureş Mts., Petrova, Frumuena; 1 ♀ – Maramureş County, Baia Mare (Nagybánya), Valhani plateau, Rozsály Mt.; 1 ♀ – Maramureş County, Rodna Mts., Săcel (Izaszacsal); 1 ♀ – Maramureş County, Săpânţa (Szaplonca), Kőhát; 1 ♀ – Maramureş County, Sighetu Marmatiei; 1 ♀ – Satu Mare County, Negreşti-Oaş. Russia: 1 ♀ – Chechnya, Dzheirakhs District, Olgeti village. Serbia-Montenegro: 1 ♀ – Savino Polje; 1 ♀ – Zlatibor Mts., Vodice. Slovakia: 2 ♀ – Červený Kláštor, Pieniny National Park; 1 ♀ – Košice (Kassa); 4 ♀ – Slovakian Raj NP, Cingov; 1 ♀ – Staré Hory (Óhegy). Slovenia: 1 ♀ – Bohinjska Bela; 1 ♀ – Predjama; 1 ♀ – Ribcev Laz Lake Bohijsko Jezero; 1 ♀ – Triglav NP., Koča pri Peričniku. Ukraine: 1 ♀ – Kiev.

Distribution. Armenia, Austria, Azores, Belgium, China (Beijing (=Peking)), Corsica, former Czechoslovakia, France, Germany, Hungary, Italy, Luxembourg, Madeira Islands, Netherlands, Poland, Romania, Sweden, Switzerland, USSR, Ukraine, United Kingdom (England, Scotland, Wales), former Yugoslavia (García et al. 2015); Bosnia-Herzegovina, Croatia, Montenegro, Serbia, **Slovakia**, Slovenia.

Comments. The type locality of *O. vejdovskyi* is in Czech Republic, originally: Bohemia, Bechlin; Králové Dvur n. L. east Bohemi (Šulc 1895), and this is the only report from the area of former Czechoslovakia (García et al. 2015), thus the current data from Slovakia can be considered as a new country record. *O. vejdovskyi* was reported from Yugoslavia by Kosztarab and Kozár (1988) (García et al. 2015), without detailed locality data, therefore we have no exact information which current successor state(s) could have been the actual locality(ies) in that report. Accordingly we list the current localities by states, without considering these as new country records, thus it was not unequivocally proven.

Pseudococcidae

Atrococcus parvulus (Borchsenius)

Material examined. Slovakia: 1 ♀ – Pieniny National Park, Červený Kláštor.

Distribution. China, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Uzbekistan (García et al. 2015); **Slovakia**.

Ferrisia malvastra (McDaniel)

Material examined. Spain: 1 ♀ – Canary Island, Tenerife, Masca.

Distribution. Argentina, Ascension Island, Australia (Queensland), Bahamas, Bermuda, Brazil, Canary Islands, Cook Islands, Cuba, Hawaiian Islands (Hawaii), India, Israel, Jamaica, Kiribati, Mexico, New Caledonia, Papua New Guinea, Peru, South Africa, Spain, Sri Lanka, Swaziland, Tobago, Tonga, Trinidad, Tuvalu, United States of America, Vanuatu, Venezuela (García et al. 2015).

Balanococcus boratynskii Williams

Material examined. Romania: 1 ♀ – Maramureş County, Maramureş Mts., Borşa-Băile Borşa.

Distribution. Bulgaria, Hungary, Italy, Poland, Russia, Sweden, Switzerland, United Kingdom (England) (García et al. 2015); **Romania**.

Balanococcus orientalis Danzig & Ivanova

Material examined. Albania: 1 ♀ – Shkodër Municipality, Shkodër, Castle of Rozafat. Romania: 1 ♀ – Maramureş County, Maramureş Mts., Borşa-Băile Borşa.

Distribution. Italy, North Korea, Russia, Sardinia (García et al. 2015); **Albania, Romania**.

Genus *Brevennia* Goux

Ripersia Goux 1940:58. Type species: *Ripersia tetrapora* Goux by original designation. Accepted valid name.

Asphodelococcus Morrison 1945:41. Type species: *Ripersia asphodeli* Bodenheimer by monotypy and original designation. Junior synonym.

Brevennia Borchsenius, 1948: 953. Change of status.

Asphodeloripersia Bodenheimer, 1953: 164. Misspelling of genus name.

Pseudorhodania Borchsenius, 1962: 242. Type species: *Pseudorhodania marginata* Borchsenius, by original designation. Synonymy by Danzig and Gavrilov-Zimin 2012a: 786.

Type species. *Ripersia* (*Brevennia*) *tetrapora* Goux, 1940: 58.

Diagnosis. *Living female.* Female covered with white wax powder.

Adult female. Labium three-segmented, longer than wide. Posterior pair of spiracles always larger than anterior spiracles. Circulus present or absent. Legs well developed, claw with or without denticle; tarsal digitules hair-like, not capitate; claw digitules knobbed, claw digitules broader than tarsal digitules. Only posterior ostioles developed; anterior ostioles absent. Anal lobes poorly developed. Anal ring oval, with one inner row of pores and one or two outer rows of pores plus with six setae. Minute discodial pores present of various sizes, scattered throughout.

Dorsum. Antennae 6-8 segmented. Eyes oval, each on a small basal cone. Cerarii present numbering 1-4, only on posterior abdominal segments. Dorsal body setae spinelike. Multilocular disc pores present or absent. Quinquelocular pores present, scattered all surface. Oral collar tubular present in transverse rows on body segments. Trilocular pores absent. Minute discodial pores present, from a few to scattered on the surface, variable in sizes.

Venter. Most ventral setae slender and hair-like, of various sizes. Oral collar tubular ducts of one or two sizes, each varying in length and width. Multilocular disc pores present on posterior abdominal segments, especially around vulva or absent. Quinquelocular pores present, scattered throughout. Trilocular pores, each 2.5–5.0 µm in diameter, only around atrium of both pairs of spiracles. Minute discodial pores present, of variable sizes, scattered through.

Comments. In this study, the concept of Kaydan (2011) and Foldi and Cox (1989) are accepted and *Brevennia* Goux *sensu stricto* is regarded as a valid genus and is considered to include: *Brevennia cicatricosa* (Danzig), *B. dasiphorae* (Danzig), *B. filicta* (De Lotto), *B. oryzae* (Tang), *B. pulveraria* (Newstead) and *Brevennia rehi* (Borchsenius). These species are characterized by: (i) lack of anterior ostioles; (ii) trilocular pores restricted to around each spiracular atrium on the venter and to the cerarii on the dorsum. For further discussion see Danzig and Gavrilov (2012; 2013), Kaydan (2011) and Foldi and Cox (1989).

Key to adult female *Brevennia* (adapted from Danzig and Gavrilov 2012)

1	Multilocular pores present either on venter or dorsum	**2**
–	Multilocular pores absent from both venter and dorsum	***Brevennia larvalis* sp. n.**
2	Multilocular pores absent on dorsum	**3**
–	Multilocular pores present on dorsum	**4**
3	Trilocular pores situated in cerarii and near spiracles; one circulus present	***B. cicatricosa* (Danzig)**
–	Trilocular pores situated only in cerarii; circuli absent	***B. dasiphorae* (Danzig)**
4	Cerarii with quinquelocular pores only	**5**
–	Cerarii with both quinquelocular pores and trilocular pores	**6**
5	Multiocular disc pores on dorsum present on margin of head, thorax and abdominal segments	***B. rehii* (Maxwell-Lefroy)**
–	Multiocular disc pores on dorsum present only on margin of abdominal segments	***B. oryzae* (Tang)**
6	Multilocular disc pores on dorsum wide band on body margin and present on mid-abdominal area of posterior abdominal segments	***B. filicta* (De Lotto)**
–	Multilocular disc pores on dorsum few on body margin and absent on mid-abdominal area of posterior abdominal segments	***B. pulveraria* (Newstead)**

Brevennia larvalis **Kaydan, sp. n.**

http://zoobank.org/A63FA89F-F938-4E9E-ACEB-01F4307AFE91

Figs 3–4

Material examined. *Holotype*. Adult female. Albania: Qafa e Pejës, 1700 m a.s.l., 17.vii.1996, leg. Horváth E. (PPI: 12211, HNHM: E-1451). *Other material examined*. 5 nymphs – same data as holotype.

Description. *Adult female* (Fig. 3). Body elongate oval, 1.24 mm long, 0.48 mm wide. Eye marginal, 35–40 µm wide. Antenna seven or eight segmented, 1.90 µm long; apical segment 32.5–35 µm long, 25–30 µm wide, with apical setae 22.5–27.5 µm long plus three fleshy setae, each 20–35 µm long. Tentorium 135 µm long, 120 µm wide. Labium 65 µm long, 90 µm wide. Anterior spiracles 37.5–42.5 µm long, 17.5–20.0 µm wide across atrium; posterior spiracles 45 µm long, 22.5–25.0 µm wide across atrium; each spiracle associated with 2 or 3 trilocular pores. Legs well developed; data for posterior legs: coxa 70 µm, trochanter + femur 125 µm, tibia + tarsus 135 µm, claw 17.5 µm. Ratio of lengths of tibia + tarsus to trochanter + femur 1.02–1.70:1; ratio of lengths of tibia to tarsus 1.23–1.70:1; ratio of length of hind trochanter + femur to greatest width of femur 3.45–3.80:1. Tarsal digitules each 25 µm long, hair-like. Claw digitules knobbed each 17.5 µm long. Hind tibia with 4–9 translucent pores. Anterior ostioles absent; posterior ostioles present, without pores or setae. Anal ring 60 µm wide, with six setae, each seta 55–90 µm long. Cerarii three pairs only, each slightly sclerotized; anal lobe cerarii each with two enlarged setae, 15 µm long, plus one quiquelocular pore; cerarii on abdominal segments VII and VI both with two slender enlarged setae and two or three quinquelocular pores.

Dorsum. Body setae spine-like in various sizes, each 5.0–12.5 µm long. Quinquelocular pores in rows on abdominal segments as follows: I-III 84, IV 32, V 32, VI 39, VII 34, VIII + IX 11; each pore 5–6 µm in diameter; pores scattered on head and thorax. Oral collar tubular ducts, each 7.5–10 µm long, 4–5 µm wide, in single rows across all abdominal segments: I-III 14 ducts, IV 8, V 8, VI 10, VII 9, VIII + IX 3, and also submarginal area of head and thorax, each pore 5–6 µm in diameter. Minute discoidal pores scattered throughout, each 2 µm in diameter.

Venter. Setae slender, hair-like, each 10–35 µm long, longest setae medially on head. Apical setae of anal lobe each 110–120 µm long. Multilocular disc pores absent. Quinquelocular pores each 5–6 µm in diameter; in rows on abdominal segments as follows: II-III 74, IV 36, V 45, VI 39, VII 50, VIII + IX 34; and scattered on head and thorax. Minute discoidal pores few, each 2 µm in diameter, scattered throughout. Oral collar tubular ducts concentrated on body margin of abdominal segments, of one size, each 4–5 µm long, 7.5–10 µm wide, and on margin of head, thorax and abdominal segments, as follows: II-III 30 ducts, IV 12, V 10, VI 9, VII 4, VIII + IX.

Comments. *Brevennia larvalis* sp. n. Kaydan can be readily distinguished by: (i) absence of multilocular pores; (ii) absence of pores and setae on the lips of ostioles; and (iii) in having three pairs of cerarii. There is no other species in the genus without multilocular pores.

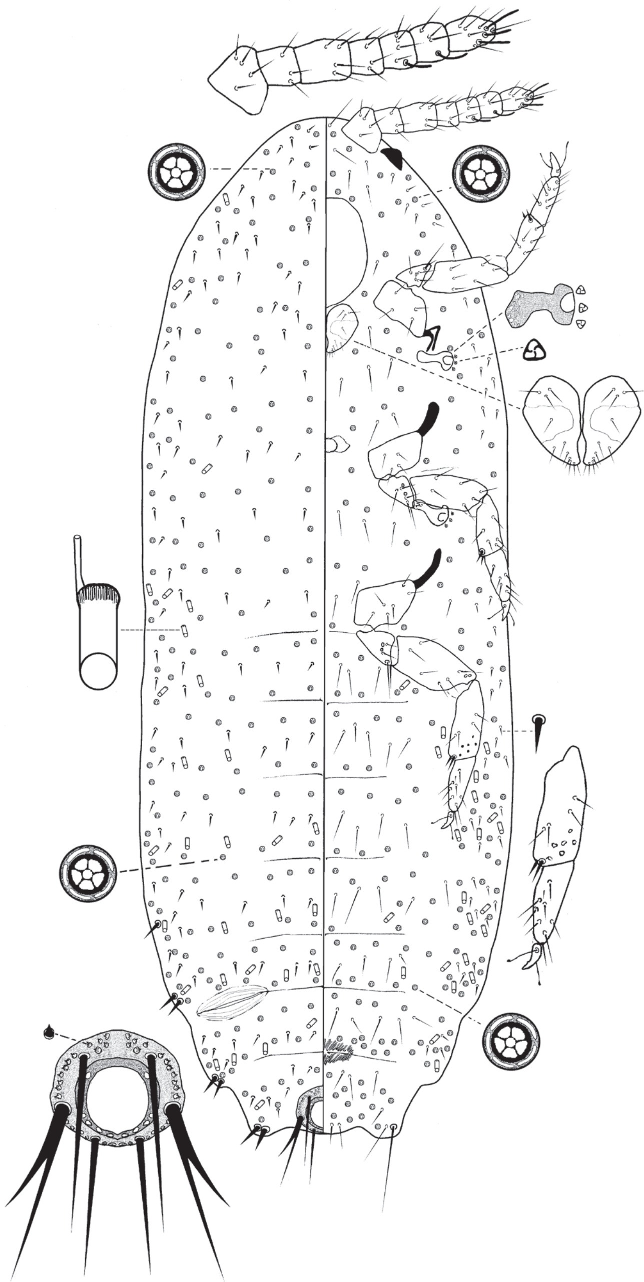

Figure 3. *Brevennia larvalis* Kaydan, sp. n., adult female, holotype.

First-instar nymph (Fig. 4). Body elongate oval, 0.51–0.56 mm long, 0.20–0.22 mm wide. Eye marginal, 35–40 µm wide. Antenna six-segmented, 1.30–1.90 µm long; apical segment 45–52.5 µm long, 22.5–27.5 µm wide, with apical setae 22.5–

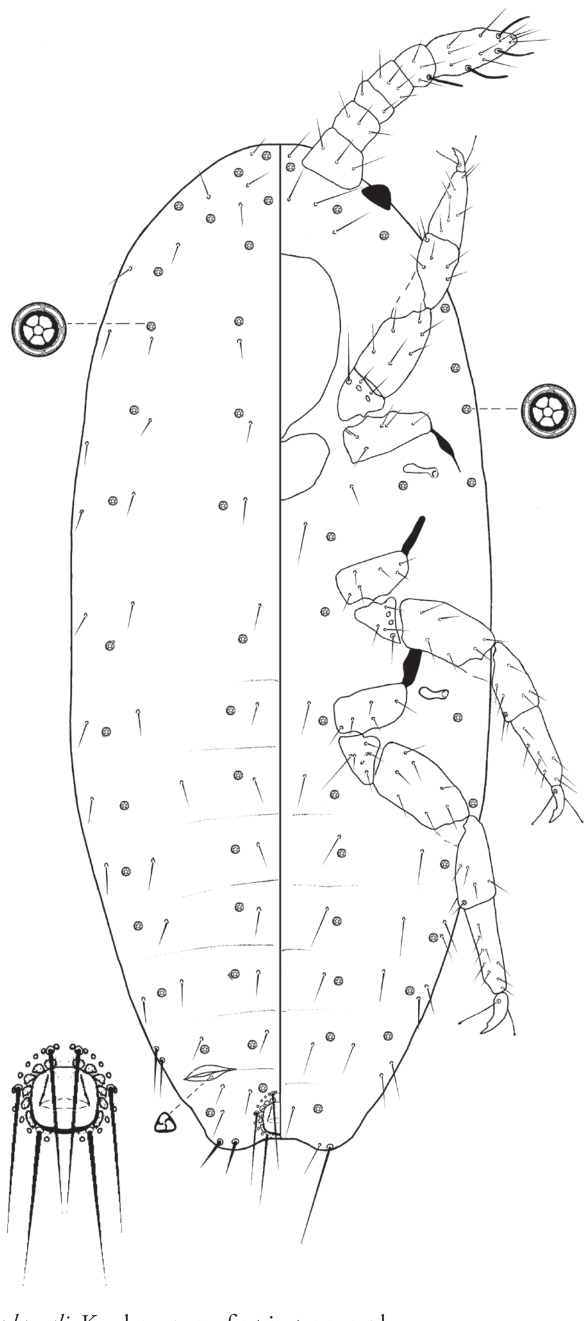

Figure 4. *Brevennia larvalis* Kaydan, sp. n., first instar nymph.

27.5 µm long plus three fleshy setae, each 15–17.5 µm long. Tentorium 80 µm long, 75 µm wide. Labium 40-45 µm long, 52.5 µm wide. Anterior spiracles 22.5–25 µm long, 7.5 µm wide across atrium; posterior spiracles 22.5–25 µm long, 7.5 µm wide across atrium. Legs well developed; data for posterior legs: coxa 37.5–42.5 µm, trochanter + femur 75.0–82.5 µm, tibia + tarsus 92.5–95 µm, claw 12.5–15.0 µm. Ratio of lengths of tibia + tarsus to trochanter + femur 1.02–1.70:1; ratio of lengths of tibia to tarsus 1.23–1.70:1; ratio of length of hind trochanter + femur to greatest width of femur 3.45–3.80:1. Tarsal digitules each 15–20 µm long, hair-like. Claw digitules knobbed each 12.5–15 µm long. Anterior ostioles absent; posterior ostioles present with only one trilocular pore 2.5–3.0 µm in diameter. Anal ring 42.5 µm wide, with six setae, each seta 40 µm long. Cerarii two pairs only; anal lobe cerarii each with two enlarged setae, 15–25 µm long, cerarius on abdominal segment VII with two slender enlarged setae.

Dorsum. Body setae spinelike of various sizes, each 5.0–12.5 µm long. Quinquelocular pores in four longitudinal rows, each pore 5–6 µm in diameter.

Venter. Setae slender and hair-like, each 15–25 µm long, longest setae medially on head. Apical setae of anal lobe each 42.5–85.0 µm long. Quinquelocular pores in four longitudinal rows, each pore 5–6 µm in diameter.

Etymology. This species is named because of absence of multilocular pores on venter and dorsum, which is a character of larval (nymphal) stages.

Host plants. Unknown.

Distribution. Albania.

Fonscolombia europaea (Newstead)

Material examined. Greece: 3 ♀♀ – Epirus, Ioannina regional unit, Lakmos Mts. Romania: 6 ♀♀ – Cluj County, Cheile Turzii (Tordai hasadék).

Distribution. Armenia, Austria, France, Germany, Hungary, Italy, Luxembourg, Mongolia, Netherlands, Poland, Russia, Sweden, Turkey, Ukraine, United Kingdom (Channel Islands, England) (García et al. 2015); **Greece, Romania**.

Fonscolombia graminis Lichtenstein

Material examined. Croatia: 1♀ – Njivice.

Distribution. Corsica; France (García et al. 2015); **Croatia**.

Metadenopus festucae Šulc

Material examined. Greece: 1♀, 1 nymph – West Greece, Aetolia-Acarnania regional unit, Panetoliko Mts., Agios Vlasios.

Distribution. China, Czech Republic, France, Hungary, Italy, Moldova, Mongolia, Poland, Russia, Turkey, Ukraine (García et al. 2015); **Greece**.

Mirococcopsis subterranea (Newstead)

Material examined. Romania: 4 ♀♀ – Cluj County, Cheile Turzii (Tordai hasadék).

Distribution. Armenia, Czech Republic, Denmark, France, Georgia (Georgia), Hungary, Italy, Kazakhstan, Lithuania, Netherlands, Poland, Russia, Spain, Sweden, Ukraine, United Kingdom (Channel Islands, England, Scotland) (García et al. 2015); **Romania**.

Peliococcus chersonensis (Kiritshenko)

Material examined. Bulgaria: 1♀ – Plovdiv Province, Asenovgrad.

Distribution. Armenia, China; Italy, Kazakhstan, Lithuania, Mongolia, Russia, South Korea, Turkey, Ukraine (García et al. 2015); **Bulgaria**.

Peliococcus loculatus Danzig

Material examined. Romania: 1 ♀ – Maramureş County, Rodna Mts., Borşa-Staţiunea Borşa.

Distribution. Russia (García et al. 2015); **Romania**.

Pelionella manifecta (Borchsenius)

Material examined. Greece: 1 ♀ – Kos.

Distribution. Armenia, Azerbaijan, Italy, Kazakhstan, Sardinia, Sweden, Turkey (García et al. 2015); **Greece**.

Phenacoccus abditus Borchsenius

Material examined. Croatia: 1 ♀ – Njivice.

Distribution. Armenia, Crete, Georgia, Hungary, Kazakhstan, Poland, Russia, Tajikistan, Turkey, Turkmenistan (García et al. 2015); **Croatia**.

Phenacoccus hordei (Lindeman)

Material examined. Albania: 2 ♀♀ –Mat District, Qafa e Shtamës.

Distribution. Armenia, Finland, France, Germany, Greece, Hungary, Iran, Italy, Kazakhstan, Moldova, Netherlands, Poland, Russia, Sweden, Turkey, Ukraine, United Kingdom (England) (García et al. 2015); **Albania**.

Phenacoccus karaberdi Borchsenius & Ter-Grigorian

Material examined. Greece: 3 ♀♀ – Epirus, Ioannina regional unit, Lakmos Mts.

Distribution. Armenia, Austria, Kazakhstan, Russia, Tajikistan, Turkey (García et al. 2015); **Greece**.

Phenacoccus poriferus Borchsenius

Material examined. Serbia: 1 ♀ – Niš.

Distribution. China, Mongolia, North Korea, Russia, Tajikistan (García et al. 2015), **Serbia**.

Phenacoccus specificus Matesova

Material examined. Greece: 1 ♀, 1 nymph – Pieria regional unit, Olympos, Litochoro.

Distribution. Kazakhstan (García et al. 2015); **Greece**.

Phenacoccus tergrigorianae Borchsenius

Material examined. Greece: 1 ♀ – West Greece, Aetolia-Acarnania regional unit, Panetoliko Mts., Agios Vlasios village.

Distribution. Armenia, Turkey (García et al. 2015), **Greece**.

Rhodania porifera Goux

Material examined. Bulgaria: 2 ♀♀ – Belogradchik.

Distribution. Armenia, France, Georgia, Germany, Hungary, Italy, Kazakhstan, Mongolia, Poland, Russia, Turkey, Ukraine (García et al. 2015); **Bulgaria**.

Trionymus newsteadi (Green)

Material examined. Slovakia: 1 ♀ – Štos-Kupele.

Distribution. Armenia, Czech Republic, Germany, Hungary, Italy, Netherlands, Poland, Russia, Ukraine, United Kingdom (England), former Yugoslavia (García et al. 2015); **Slovakia**.

Volvicoccus volvifer (Goux)

Material examined. Romania: 1♀ – Cluj County, Cheile Turzii (Tordai hasadék).

Distribution. Armenia, Bulgaria, France, Hungary, Italy, Poland, Turkey, Ukraine (García et al. 2015); **Romania**.

Putoidae

Puto antennatus (Signoret)

Material examined. Bulgaria: 1 ♀ –Pirin, Demianitsa; 1 ♀ – Pirin; Vihren; 1 ♀ – Vitosha. Serbia: 1 ♀ – Savino Polje, Đalovica klisura.

Distribution. Austria, Bulgaria, Czech Republic, France, Germany, Italy, Serbia, Switzerland (García et al. 2015).

Comments. Occurring on needles and in bark crevices of conifers. Biology in Italy studied by Sampo and Olmi (1979). Life history discussed by Kosztarab and Kozár (1988).

Rhizoecidae

Rhizoecus albidus Goux

Material examined. Romania: 1 ♀ – Prahova County, Cheia Cul. Mea, Gropsoarale, Zagram.

Distribution. Armenia, Crete, France, Germany, Hungary, Iran, Italy, Kazakhstan, Romania, Russia, Sweden, Ukraine, United Kingdom (England) (García et al. 2015).

Rhizoecus kazachstanus Matesova

Material examined. Albania: 1 second instar nymph – Skrapar District, Tomor Mts., Skrapar.

Distribution. Albania, Hungary, Kazakhstan (García et al. 2015).

Rhizoecus pseudocacticans Hambleton
Fig. 5

Material examined. Spain: 1 ♀ – Canary Islands, Tenerife, Masca, 450 m a.s.l., 20.x.2008, leg. Jely Z., soil (PPI: 11938, HNHM: E-2531).

Host plants. *Crassula* sp., *Kalanchoe tomentosa*, *Sedum* sp. (Crassulaceae), *Aloe* sp. (Liliaceae) (García et al. 2015).

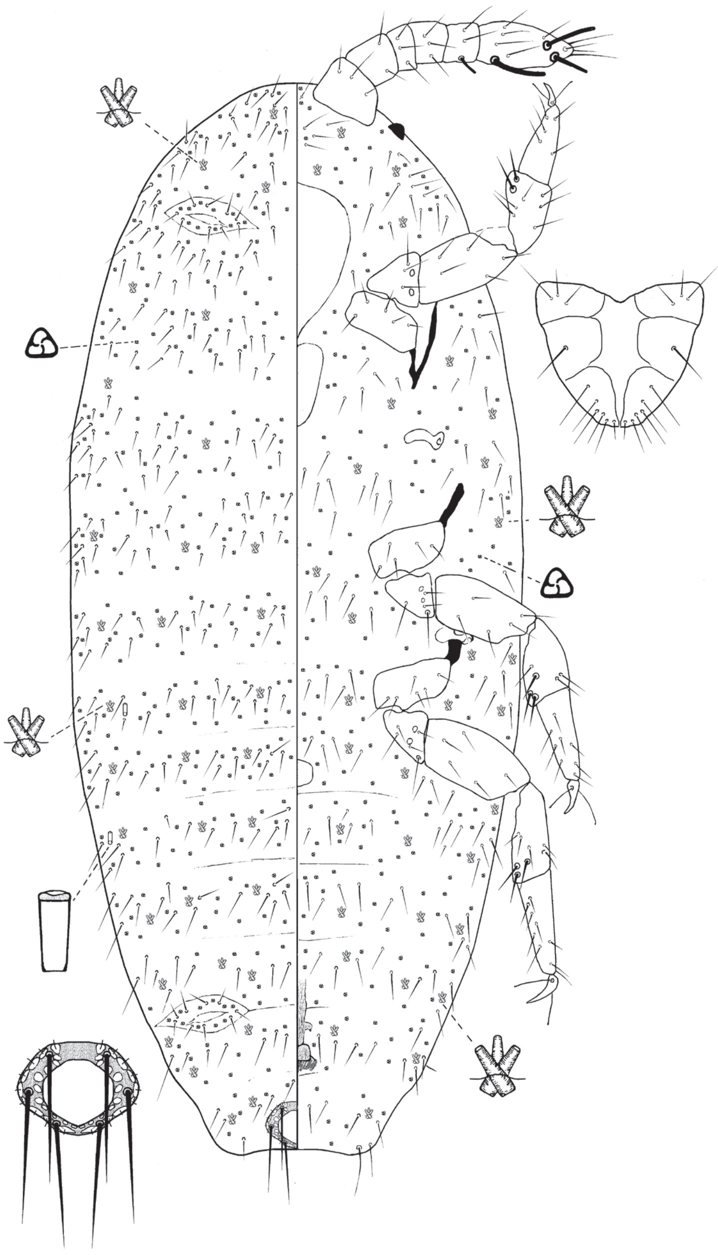

Figure 5. *Rhizoecus pseudocacticans*, Hambleton, original.

Distribution. United States of America (García et al. 2015), **Spain**.

Comment. This species is characterized by the lack of multilocular pores on both the dorsum and venter and in having very few oral collar tubular ducts on the dorsum. This species is similar to *R. cacticans* and *R. leucosomus*, but differs from both in having more anal ring pores. In addition, this species is also similar to *R. nakaharai* but differs in having a longer labium. However, these are poor characteristics upon which to base species differences and so a drawing of this species is presented here. Detailed descriptions of the above mentioned species are available in Kozár and Konczné Benedicty (2007).

Ripersiella caesii (Schmutterer)

Material exmined. Serbia: 2 ♀♀ – Niš; 5 ♀♀ – Špiljani.

Distribution. Germany (García et al. 2015); **Serbia**.

Ripersiella halophila (Hardy)

Material exmined. Albania: 2 ♀♀ – Kukës District, Topojan.

Distribution. Bulgaria, Czech Republic, France, Germany, Hungary, Ireland, Poland, Russia, Ukraine, United Kingdom (England, Scotland, Wales) (García et al. 2015); **Albania**.

Ripersiella parva (Danzig)

Material examined. Albania: 6 nymphs – Librazhd District, Gizavësh, Librazhd; 2 nymphs – Mirditë District, Ndërshenë; 1 nymph – Mat District, Dejë Mts., Macukull; 25 nymphs – Pogradec District, Lin.

Distribution. Albania, Russia, Turkey (García et al. 2015).

Ripersiella periolana Goux

Material examined. Greece: 1 ♀, 1 nymph – Pieria regional unit, Olympos Mts., Litochoro.

Distribution. Greece, Hungary, Italy, Turkey (García et al. 2015).

Discussion

In this study, 43 scale insect species were found in 16 different European countries. Despite scale insects being found in only 10% of the 2970 samples collected, the Berlese funnel collection method has revealed new species and widened distribution records for known species. It is believed that the use of diverse collecting methods can provide researchers with additional sources of information about species distribution and diversity.

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Systematics of the parasitic wasp genus *Oxyscelio* Kieffer (Hymenoptera, Platygastridae s.l.), part III: African fauna

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Abstract

African species of *Oxyscelio* (Hymenoptera: Platygastridae s.l.) are revised. A total of 14 species are recognized, 13 of which are described as new: *O. absentiae* Burks, **sp. n.**, *O. galeri* Burks, **sp. n.**, *O. gyri* Burks, **sp. n.**, *O. idoli* Burks, **sp. n.**, *O. intensionis* Burks, **sp. n.**, *O. io* Burks, **sp. n.**, *O. kylix* Burks, **sp. n.**, *O. lunae* Burks, **sp. n.**, *O. nemesis* Burks, **sp. n.**, *O. pulveris* Burks, **sp. n.**, *O. quassus* Burks, **sp. n.**, *O. teli* Burks, **sp. n.** and *O. xenii* Burks, **sp. n.** The genus *Freniger* Szabó, **syn. n.** is recognized as part of an endemic African species group of *Oxyscelio* with incomplete hind wing venation, and *O. bicolor* (Szabó), **comb. n.** is therefore recognized as the only previously described species of *Oxyscelio* from Africa. The *O. crateris* and *O. cuculli* species groups, previously known from southeast Asia, are represented in Africa by seven and one species respectively.

Keywords

Platygastroidea, Scelionidae, Oxyscelio, Scelioninae, key, revision, database, parasitoid

Introduction

Oxyscelio Kieffer was first described to contain a single species of Scelioninae from Java (Kieffer 1907). It remained in obscurity until Dodd (1931) recognized that it was the oldest generic name corresponding to a set of Australian and Indo-Malayan species that previously had been placed in several other genera. Dodd's concept of *Oxyscelio* has been upheld in more recent examinations of scelionine genera (Masner 1976, Galloway and Austin 1984, Austin and Field 1997). The Indo-Malayan, Palearctic (Burks et al. 2013a, Johnson et al. 2013), Australian, and Pacific (Burks et al. 2013b) species of *Oxyscelio* have been recently reviewed, expanding the number of described species of the genus from 36 to 170, while retaining as valid all but one of the species that had been recognized by Dodd.

Despite the diversity of *Oxyscelio*, very little is known of its life history. The host of *Oxyscelio perpensus* Kononova, an exposed orthopteran egg laid from an unknown species onto plant tissue, was photographed as part of its original description (Kononova and Fursov 2007) and is the only known host record of the genus.

In this study we recognize 14 species of *Oxyscelio* from the Afrotropical realm, including 13 newly described species. Eight of these species are placed in species groups previously recognized from the Indo-Malayan realm. Four of the remaining species are placed in a uniquely African species group comprising the only species of *Oxyscelio* known to have incomplete hind wing venation, a feature that has most notably been found in other genera of Scelioninae, including *Scelio* Latreille, *Sparasion* Latreille, and *Nixonia* Masner. These species are determined to belong to *Oxyscelio* based on a single spur on both the mid and hind tibia, the presence of a facial submedian carina, and fore wing with a punctiform marginal vein and no pseudostigma (*sensu* Masner 1976).

Materials and methods

Specimens examined were provided by the following collections: Australian National Insect Collection, Canberra, Australia (ANIC)[1]; The Natural History Museum, London, United Kingdom (BMNH)[2]; Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Canada (CNCI)[3]; Hungarian Natural History Museum, Budapest, Hungary (HNHM)[4]; Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA (MCZC)[5]; Lund Museum of Zoology, Lund University, Lund, Sweden (MZLU)[6]; National Museum of Kenya (NMKE)[7]; C.A. Triplehorn Insect Collection, Ohio State University, Columbus, Ohio (OSUC)[8]; Queensland Primary Industries and Fisheries Insect Collection, Indooroopilly, Australia (QDPC)[9]; Queensland Museum, Brisbane, Australia (QMBA)[10]; South African Museum, Iziko Museums of Cape Town, South Africa (SAMC)[11]; National Museum of Natural History, Washington, DC (USNM)[12]; Waite Insect and Nematode Collection, Adelaide, Australia (WINC)[13].

This revision is a product of the Platygastroidea Planetary Biodiversity Inventory, funded by the U.S. National Science Foundation (N.F. Johnson, Ohio State University; Andy Austin, University of Adelaide; Principal Investigators). An objective of this project is to use biodiversity informatics resources to accelerate taxonomic work, making real-time collaboration possible. Data associated with specimens examined in this study can be accessed at hol.osu.edu and entering the unique specimen identifier (e.g. OSUC 359541) in the search form. Scale bars on all figures are in mm format. Morphological terminology follows Mikó et al. (2007) except as specified here. Ovipositor terminology is used as described by Austin and Field (1997). "T1 midlobe" refers to the raised antero-medial area of T1 that is flanked by depressed lateral areas. This is usually flat and only weakly elevated in *Oxyscelio*, and therefore is not strictly the same as a T1 horn, but a T1 midlobe can be expressed as a T1 horn. All terms except those for surface sculpture are defined in the Hymenoptera Anatomy Ontology (http://portal.hymao.org).

Surface sculpture terminology follows Eady (1968) in most cases and Burks et al. (2013a, 2013b) in interpretations of major sculpture versus microsculpture, which are explained again here. Diminutive variant sculptural terms were avoided because of a lack of criteria for separating them from non-diminutive alternatives. "Major" surface sculpture refers to repeated sculptural patterns that interact with seta placement, not including non-repeated elements or those which are repeated only once due to bilateral symmetry. "Umbilicate-foveate" sculpture refers to rounded crater-like sculptural elements, each surrounding a setiferous pit (and thus interacting with a seta), with each fovea being much larger than its setiferous pit and spatially separated from that pit (see, e.g., Fig. 3). "Umbilicate-punctate" sculpture indicates that no sculptural element accompanies the setiferous pit (and therefore the setal pit is the "major" surface sculpture element here, e.g., T6 in Fig. 67). "Rugose" sculpture refers to a pattern of branching or wrinkling elevations that flank setiferous pits but do not fully surround them (e.g., Figs 6, 7). Rugose sculpture can coexist with umbilicate sculpture in the same area of the sclerite, in which case the rugae occur on spaces between umbilicate sculptural elements. Note that "rugose" refers to a distribution of sculptural elements, and therefore can be "irregular" or "regular" even though rugae (the elements themselves) are by definition wrinkle-like and therefore at least slightly irregular. Where both umbilicate-foveate and umbilicate-punctate sculpture are reported for the same sclerite, this should be interpreted as variable sculpture where some setiferous pits are surrounded by foveae while others are not. Under this scheme, "major" surface sculpture cannot occur in any part of the sclerite that lacks setae.

"Microsculpture" refers to repeated tiny sculptural elements that do not interact with seta placement. Microsculpture can occur on "major" sculptural elements, such as on rugae and on all surfaces of foveae. "Punctate" microsculpture refers to tiny round pits that do not bear setae. "Granulate" microsculpture refers to sculpture that is similar to that of leather or skin, with areas enclosed by tiny grooves (= sunken septa). Microsculpture can occur in areas that lack setae.

Sculptural terms for repeated sculpture that are not included in the above categories are 1) "carinae" which refers to elevations that are sharp and not branched or wrinkled but do not repeat in a way that forms a pattern (excluding repeating due to bilateral symmetry), 2) "striae" which refers to repeated elevations that are not sharp and not branched or wrinkled. These sculptural elements do not interact with setiferous pit placement, but major sculptural elements can occur between them. While alternative logic may suggest that rugose sculpture is better classed within this category, this choice was avoided because rugose sculptural patterns did apparently interact with umbilicate sculptural patterns. For the occipital carina, "crenulate" means that short carinae radiate from the occipital carina. Certain carinae may be described using the phrase "wrinkle-like," which replaces our previous words "as a ruga," this change being done to make the terms more clearly descriptive.

Illustrations. Photographs were taken using a Synoptics Ltd. system using a Leica Z16 APO microscope and a JVC KY-F75U 3-CCD camera. Source photos were stacked using Zerene Stacker version 1.04, or Auto-Montage Pro version 5.01.0005, and enhanced using Adobe Photoshop CS5 or CS6.

Phylogenetic analysis. A New Technology Search at initial level 95 was performed using TNT (Tree analysis using New Technology) version 1.1 (Goloboff et al. 2003, 2008). Implied weighting was used, with a default function of K = 15. Bootstrapping was performed with 1,000 replicates using the same settings but without implied weighting. *Bracalba cuneata* Dodd was used as an outgroup for the analyses (specimens OSUC 238172, OSUC 238164), chosen because of morphological similarity between *Oxyscelio* and *Bracalba*. A total of 14 out of 50 characters were used from the overall dataset (see Appendix I for characters and matrix).

Taxonomy

Oxyscelio Kieffer

http://zoobank.org/99E3E72E-DA88-4740-9ECB-2D03BCD1DACE
http://bioguid.osu.edu/xbiod_concepts/529

Oxyscelio Kieffer 1907: 310. Original description. Type: *Oxyscelio foveatus* Kieffer, by monotypy. See Burks et al. (2013a, b) for complete bibliography, description of the genus, and discussion of its phylogenetic position within the family.

Freniger Szabó 1956: 47. Original description. Type: *Freniger bicolor* Szabó, by monotypy and original designation. Masner 1976: 6, 19 (description, keyed). Johnson 1992: 373 (catalogued, catalog of world species). **New synonymy**

Internal phylogenetic relationships. The phylogenetic analysis performed with a select group of characters (Fig. 1) found the *bicolor*-group and African species of the *crateris*-group to be monophyletic, with *Oxyscelio quassus* as the sister group to the *bicolor*-group and the *crateris*-group species as sister group to all other African species.

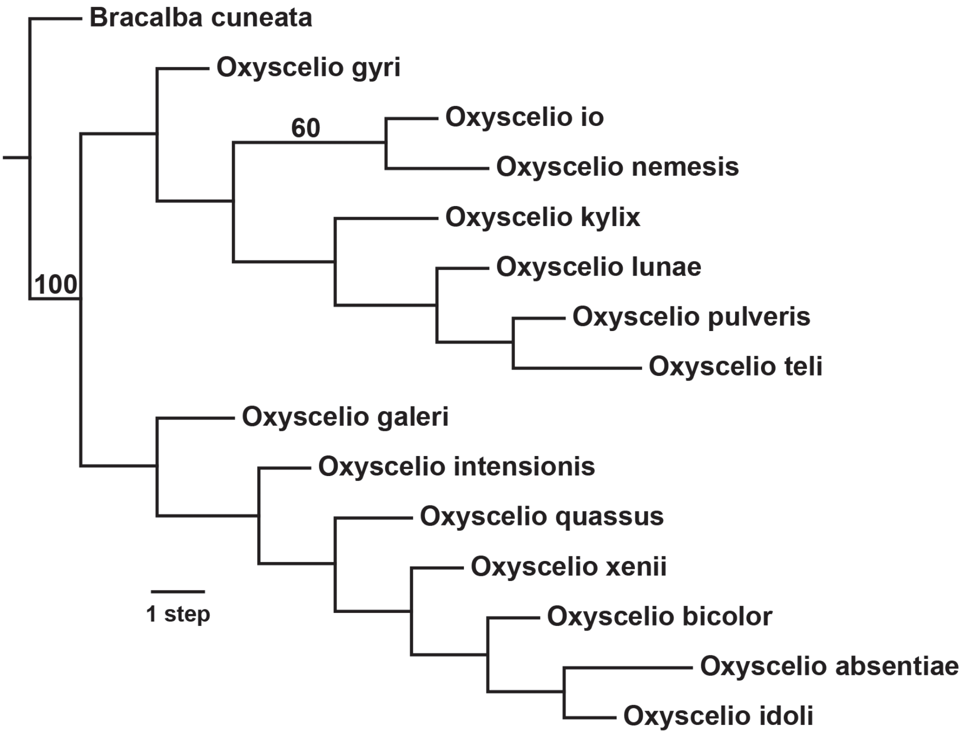


Figure 1. Single most parsimonious phylogram for African species of *Oxyscelio* using TNT New Technology Search with set initial level = 95, implied weighting default function K = 15. Best score = 0.74877. Bootstrap support values above 50% indicated above branches.

These results indicate that recognition of the genus *Freniger* (with *F. bicolor* as type) would make the genus *Oxyscelio* paraphyletic. Our understanding of relationships among all *Oxyscelio* species is insufficient to suggest a robust reclassification of these into monophyletic taxa. Therefore, we opt to treat *Freniger* as a junior synonym of *Oxyscelio*.

Species groups of African *Oxyscelio*

These groups are provided here to indicate intuitively perceived structure within the genus, and to provide an aid for identification. They are succinctly diagnosed here. Some characters are omitted situationally from species group diagnoses because those characters are variable within the group or are otherwise unhelpful for that particular group's identification. Individual species descriptions can be consulted regarding characters omitted from these diagnoses. The only uniquely African species group is the *bicolor*-group, which is defined by a character that is unique in *Oxyscelio*. Two other African species are not placed to group, and may represent important lineages as well (see below). The more lengthy species group diagnoses for the other groups in Burks et al. (2013a, b) can be consulted for the full list of other character states that fully define the *crateris*-group and *cuculli*-group.

Oxyscelio bicolor species group

Characteristics. Hyperoccipital carina absent or not connected to occipital carina. Hind wing vein (Sc+R) interrupted.

Comments. The *bicolor*-group contains species with a broadly interrupted hind wing vein (Sc+R). This feature is unique to this group within *Oxyscelio*, and previously has been used to help define the Scelionini, Nixoniini, and Sparasionini (Masner 1976)

Contains: *O. absentiae*, *O. bicolor*, *O. idoli*, *O. xenii*.

Oxyscelio crateris species group

Characteristics. Hyperoccipital carina connected to occipital carina laterally. Hind wing vein (Sc+R) not interrupted.

Comments. The *crateris*-group also occurs in the Indo-Malayan realm, with species that have a slightly less pronounced “crater” on the occiput between the hyperoccipital and occipital carinae. A potential species complex within this group contains *O. io*, *O. nemesis*, and *O. teli*, which are vaguely similar in the shape of the head, body, hyperoccipital carina, and occipital carina. However, that grouping was not upheld by the phylogenetic analysis and could not be characterized with any consistently definable features.

Contains: *O. gyri*, *O. io*, *O. lunae*, *O. nemesis*, *O. pulveris*, *O. kylix*, *O. teli*.

Oxyscelio cuculli species group

Characteristics. Hyperoccipital carina present as a sharp carina but not connected to occipital carina laterally. Hind wing vein (Sc+R) not interrupted.

Comments. The *cuculli*-group also occurs throughout the Indo-Malayan realm, with species very similar to the only known African species.

Contains: *O. galeri*.

Species not placed to group

Included species: *O. intensionis*, *O. quassus*.

Comments. There is some general resemblance between *O. intensionis* and the Australian *aciculae*-group, but members of that group do not have a setose metasomal depression. *Oxyscelio quassus* has a setose metasomal depression, but lacks the important features of other species groups, resembling the *bicolor*-group but having a complete hind wing vein. The Indo-Malayan and Australian *dasymesos*-group differs from *O. intensionis* in occipital sculpture and in having sharp projections from the corners of T7. The *dasymesos*-group differs from *O. quassus* in having a complete mesoscutal median carina, and in having a very different (short and stout) body shape.

Key to African species of *Oxyscelio*

1	Hind wing vein (Sc+R) incomplete, broadly interrupted between base and apex (Fig. 4, 77). (*bicolor s*pecies group)	**2**
–	Hind wing vein (Sc+R) complete (Figs 55, 66–67)	**5**
2	Metasomal depression setose (Figs 10, 32–33, 56–57, 65, 75–76)	**3**
–	Metasomal depression not setose (Figs 21, 49)	**4**
3	T1 without carinae between midlobe and lateral areas (Figs 75–77)	***Oxyscelio xenii* Burks, sp. n.**
–	T1 with one or more longitudinal carinae between midlobe and lateral areas (Figs 9–10)	***Oxyscelio bicolor* (Szabó)**
4	Metascutellum much broader than long (Fig. 3); female T1 with very long anterior horn (Figs 3, 5)	***Oxyscelio absentiae* Burks, sp. n.**
–	Metascutellum about as broad as long (Fig. 23); female T1 without anterior horn (Figs 23, 25)	***Oxyscelio idoli* Burks, sp. n.**
5	Metascutellum triangular, acuminate posteriorly (Fig. 13). (*cuculli* group)	***Oxyscelio galeri* Burks, sp. n.**
–	Metascutellum not triangular, not acuminate apically (Figs 17, 32–33, 41, 47, 49, 56–57, 59, 65, 69)	**6**
6	Metasomal depression setose (Figs 32–33, 56–57, 65)	**7**
–	Metasomal depression not setose (Fig. 21) (*crateris* group, in part)	**9**
7	Occipital carina medially flat (Fig. 53) (*crateris* group, in part)	***Oxyscelio nemesis* Burks, sp. n.**
–	Occipital carina medially arched (Fig. 29)	**8**
8	Hyperoccipital carina indicated by a set of complete wrinkle-like carinae (Fig. 29)	***Oxyscelio intensionis* Burks, sp. n.**
–	Hyperoccipital carina absent (Figs 62–63)	***Oxyscelio quassus* Burks, sp. n.**
9	Mesoscutellum with some granulate sculpture (Figs 35, 47, 59)	**10**
–	Mesoscutellum without granulate sculpture (Figs 17, 41, 69)	**12**
10	Frontal depression with median longitudinal carina-like elevation arising from interantennal process (Fig. 36)	***Oxyscelio io* Burks, sp. n.**
–	Frontal depression without median longitudinal carina-like elevation (Figs 48, 60)	**11**
11	Head and mesosomal dorsum with sharp carinae and less extensive granulate sculpture (Figs 46–47)	***Oxyscelio lunae* Burks, sp. n.**

– Head and mesosomal dorsum with weak carinae and more extensive granulate sculpture (Figs 58–59)........................ ***Oxyscelio pulveris*** **Burks, sp. n.**
12 Occipital carina medially flat (Fig. 69).............. ***Oxyscelio teli*** **Burks, sp. n.**
– Occipital carina arched or sinuate medially (Figs 17, 41)......................... **13**
13 Occipital carina with sharp lateral corners, connected to hyperoccipital carina laterally (Fig. 41) .... ***Oxyscelio kylix*** **Burks, sp. n.**
– Occipital carina without lateral corners, not connected to hyperoccipital carina laterally (Fig. 17) .... ***Oxyscelio gyri*** **Burks, sp. n.**

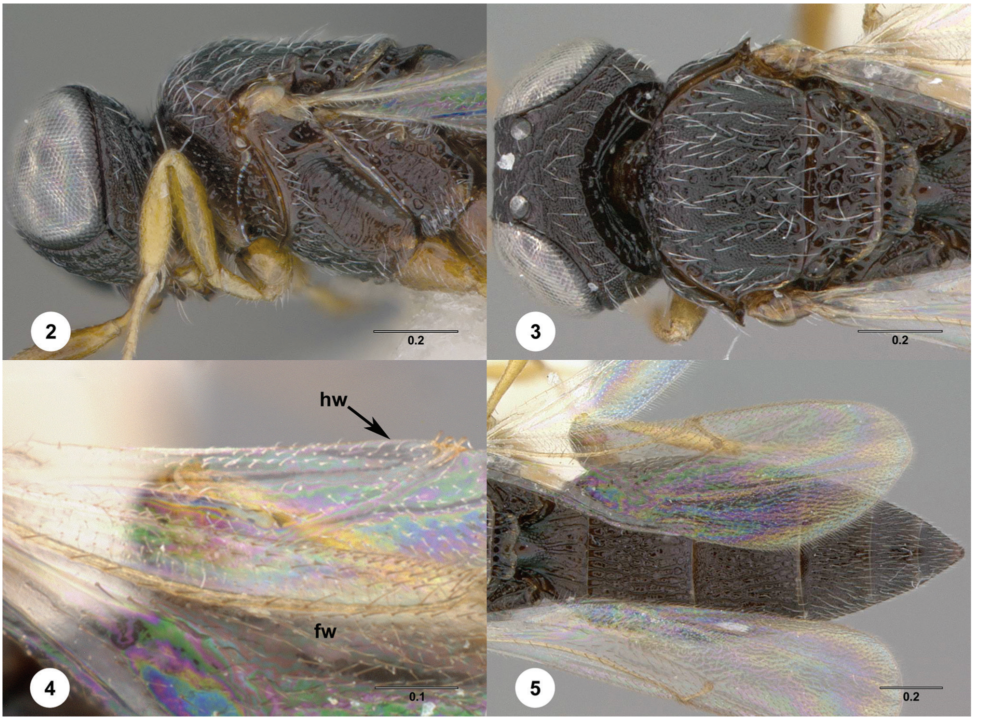
Species descriptions

Oxyscelio absentiae **Burks, sp. n.**
http://zoobank.org/5C78286D-3D78-4825-9EBA-81DCABC13E66
http://bioguid.osu.edu/xbiod_concepts/309292
Figures 2–5; Morphbank[14]

Description. *Female*. Body length 2.5–2.65 mm (n = 4).

Radicle color: same as scape. A4: broader than long. A5: broader than long. Upper frons: not hood-like. Frontal depression sculpture: with 3 or more broadly interrupted transverse carinae; with 2–4 complete transverse carinae. Median longitudinal elevation in frontal depression: absent. Major sculpture of gena anteroventrally: rugose; umbilicate-punctate. Major sculpture of gena posteroventrally: umbilicate-punctate. Microsculpture of gena anteroventrally: granulate. Microsculpture of gena posteroventrally: granulate. Hyperoccipital carina: not indicated medially. Median carina extending posteriorly from hyperoccipital carina: absent. Lateral connection between hyperoccipital and occipital carinae: absent. Area between vertex and occipital carina: umbilicate-foveate; umbilicate-punctate. Occipital carina medially: uniformly rounded. Lateral corners of occipital carina: absent.

Mesoscutum anteriorly: steep. Mesoscutal median carina: absent or incomplete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe posteriorly: absent. Major sculpture of mesoscutellum: umbilicate-foveate. Microsculpture of mesoscutellum medially: punctate. Microsculpture of mesoscutellum laterally: punctate. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: more than 5. Setae along anterior limit of femoral depression: arising from rows of foveae. Metascutellum dorsally: flat or convex. Metascutellar sculpture centrally: with longitudinal carinae. Metascutellar apex: deeply emarginate; shallowly emarginate. Metapleuron above ventral metapleural area: foveate or rugose. Lateral propodeal carinae antero-medially: strongly diverging. Metasomal depression setae: absent. Anterior areoles of metasomal depression: absent. Anterior longitudinal carinae in metasomal



Figures 2–5. *Oxyscelio absentiae* sp. n., paratype female (OSUC 369414) **2** Head and mesosoma, lateral view **3** Head and mesosoma, dorsal view **4** Hind wing, dorsal view (fw = fore wing, hw = hind wing) **5** Metasoma, dorsal view. Morphbank[14]

depression: absent. Postmarginal vein: present. Fore wing apex: reaching middle of T5. Hind wing vein (Sc+R): interrupted.

Carinae between T1 midlobe and T1 lateral carina: present. T1 midlobe: obscured by other raised sculpture. T1: with long anterior bulge that reaches metascutellum. T6: longer than broad; as long as broad. Metasomal apex: rounded. Major sculpture of T6: umbilicate-punctate. Microsculpture of T6: absent; granulate.

Diagnosis. Both sexes: Hyperoccipital carina absent. Gena with granulate sculpture anteroventrally and posteroventrally. Mesoscutellum without granulate sculpture. Metascutellum much broader than long. Metasomal depression not setose, without median carina; lateral propodeal carinae strongly diverging. Hind wing Sc+R interrupted. T1 with carinae between midlobe and lateral carina. Female: A4 broader than long; T1 midlobe with strong anterior horn.

Etymology. Latin noun, genitive case, meaning "absence."

Link to distribution map. [http://hol.osu.edu/map-full.html?id=309292]

Material examined. Holotype, female: **SOMALIA:** Mogadishu, Shabelle (Shabelli) Valley, Afgooye (Afgoi), 1.II–15.II.1977, malaise trap, F. Bin, OSUC 369416 (deposited in CNCI). *Paratypes*: **SOMALIA:** 3 females, OSUC 369414–369415, 369417 (CNCI).

***Oxyscelio bicolor* (Szabó), comb. n.**
http://zoobank.org/FE1CAEFA-4FFD-4ADC-B7A4-55D1F5FA55A6
http://bioguid.osu.edu/xbiod_concepts/4310
Figures 6–11; Morphbank[15]

Freniger bicolor Szabó 1956: 48 (original description); Masner 1976: 20 (type information).

Description. *Female*. Body length 3.15–3.55 mm (n = 5).

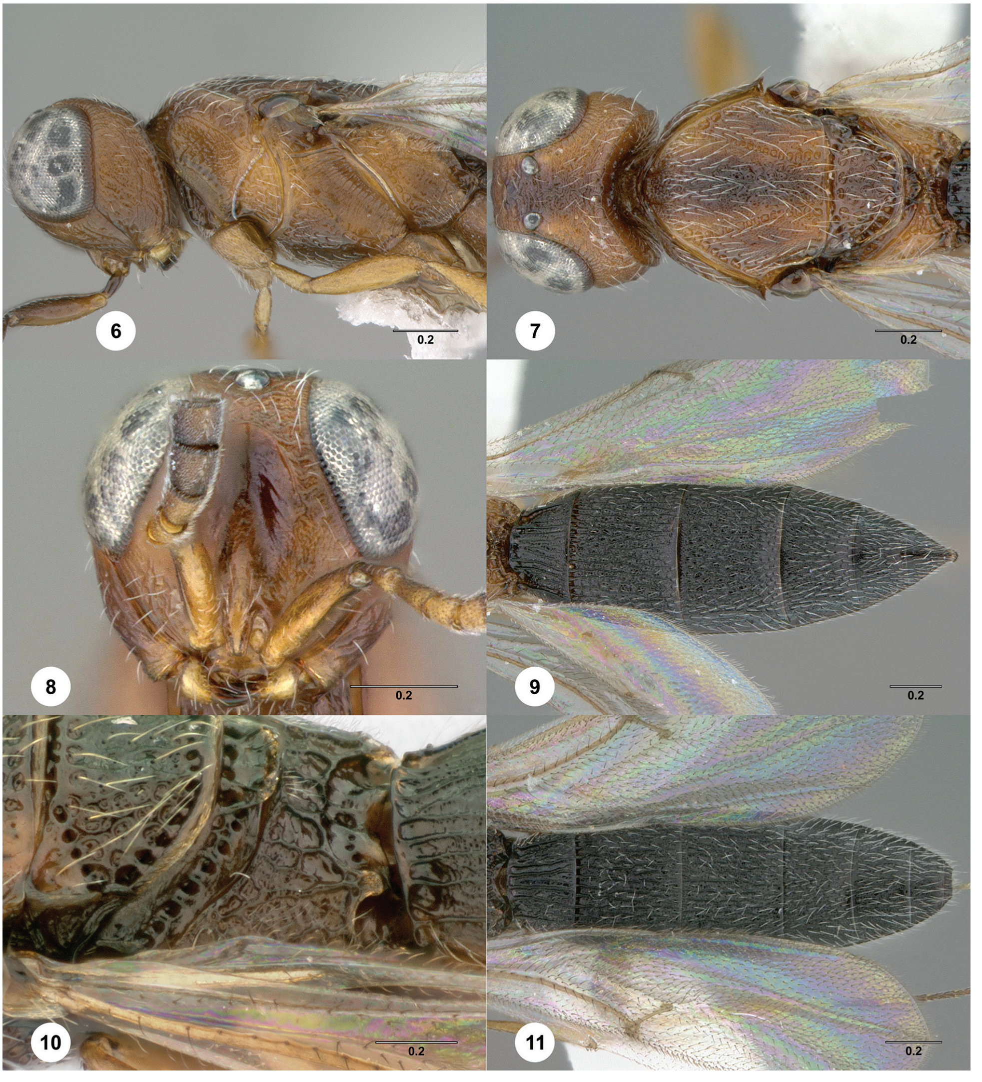
Radicle color: same as scape; darker than scape. A4: longer than broad. A5: broader than long. Upper frons: not hood-like. Frontal depression sculpture: with 1–2 broadly interrupted transverse carinae. Median longitudinal elevation in frontal depression: absent. Major sculpture of gena anteroventrally: umbilicate-foveate; rugose. Major sculpture of gena posteroventrally: rugose; umbilicate-punctate. Microsculpture of gena anteroventrally: granulate. Microsculpture of gena posteroventrally: granulate. Hyperoccipital carina: wrinkle-like. Median carina extending posteriorly from hyperoccipital carina: absent. Lateral connection between hyperoccipital and occipital carinae: absent. Area between vertex and occipital carina: umbilicate-foveate; rugose. Occipital carina medially: uniformly rounded. Lateral corners of occipital carina: absent.

Mesoscutum anteriorly: not steep. Mesoscutal median carina: absent or incomplete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe posteriorly: absent; granulate. Major sculpture of mesoscutellum: umbilicate-foveate; obliquely rugose. Microsculpture of mesoscutellum medially: absent. Microsculpture of mesoscutellum laterally: absent. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: more than 5. Setae along anterior limit of femoral depression: arising from rows of foveae. Metascutellum dorsally: concave. Metascutellar sculpture centrally: smooth; rugose. Metascutellar apex: convex or straight. Metapleuron above ventral metapleural area: foveate or rugose. Lateral propodeal carinae antero-medially: weakly diverging. Metasomal depression setae: present. Anterior areoles of metasomal depression: one or more areoles present. Anterior longitudinal carinae in metasomal depression: absent. Postmarginal vein: present. Fore wing apex: reaching apex of T6; reaching beyond T6. Hind wing vein (Sc+R): interrupted.

Carinae between T1 midlobe and T1 lateral carina: present. T1 midlobe: with 6 or more longitudinal carinae. T1: without anterior bulge. T6: broader than long. Metasomal apex: rounded. Major sculpture of T6: umbilicate-punctate. Microsculpture of T6: granulate.

Male. Body length 3.15–3.4 mm (n = 7). A5 tyloid: carina-like, not expanded. A11: longer than broad. T1 midlobe: with 5 longitudinal carinae. Metasomal apex: with acuminate lateral corners.

Diagnosis. Both sexes: Hyperoccipital carina wrinkle-like, not connected to occipital carina laterally or medially. Gena with granulate sculpture anteroventrally and pos-



Figures 6–11. *Oxyscelio bicolor* (Szabó), female (OSUC 369418) **6** Head and mesosoma, lateral view **7** Head and mesosoma, dorsal view **8** Head, anterior view **9** Metasoma, dorsal view. Female (OSUC 369371) **10** Propodeum, dorsolateral view. Male (OSUC 369427) **11** Metasoma, dorsal view. Morphbank[15]

teroventrally. Mesoscutellum without granulate sculpture; without punctate sculpture between foveae. Metasomal depression setose, without median carina; lateral propodeal carinae weakly diverging. Hind wing Sc+R interrupted. T1 with carinae between midlobe and lateral carina. Female: A4 longer than broad; T1 without anterior horn.

Link to distribution map. [http://hol.osu.edu/map-full.html?id=4310]

Material examined. Holotype, female: **TANZANIA:** Arusha Reg., Upper Arusha (Arusha-Ju), X–1905, Katona, Hym.Typ.No. 9553, Mus.Budapest (deposited in HNHM). Other material: (4 females, 8 males) **KENYA:** 3 females, 7 males, OSUC

369418, 369425–369433 (CNCI). **TANZANIA:** 1 female, 1 male, OSUC 369370–369371 (CNCI).

Comments. *Freniger* Szabó represents an unusual species group of African *Oxyscelio*, with a broadly interrupted hind wing vein (Sc+R). The metasomal depression setae in this and some other African *Oxyscelio* are rarely found in species outside Africa – only in the two Asian and single Australian species of the *dasymesos* group.

Oxyscelio galeri Burks, sp. n.

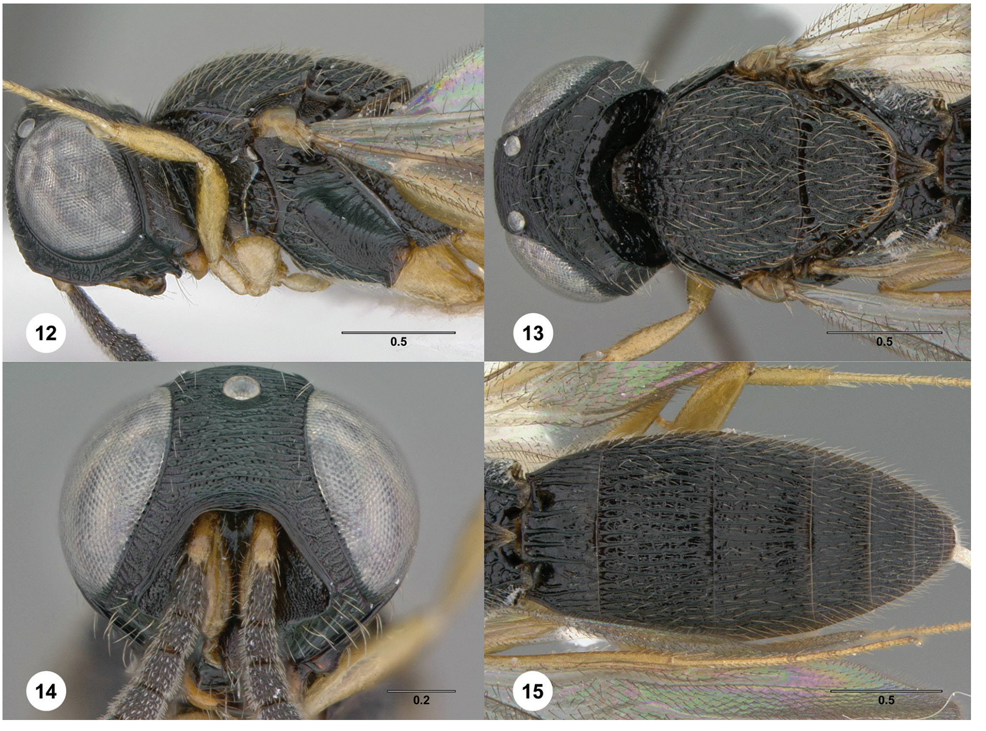
http://zoobank.org/51C5ECA4-5C4D-402E-A7A4-8F2E7E4995F3
http://bioguid.osu.edu/xbiod_concepts/309293
Figures 12–15; Morphbank[16]

Description. *Male*. Body length 3.95–4.1 mm (n = 5).

Radicle color: same as scape. A5 tyloid: carina-like, not expanded. A11: longer than broad. Upper frons: hood-like, protruding over pedicel when antenna at rest. Frontal depression sculpture: without transverse or oblique carinae below submedian carina. Median longitudinal elevation in frontal depression: absent. Major sculpture of gena anteroventrally: umbilicate-foveate. Major sculpture of gena posteroventrally: umbilicate-punctate. Microsculpture of gena anteroventrally: granulate. Microsculpture of gena posteroventrally: granulate. Hyperoccipital carina: complete as a sharp carina. Median carina extending posteriorly from hyperoccipital carina: absent. Lateral connection between hyperoccipital and occipital carinae: absent. Area between vertex and occipital carina: umbilicate-foveate; rugose. Occipital carina medially: sinuate with a more strongly arched median portion. Lateral corners of occipital carina: absent.

Mesoscutum anteriorly: not steep. Mesoscutal median carina: present and complete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate; transversely rugose; obliquely rugose. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe posteriorly: granulate. Major sculpture of mesoscutellum: umbilicate-foveate; obliquely rugose. Microsculpture of mesoscutellum medially: granulate. Microsculpture of mesoscutellum laterally: granulate. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: more than 5. Setae along anterior limit of femoral depression: arising from rows of foveae. Metascutellum dorsally: concave. Metascutellar sculpture centrally: with longitudinal carinae. Metascutellar apex: sharply acuminate. Metapleuron above ventral metapleural area: foveate or rugose. Lateral propodeal carinae antero-medially: strongly diverging. Metasomal depression setae: absent. Anterior areoles of metasomal depression: absent. Anterior longitudinal carinae in metasomal depression: absent. Postmarginal vein: present. Hind wing vein (Sc+R): not interrupted.

Carinae between T1 midlobe and T1 lateral carina: absent. T1 midlobe: with 4 longitudinal carinae. Metasomal apex: with no distinct corners.



Figures 12–15. *Oxyscelio galeri* sp. n., paratype male (OSUC 369355) **12** Head and mesosoma, lateral view **13** Head and mesosoma, dorsal view **14** Head, anterior view **15** Metasoma, dorsal view. Morphbank[16]

Diagnosis. Both sexes: Frontal depression forming hood-like structure (deep and with strongly protruding submedian carina that overhangs pedicels). Hyperoccipital carina present and sharp, not connected to occipital carina laterally; median carina between hyperoccipital carina and occipital carina absent. Gena with granulate sculpture anteroventrally and posteroventrally. Mesoscutellum with granulate sculpture. Metascutellum acuminate apically. Metasomal depression without median carina; lateral propodeal carinae strongly diverging. Hind wing Sc+R complete.

Etymology. Latin noun, genitive case, referring to a kind of helmet.

Link to distribution map. [http://hol.osu.edu/map-full.html?id=309293]

Material examined. Holotype, female: **CAMEROON:** Centre Prov., Mbalmayo, VII–1993, malaise trap, P. Eggleton, OSUC 369356 (deposited in BMNH). *Paratypes*: **CAMEROON:** 5 males, OSUC 369353–369355 (CNCI), 369357–369358 (BMNH).

Comments. The other members of the *cuculli* group are widespread in Asia, including China and India. *Oxyscelio galeri* is distinct within this group due to its acuminate metascutellum.

Oxyscelio gyri **Burks, sp. n.**
http://zoobank.org/43C8DD10-DDEA-40DE-AAA5-2CB62ED3FE09
http://bioguid.osu.edu/xbiod_concepts/309294
Figures 16–21; Morphbank[17]

Description. *Female*. Body length 3.35 mm (n = 1).

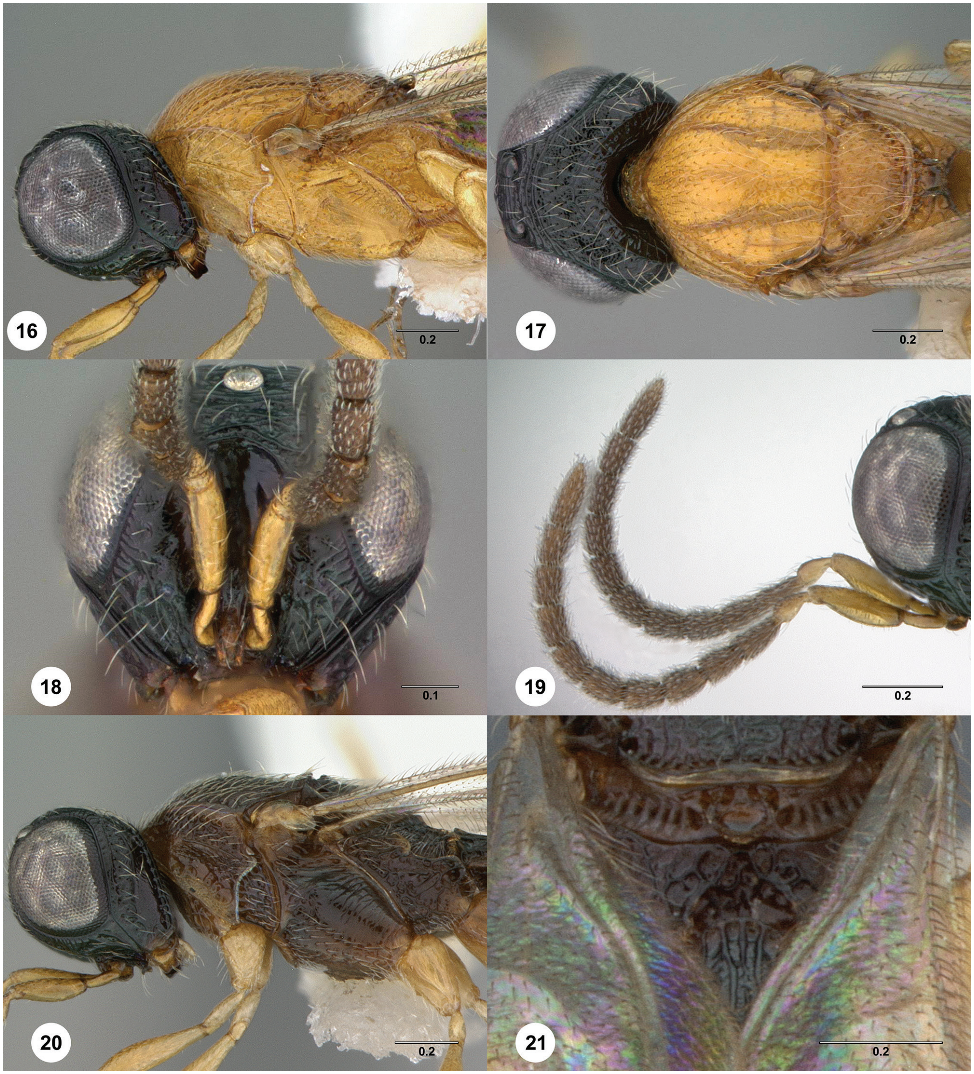
Radicle color: same as scape. A4: longer than broad. A5: longer than broad; as long as broad. Upper frons: not hood-like. Frontal depression sculpture: with 2–4 complete transverse carinae. Median longitudinal elevation in frontal depression: absent. Major sculpture of gena anteroventrally: umbilicate-foveate. Major sculpture of gena posteroventrally: absent. Microsculpture of gena anteroventrally: absent. Microsculpture of gena posteroventrally: granulate. Hyperoccipital carina: complete as a sharp carina. Median carina extending posteriorly from hyperoccipital carina: absent. Lateral connection between hyperoccipital and occipital carinae: absent. Area between vertex and occipital carina: rugose; umbilicate-punctate. Occipital carina medially: uniformly rounded. Lateral corners of occipital carina: absent.

Mesoscutum anteriorly: not steep. Mesoscutal median carina: present and complete; absent or incomplete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate; umbilicate-punctate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate; obliquely rugose. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe posteriorly: absent. Major sculpture of mesoscutellum: umbilicate-foveate; obliquely rugose. Microsculpture of mesoscutellum medially: absent. Microsculpture of mesoscutellum laterally: absent. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: more than 5. Setae along anterior limit of femoral depression: arising from rows of foveae. Metascutellum dorsally: concave. Metascutellar sculpture centrally: smooth. Metascutellar apex: convex or straight. Metapleuron above ventral metapleural area: crossed by carinae. Lateral propodeal carinae antero-medially: strongly diverging; weakly diverging. Metasomal depression setae: absent. Anterior areoles of metasomal depression: absent. Anterior longitudinal carinae in metasomal depression: absent. Postmarginal vein: present. Fore wing apex: reaching middle of T6. Hind wing vein (Sc+R): not interrupted.

Carinae between T1 midlobe and T1 lateral carina: present. T1 midlobe: with 5 longitudinal carinae; with 6 or more longitudinal carinae. T1: without anterior bulge. T6: broader than long; as long as broad. Metasomal apex: rounded. Major sculpture of T6: umbilicate-punctate; longitudinally striate or rugose. Microsculpture of T6: granulate.

Male. Body length 3.2 mm (n = 1). A5 tyloid: carina-like, not expanded. A11: longer than broad. T1 midlobe: with 5 longitudinal carinae. Metasomal apex: with acuminate lateral corners.

Diagnosis. Both sexes: Hyperoccipital carina present and sharp, not connected to occipital carina laterally; median carina between hyperoccipital and occipital carinae absent. Gena with granulate sculpture posteroventrally but not anteroventrally. Mesoscutellum without granulate sculpture. Metasomal depression without median



Figures 16–21. *Oxyscelio gyri* sp. n., holotype female (OSUC 369372) **16** Head and mesosoma, lateral view **17** Head and mesosoma, dorsal view Paratype male (OSUC 369374) **18** Head, anterior view **19** Antenna **20** Mesosoma, lateral view **21** Propodeum, posterior view. Morphbank[17]

carina; lateral propodeal carinae strongly or weakly diverging. Hind wing Sc+R vein complete. Female: A4 longer than broad.

Etymology. Latin noun, genitive case, meaning "circle."

Link to distribution map. [http://hol.osu.edu/map-full.html?id=309294]

Material examined. Holotype, female: **TANZANIA:** Tanga Reg., hills, Amani, 23.VI–24.VII.2001, D. Quicke, OSUC 369372 (deposited in BMNH). *Paratypes*: **TANZANIA:** 1 female, 1 male, OSUC 369373, 369374 (BMNH).

Oxyscelio idoli **Burks, sp. n.**
http://zoobank.org/97BEFB0C-F785-48A3-B660-72AF7AE6B20A
http://bioguid.osu.edu/xbiod_concepts/309295
Figures 22–27; Morphbank[18]

Description. *Female*. Body length 2.55–2.6 mm (n = 2).

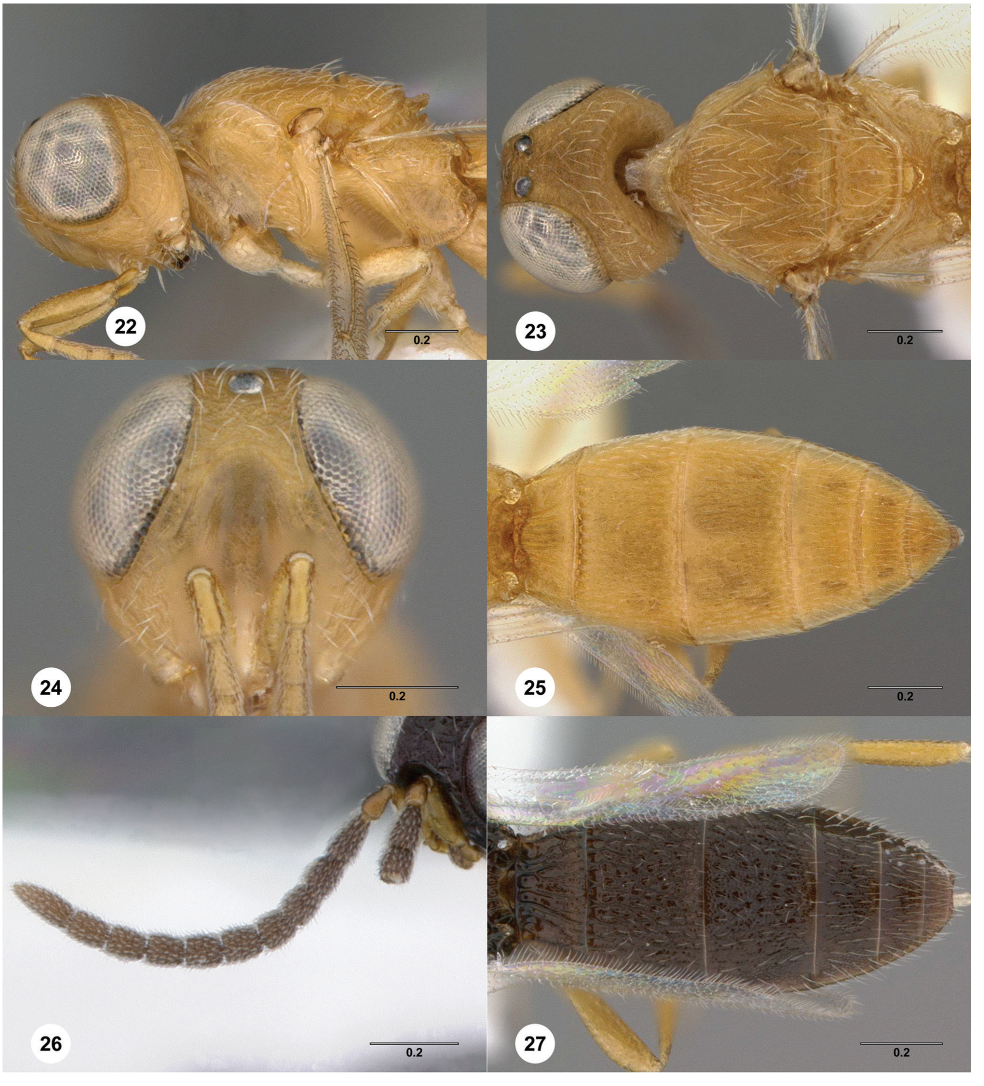
Radicle color: same as scape. A4: longer than broad; as long as broad. A5: broader than long. Upper frons: not hood-like. Frontal depression sculpture: with 2–4 complete transverse carinae; with 1–2 broadly interrupted transverse carinae. Median longitudinal elevation in frontal depression: absent. Major sculpture of gena anteroventrally: rugose; umbilicate-punctate. Major sculpture of gena posteroventrally: umbilicate-foveate; rugose. Microsculpture of gena anteroventrally: granulate. Microsculpture of gena posteroventrally: granulate. Hyperoccipital carina: wrinkle-like. Median carina extending posteriorly from hyperoccipital carina: absent. Lateral connection between hyperoccipital and occipital carinae: absent. Area between vertex and occipital carina: rugose; umbilicate-punctate. Occipital carina medially: uniformly rounded. Lateral corners of occipital carina: absent.

Mesoscutum anteriorly: not steep. Mesoscutal median carina: present and complete; absent or incomplete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate; umbilicate-punctate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe posteriorly: absent; granulate. Major sculpture of mesoscutellum: umbilicate-foveate; obliquely rugose. Microsculpture of mesoscutellum medially: absent. Microsculpture of mesoscutellum laterally: absent. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: more than 5. Setae along anterior limit of femoral depression: arising from rows of foveae. Metascutellum dorsally: concave. Metascutellar sculpture centrally: smooth. Metascutellar apex: convex or straight; shallowly emarginate. Metapleuron above ventral metapleural area: crossed by carinae. Lateral propodeal carinae antero-medially: weakly diverging. Metasomal depression setae: absent. Anterior areoles of metasomal depression: one or more areoles present. Anterior longitudinal carinae in metasomal depression: absent. Postmarginal vein: present. Fore wing apex: reaching beyond T6. Hind wing vein (Sc+R): interrupted.

Carinae between T1 midlobe and T1 lateral carina: present. T1 midlobe: with 6 or more longitudinal carinae. T1: without anterior bulge. T6: broader than long. Metasomal apex: rounded. Major sculpture of T6: umbilicate-punctate. Microsculpture of T6: absent.

Male. Body length 2.4 mm (n = 1). A5 tyloid: carina-like, not expanded. A11: longer than broad. T1 midlobe: with 4 longitudinal carinae. Metasomal apex: with acuminate lateral corners.

Diagnosis. Both sexes: Hyperoccipital carina wrinkle-like. Gena with granulate sculpture anteroventrally and posteroventrally. Mesoscutellum without granulate sculpture. Metascutellum about as broad as long. Metasomal depression not setose;



Figures 22–27. *Oxyscelio idoli* sp. n., holotype female (OSUC 369367) **22** Head and mesosoma, lateral view **23** Head and mesosoma, dorsal view **24** Head, anterior view **25** Metasoma, dorsal view. Paratype male (OSUC 369368) **26** Antenna **27** Metasoma, dorsal view. Morphbank[18]

lateral propodeal carinae weakly diverging. Hind wing Sc+R interrupted. Female: T1 midlobe without anterior horn.

Etymology. Latin noun, genitive case, meaning "ghost."

Link to distribution map. [http://hol.osu.edu/map-full.html?id=309295]

Material examined. Holotype, female: **TANZANIA:** Tanga Reg., Muheza Dist., canopy, Kwangumi Forest Reserve, 04°57'S 38°44'E, 9.XI.1995, fogging, OSUC 369367 (deposited in BMNH). *Paratypes*: **TANZANIA:** 1 female, 1 male, OSUC 369366, 369368 (BMNH).

***Oxyscelio intensionis* Burks, sp. n.**
http://zoobank.org/828EFF7A-C702-46CA-8E73-C523925A3ABC
http://bioguid.osu.edu/xbiod_concepts/309296
Figures 28–33; Morphbank[19]

Description. *Male*. Body length 3.55 mm (n = 1).

Radicle color: same as scape. A5 tyloid: carina-like, not expanded. A11: longer than broad. Upper frons: not hood-like. Frontal depression sculpture: without transverse or oblique carinae below submedian carina. Median longitudinal elevation in frontal depression: present. Major sculpture of gena anteroventrally: rugose; umbilicate-punctate. Major sculpture of gena posteroventrally: rugose; umbilicate-punctate. Microsculpture of gena anteroventrally: absent. Microsculpture of gena posteroventrally: absent. Hyperoccipital carina: wrinkle-like. Median carina extending posteriorly from hyperoccipital carina: absent. Lateral connection between hyperoccipital and occipital carinae: absent. Area between vertex and occipital carina: umbilicate-foveate; rugose. Occipital carina medially: uniformly rounded. Lateral corners of occipital carina: absent.

Mesoscutum anteriorly: not steep. Mesoscutal median carina: absent or incomplete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe posteriorly: absent. Major sculpture of mesoscutellum: umbilicate-foveate; longitudinally rugose. Microsculpture of mesoscutellum medially: absent. Microsculpture of mesoscutellum laterally: absent. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: more than 5. Setae along anterior limit of femoral depression: arising from tiny pits. Metascutellum dorsally: concave. Metascutellar sculpture centrally: smooth. Metascutellar apex: convex or straight. Metapleuron above ventral metapleural area: crossed by carinae. Lateral propodeal carinae antero-medially: weakly diverging. Metasomal depression setae: present. Anterior areoles of metasomal depression: one or more areoles present. Anterior longitudinal carinae in metasomal depression: absent. Postmarginal vein: present. Hind wing vein (Sc+R): not interrupted.

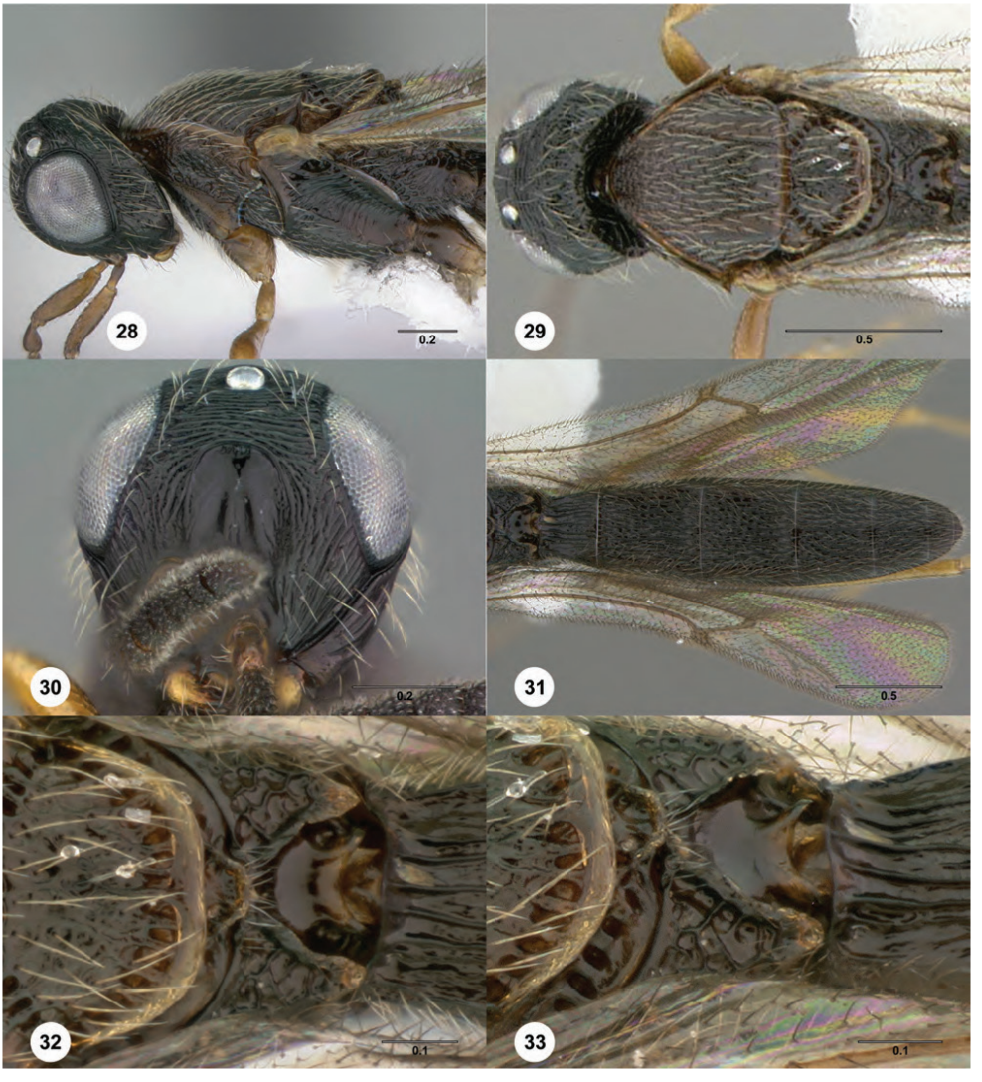
Carinae between T1 midlobe and T1 lateral carina: absent. T1 midlobe: with 5 longitudinal carinae. Metasomal apex: with no distinct corners.

Diagnosis. Both sexes: Hyperoccipital carina wrinkle-like, not connected to occipital carina laterally or medially. Frontal depression with median carina. Mesoscutellum without granulate sculpture. Metasomal depression setose; lateral propodeal carinae broadly separated. Hind wing Sc+R not interrupted. Male: T7 without acuminate lateral corners.

Etymology. Latin noun, genitive case, meaning “an extension.”

Link to distribution map. [http://hol.osu.edu/map-full.html?id=309296]

Material examined. Holotype, male: **TANZANIA:** Iringa Reg., Kilolo Dist., Udzungwa (Uzungwa) Mts., Luwala (Luwato) Camp area, semi-evergreen montane tropical



Figures 28–33. *Oxyscelio intensionis* sp. n., holotype male (OSUC 369369) **28** Head and mesosoma, lateral view **29** Head and mesosoma, dorsal view **30** Head, anterior view **31** Metasoma, dorsal view **32** Propodeum, dorsal view **33** Propodeum, dorsolateral view. Morphbank[19]

virgin forest edge, Ndundulu Forest, 1880m, 18.I–25.I.2007, malaise trap, L. A. Hansen & A. Hedayat, OSUC 369369 (deposited in BMNH).

Comments. *Oxyscelio intensionis* bears some resemblance to several Australian species of the *aciculae* group, especially to *Oxyscelio divisionis* Burks. None of the species within that group has a setose metasomal depression.

Oxyscelio io **Burks, sp. n.**
http://zoobank.org/DADCE45A-7345-4893-BB8C-2AF7F2129B31
http://bioguid.osu.edu/xbiod_concepts/309297
Figures 34–39; Morphbank[20]

Description. *Female*. Body length 4.6–5.25 mm (n = 9).

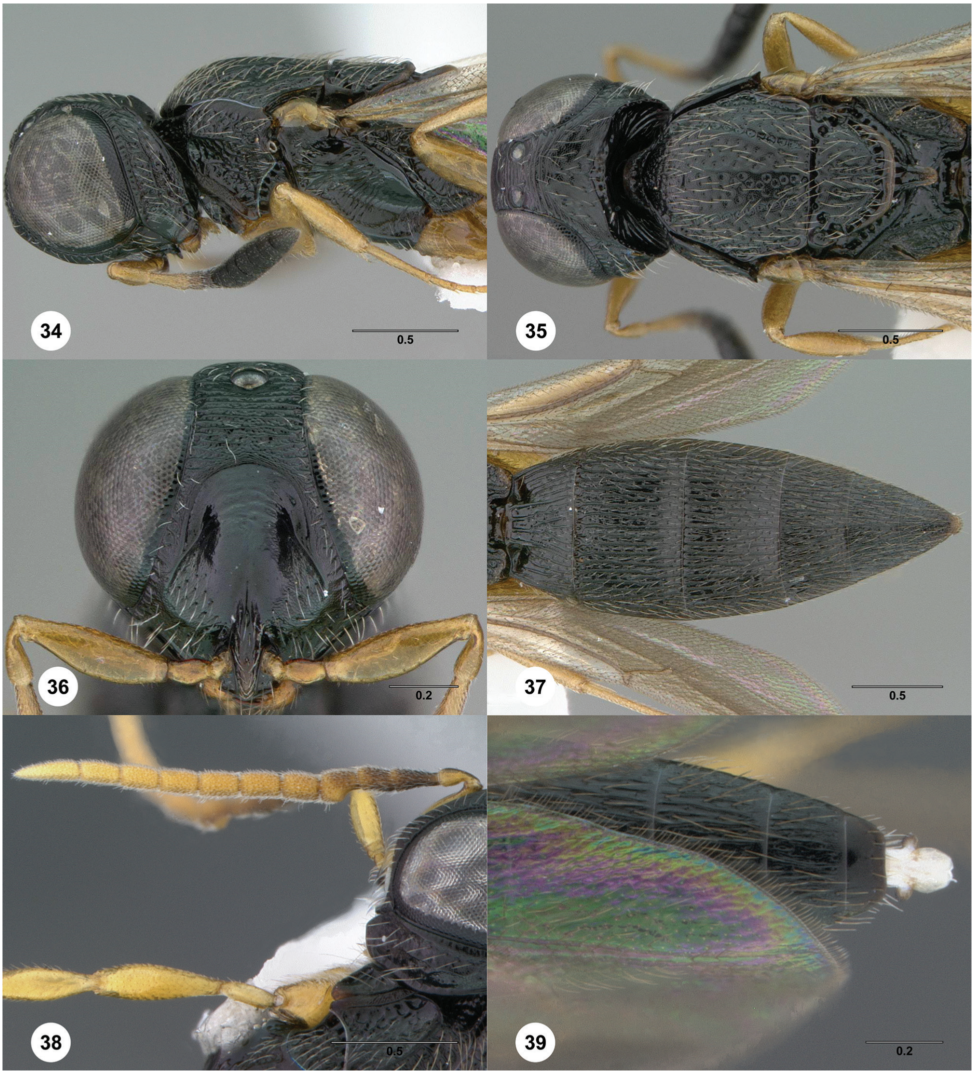
Radicle color: same as scape. A4: broader than long; as long as broad. A5: broader than long. Upper frons: not hood-like. Frontal depression sculpture: with 2–4 complete transverse carinae. Median longitudinal elevation in frontal depression: present. Major sculpture of gena anteroventrally: umbilicate-foveate. Major sculpture of gena posteroventrally: umbilicate-foveate. Microsculpture of gena anteroventrally: absent. Microsculpture of gena posteroventrally: granulate. Hyperoccipital carina: wrinkle-like. Median carina extending posteriorly from hyperoccipital carina: absent; present, anteriorly incomplete. Lateral connection between hyperoccipital and occipital carinae: absent. Area between vertex and occipital carina: umbilicate-foveate; umbilicate-punctate. Occipital carina medially: with nearly flat angular median portion. Lateral corners of occipital carina: sharp and protruding corners present.

Mesoscutum anteriorly: not steep. Mesoscutal median carina: absent or incomplete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe posteriorly: granulate. Major sculpture of mesoscutellum: umbilicate-foveate. Microsculpture of mesoscutellum medially: granulate. Microsculpture of mesoscutellum laterally: granulate. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: 3–5; more than 5. Setae along anterior limit of femoral depression: arising from tiny pits. Metascutellum dorsally: concave. Metascutellar sculpture centrally: smooth. Metascutellar apex: convex or straight. Metapleuron above ventral metapleural area: crossed by carinae. Lateral propodeal carinae antero-medially: weakly diverging. Metasomal depression setae: absent. Anterior areoles of metasomal depression: one or more areoles present. Anterior longitudinal carinae in metasomal depression: absent. Postmarginal vein: absent. Fore wing apex: reaching apex of T5; reaching middle of T6. Hind wing vein (Sc+R): not interrupted.

Carinae between T1 midlobe and T1 lateral carina: present. T1 midlobe: with 4 longitudinal carinae. T1: without anterior bulge. T6: broader than long; as long as broad. Metasomal apex: rounded. Major sculpture of T6: umbilicate-punctate; longitudinally striate or rugose. Microsculpture of T6: granulate.

Male. Body length 4.8 mm (n = 2). A5 tyloid: expanded, teardrop-shaped or sinuate. A11: longer than road. T1 midlobe: with 4 longitudinal carinae. Metasomal apex: with acuminate lateral corners.

Diagnosis. Both sexes: Hyperoccipital carina wrinkle-like, connected to occipital carina by lateral elevation; median carina between hyperoccipital and occipital carinae present but sometimes indicated only posteriorly; occipital carina nearly flat medially. Mesoscutellum with granulate sculpture. Metasomal depression not setose, without



Figures 34–39. *Oxyscelio io* sp. n., holotype female (OSUC 369403) **34** Head and mesosoma, lateral view **35** Head and mesosoma, dorsal view **36** Head, anterior view **37** Metasoma, dorsal view. Paratype male (OSUC 470506) **38** Antenna **39** Metasomal apex, dorsal view. Morphbank[20]

median carina; lateral propodeal carinae weakly diverging. Hind wing Sc+R vein complete. Female: T6 rounded apically.

Etymology. Noun, referring to a moon of Jupiter.

Link to distribution map. [http://hol.osu.edu/map-full.html?id=309297]

Material examined. Holotype, female: **GUINEA:** Lola Pref., rainforest, Mount Nimba, 07°41–42'N 08°23'W, 514–740m, XII–1990 – III–1991, flight intercept trap, L. Leblanc, OSUC 369403 (deposited in CNCI). *Paratypes*: (8 females, 3 males) **CAMEROON:** 2 females, OSUC 369362 (BMNH), 369363 (CNCI). **CENTRAL**

AFRICAN REPUBLIC: 3 females, 1 male, OSUC 267414, 369392 (OSUC); OSUC 242798, 320839 (SAMC). **CONGO:** 1 female, 1 male, OSUC 470506–470507 (OSUC). **GUINEA:** 1 female, OSUC 369407 (CNCI). **NIGERIA:** 1 male, OSUC 369382 (BMNH). **UGANDA:** 1 female, OSUC 369390 (CNCI).

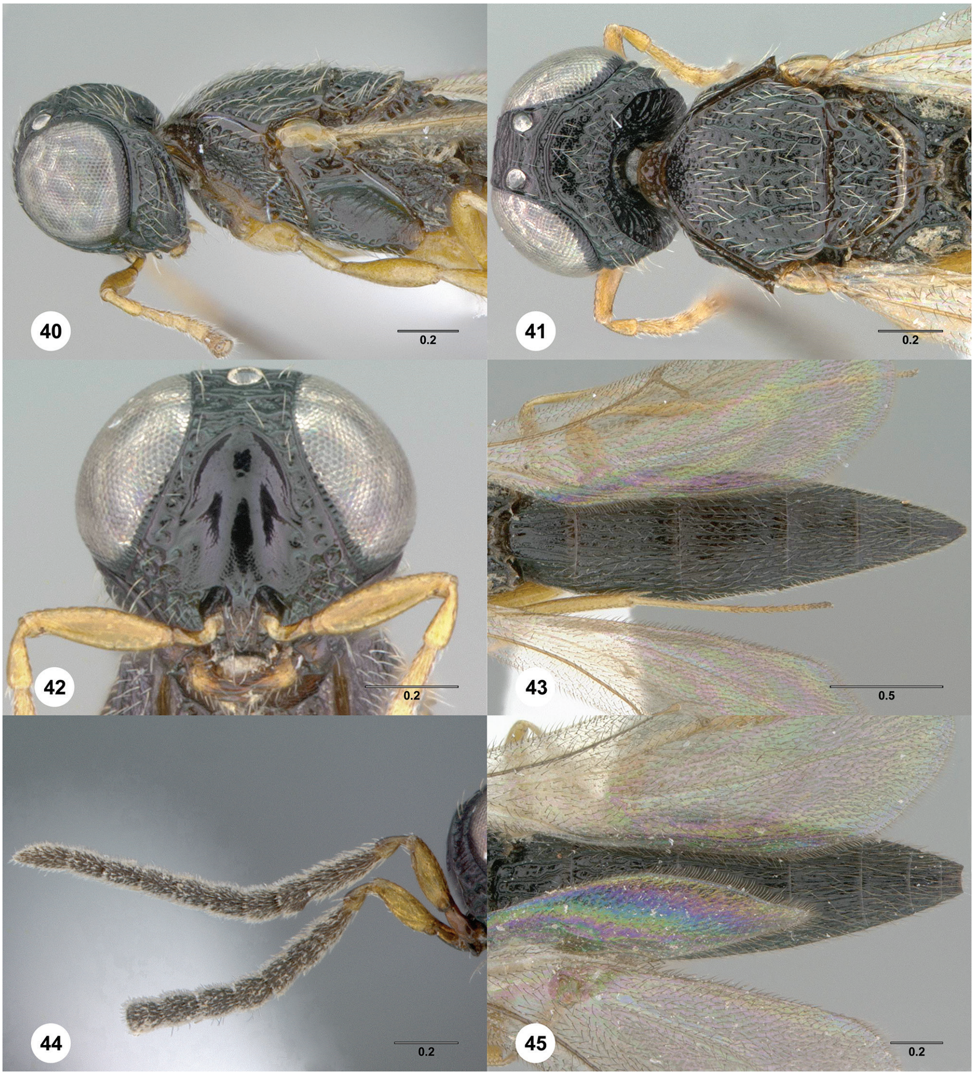
***Oxyscelio kylix* Burks, sp. n.**
http://zoobank.org/420B994F-F83B-421B-9C56-7CDB1A7D2E94
http://bioguid.osu.edu/xbiod_concepts/309298
Figures 40–45; Morphbank[21]

Description. *Female*. Body length 3.3–3.85 mm (n = 13).

Radicle color: same as scape. A4: longer than broad. A5: longer than broad; as long as broad. Upper frons: not hood-like. Frontal depression sculpture: with 1–2 broadly interrupted transverse carinae. Median longitudinal elevation in frontal depression: absent. Major sculpture of gena anteroventrally: umbilicate-foveate. Major sculpture of gena posteroventrally: rugose; umbilicate-punctate. Microsculpture of gena anteroventrally: absent. Microsculpture of gena posteroventrally: granulate. Hyperoccipital carina: complete as a sharp carina. Median carina extending posteriorly from hyperoccipital carina: present, complete; present, anteriorly incomplete. Lateral connection between hyperoccipital and occipital carinae: present as a distinct carina. Area between vertex and occipital carina: rugose; umbilicate-punctate. Occipital carina medially: uniformly rounded. Lateral corners of occipital carina: sharp and protruding corners present.

Mesoscutum anteriorly: not steep. Mesoscutal median carina: present and complete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe posteriorly: absent; granulate. Major sculpture of mesoscutellum: umbilicate-foveate; obliquely rugose. Microsculpture of mesoscutellum medially: absent. Microsculpture of mesoscutellum laterally: absent. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: more than 5. Setae along anterior limit of femoral depression: arising from rows of foveae. Metascutellum dorsally: concave. Metascutellar sculpture centrally: smooth. Metascutellar apex: convex or straight; shallowly emarginate. Metapleuron above ventral metapleural area: crossed by carinae. Lateral propodeal carinae antero-medially: strongly diverging. Metasomal depression setae: absent. Anterior areoles of metasomal depression: absent. Anterior longitudinal carinae in metasomal depression: absent. Postmarginal vein: present. Fore wing apex: reaching middle of T5. Hind wing vein (Sc+R): not interrupted.

Carinae between T1 midlobe and T1 lateral carina: present. T1 midlobe: obscured by other raised sculpture. T1: with weak anterior bulge that does not closely approach metascutellum. T6: longer than broad. Metasomal apex: rounded. Major sculpture of T6: umbilicate-punctate; longitudinally striate or rugose. Microsculpture of T6: granulate.



Figures 40–45. *Oxyscelio kylix* sp. n., holotype female (OSUC 369399) **40** Head and mesosoma, lateral view **41** Head and mesosoma, dorsal view **42** Head, anterior view **43** Metasoma, dorsal view. Paratype male (OSUC 369389) **44** Antenna **45** Metasoma, dorsal view. Morphbank[21]

Male. Body length 3.25–3.65 mm (n = 3). A5 tyloid: carina-like, not expanded. A11: longer than broad. T1 midlobe: with 4 longitudinal carinae. Metasomal apex: with acuminate lateral corners.

Diagnosis. Both sexes: Hyperoccipital carina present and sharp, connected to occipital carina by lateral carina; median carina between hyperoccipital and occipital carinae present but sometimes indicated only posteriorly. Gena with granulate sculpture posteroventrally but not anteroventrally. Mesoscutellum without granulate sculpture.

Metasomal depression without setae, without median carina; lateral propodeal carinae strongly diverging. Hind wing Sc+R vein complete. Female: A4 longer than broad.

Etymology. Greek noun, meaning “cup.”

Link to distribution map. [http://hol.osu.edu/map-full.html?id=309298]

Material examined. Holotype, female: **GUINEA:** Lola Pref., Gouan River, rainforest, Mount Nimba, 07°42'N 08°23'W, 514m, 7.I–15.I.1991, flight intercept trap, L. Leblanc, OSUC 369399 (deposited in CNCI). *Paratypes*: (12 females, 3 males) **CAMEROON:** 1 female, OSUC 369364 (BMNH). **CENTRAL AFRICAN REPUBLIC:** 2 females, OSUC 223601, 251693 (SAMC). **CONGO:** 1 male, OSUC 470505 (OSUC). **GABON:** 1 female, OSUC 369395 (BMNH). **GHANA**: 1 female, OSUC 321001 (OSUC). **GUINEA:** 2 females, OSUC 369405, 369411 (CNCI). **IVORY COAST:** 1 female, OSUC 369377 (BMNH). **NIGERIA:** 4 females, 1 male, OSUC 369380–369381 (CNCI); 369378, 369383–369384 (BMNH). **UGANDA:** 1 male, OSUC 369389 (CNCI).

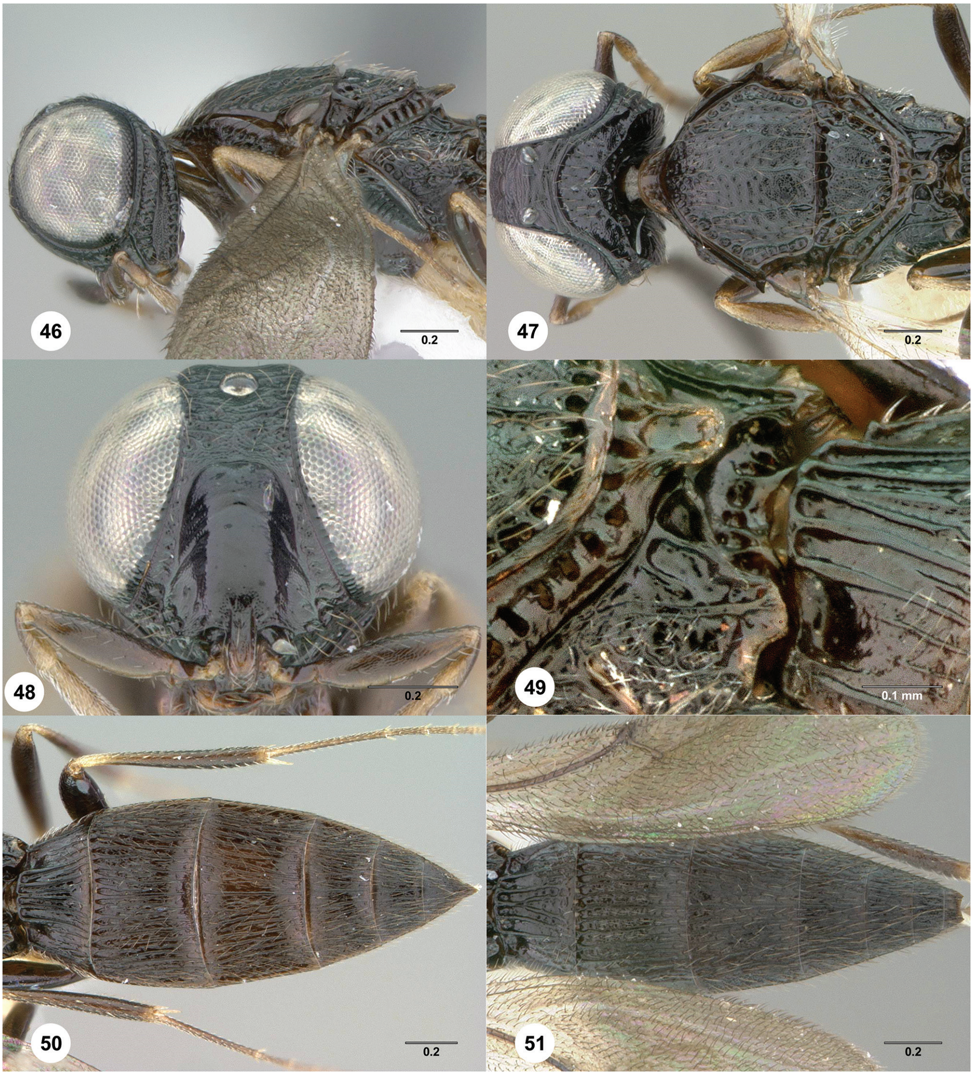
Oxyscelio lunae Burks, sp. n.

http://zoobank.org/BD17331A-6B17-4530-B540-05A18128AA85
http://bioguid.osu.edu/xbiod_concepts/309299
Figures 46–51; Morphbank[22]

Description. *Female*. Body length 3.5–3.7 mm (n = 8).

Radicle color: same as scape. A4: longer than broad. A5: broader than long. Upper frons: not hood-like. Frontal depression sculpture: with 3 or more broadly interrupted transverse carinae. Median longitudinal elevation in frontal depression: absent. Major sculpture of gena anteroventrally: umbilicate-foveate. Major sculpture of gena posteroventrally: rugose; umbilicate-punctate. Microsculpture of gena anteroventrally: absent; granulate. Microsculpture of gena posteroventrally: granulate. Hyperoccipital carina: complete as a sharp carina. Median carina extending posteriorly from hyperoccipital carina: present, complete. Lateral connection between hyperoccipital and occipital carinae: present as a distinct carina. Area between vertex and occipital carina: umbilicate-foveate; rugose; umbilicate-punctate. Occipital carina medially: sinuate with a more strongly arched median portion. Lateral corners of occipital carina: sharp and protruding corners present.

Mesoscutum anteriorly: not steep. Mesoscutal median carina: present and complete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe posteriorly: absent; granulate. Major sculpture of mesoscutellum: umbilicate-foveate. Microsculpture of mesoscutellum medially: absent. Microsculpture of mesoscutellum laterally: granulate. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: more than 5. Setae along anterior limit of femoral depression: arising from rows of foveae. Metascutellum dorsally: concave. Metascutellar sculpture



Figures 46–51. *Oxyscelio lunae* sp. n., paratype female (OSUC 369409) **46** Head and mesosoma, lateral view **47** Head and mesosoma, dorsal view **48** Head, anterior view **49** Metasoma, dorsal view **50** Propodeum, dorsolateral view. Paratype Male (OSUC 369404) **51** Metasoma, dorsal view. Morphbank[22]

centrally: smooth. Metascutellar apex: convex or straight. Metapleuron above ventral metapleural area: crossed by carinae. Lateral propodeal carinae antero-medially: weakly diverging. Metasomal depression setae: absent. Anterior areoles of metasomal depression: one or more areoles present. Anterior longitudinal carinae in metasomal depression: absent. Postmarginal vein: present. Fore wing apex: reaching middle of T6. Hind wing vein (Sc+R): not interrupted.

Carinae between T1 midlobe and T1 lateral carina: absent. T1 midlobe: with 6 or more longitudinal carinae. T1: without anterior bulge. T6: broader than long; as long as broad. Metasomal apex: rounded; tapering to a sharp point. Major sculpture of T6: umbilicate-punctate. Microsculpture of T6: absent.

Male. Body length 3.4–3.65 mm (n = 20). A5 tyloid: carina-like, not expanded. A11: longer than broad. T1 midlobe: with 4 longitudinal carinae. Metasomal apex: with acuminate lateral corners.

Diagnosis. Both sexes: Hyperoccipital carina present and sharp, connected to occipital carina by lateral carina; median carina present between hyperoccipital and occipital carinae. Gena with granulate sculpture posteroventrally but not anteroventrally. Mesoscutellum with granulate sculpture laterally. Metasomal depression not setose, without median carina; lateral propodeal carinae weakly diverging. Hind wing Sc+R vein complete. Female: A4 longer than broad.

Etymology. Latin noun, genitive case, meaning "moon."

Link to distribution map. [http://hol.osu.edu/map-full.html?id=309299]

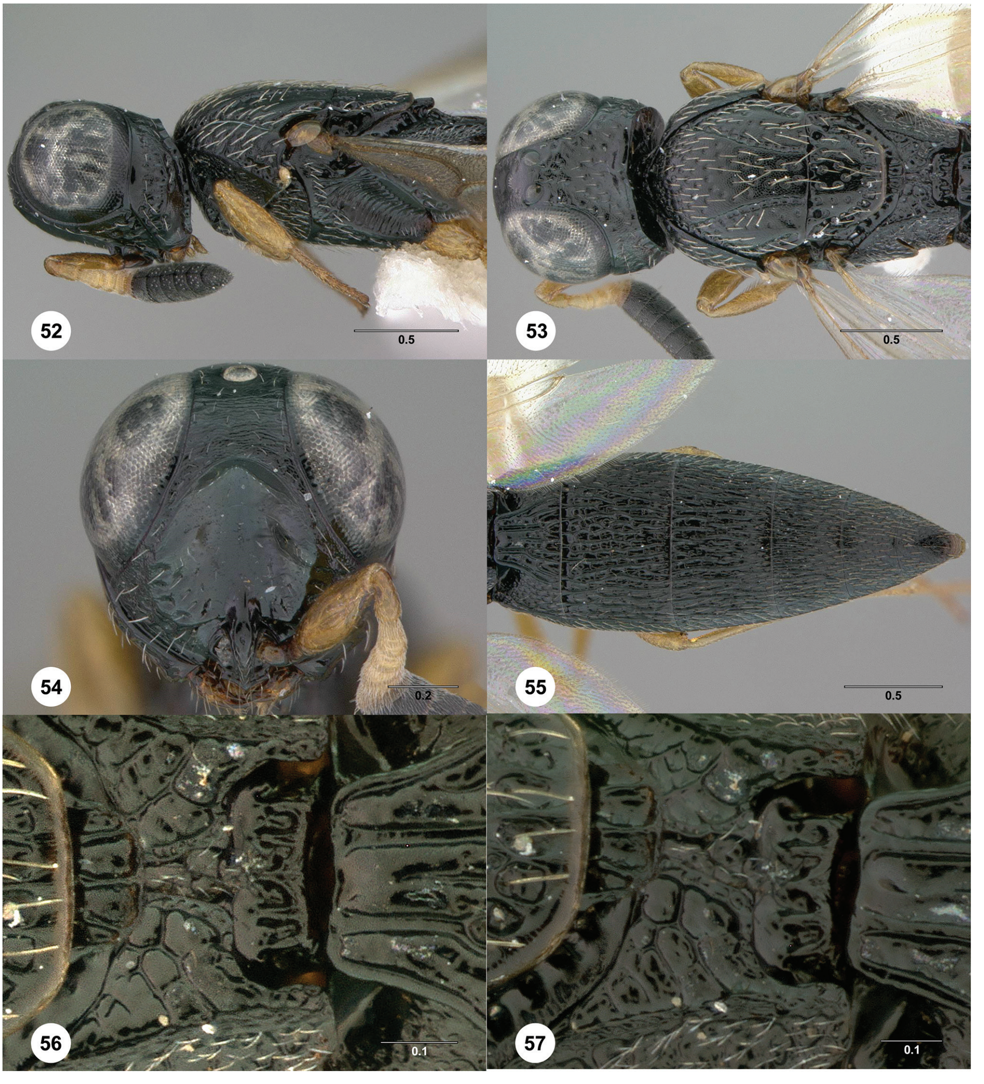
Material examined. Holotype, female: **CAMEROON:** Nkoemvom, VIII–1980, malaise trap, D. Jackson, OSUC 369365 (deposited in BMNH). *Paratypes*: (23 females, 57 males) **CAMEROON:** 15 males, OSUC 369340, 369342–369346, 369360 (CNCI), OSUC 369341, 369347–369352, 369359 (BMNH). **CENTRAL AFRICAN REPUBLIC:** 20 females, 27 males, OSUC 369391, 223802, 242799, 282894, 282896, 320854, 369393 (CNCI); OSUC 176083, 218855, 233095–233096, 320840–320841, 320845, 320847, 320849–320853, 320855, 369385, 369394 (OSUC); OSUC 176091, 218850, 223639, 223801, 225982–225985, 251694–251698, 267415–267417, 282879, 282895, 317893, 320838, 320842–320844, 320846, 320848 (SAMC). **DEMOCRATIC REPUBLIC OF THE CONGO:** 6 males, OSUC 369335–369339 (CNCI); OSUC 268178 (USNM). **GHANA:** 4 males, OSUC 369386–369387 (CNCI); OSUC 435286 (OSUC). **GUINEA:** 1 female, 5 males, OSUC 369400–369401, 369404, 369406, 369408–369409 (CNCI). **SIERRA LEONE:** 1 female, OSUC 462603 (MZLU). **TOGO:** 1 female, OSUC 320828 (BMNH).

Comments. *Oxyscelio lunae* is by far the most commonly collected species of its genus from Africa, although nearly all known specimens are male. It is very similar to *O. pulveris*, but after extensive comparison of the two series we concluded that they are different species. The chief difference is the considerably more granulate sculpture of *O. pulveris*, which occurs in conjunction with lower and more rounded (therefore, less sharp and less distinctive) carinae, especially the hyperoccipital and mesoscutellar disc carinae. These features are accompanied by some more vague and less easily described differences in eye shape, mesosomal and metasomal sclerite shape, and metasomal sculpture.

Oxyscelio nemesis Burks, sp. n.

http://zoobank.org/378ACB70-2B66-476E-8E7C-1F4AA4856FFC
http://bioguid.osu.edu/xbiod_concepts/312620
Figures 52–57; Morphbank[23]

Description. Female. Body length 4.8 mm (n = 1).



Figures 52–57. *Oxyscelio nemesis* sp. n., holotype female (OSUC 369379) **52** Head and mesosoma, lateral view **53** Head and mesosoma, dorsal view **54** Head, anterior view **55** Metasoma, dorsal view **56** Propodeum, dorsal view **57** Propodeum, dorsolateral view. Morphbank[23]

Radicle color: darker than scape. A4: broader than long. A5: broader than long. Upper frons: not hood-like. Frontal depression sculpture: without transverse or oblique carinae below submedian carina. Median longitudinal elevation in frontal depression: absent. Major sculpture of gena anteroventrally: umbilicate-foveate. Major sculpture of gena posteroventrally: rugose; umbilicate-punctate. Microsculpture of gena anteroventrally: absent. Microsculpture of gena posteroventrally: granulate. Hyperoccipital carina: wrinkle-like. Median carina extending posteriorly from hyperoccipital carina: absent. Lateral connection between hyperoccipital and occipital carinae: absent. Area between vertex and occipital carina: umbilicate-foveate; umbilicate-punctate. Occipital carina medially: with nearly flat angular median portion. Lateral corners of occipital carina: sharp and protruding corners present.

Mesoscutum anteriorly: steep. Mesoscutal median carina: absent or incomplete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe posteriorly: granulate. Major sculpture of mesoscutellum: umbilicate-foveate. Microsculpture of mesoscutellum medially: granulate. Microsculpture of mesoscutellum laterally: granulate. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: more than 5. Setae along anterior limit of femoral depression: arising from rows of foveae. Metascutellum dorsally: flat or convex. Metascutellar sculpture centrally: rugose. Metascutellar apex: convex or straight. Metapleuron above ventral metapleural area: crossed by carinae; foveate or rugose. Lateral propodeal carinae antero-medially: weakly diverging. Metasomal depression setae: present. Anterior areoles of metasomal depression: absent. Anterior longitudinal carinae in metasomal depression: absent. Postmarginal vein: absent. Fore wing apex: reaching apex of T5. Hind wing vein (Sc+R): not interrupted.

Carinae between T1 midlobe and T1 lateral carina: absent. T1 midlobe: with 4 longitudinal carinae. T1: without anterior bulge. T6: longer than broad. Metasomal apex: rounded. Major sculpture of T6: umbilicate-punctate. Microsculpture of T6: granulate.

Diagnosis. Both sexes: Hyperoccipital carina wrinkle-like, not connected to occipital carina laterally; median carina between hyperoccipital and occipital carinae absent; occipital carina nearly flat medially. Mesoscutellum with granulate sculpture. Metasomal depression setose, without median carina; lateral propodeal carinae weakly diverging. Hind wing Sc+R vein complete. Female: T6 rounded apically.

Etymology. Latin noun, genitive case.

Link to distribution map. [http://hol.osu.edu/map-full.html?id=312620]

Material examined. Holotype, female: **NIGERIA:** Oyo St., International Institute of Tropical Agriculture (IITA), Ibadan, XI–1987, pan trap, J. S. Noyes, OSUC 369379 (deposited in BMNH).

Comments. *Oxyscelio nemesis* strongly resembles *Oxyscelio io*, and they both vaguely resemble *Oxyscelio teli*. These three species together may form a monophyletic species complex, but such a grouping would currently be difficult to fully distinguish from similar African species. It can be roughly defined by the medially more or less flat occipital carina, but this feature in *O. io* is variable and sometimes not greatly different from that of some excluded African species.

The shape of the head of this species and the carinate margin of the antennal scribe make it superficially similar to the genus *Baryconus* Förster. The fore wing venation, however, makes it clear that this is an *Oxyscelio*: it lacks elongate marginal and postmarginal veins, and the stigma vein arises from the upturned apical portion of the submarginal vein.

Oxyscelio pulveris **Burks, sp. n.**
http://zoobank.org/307734E3-F87F-44F8-A004-E828FB52908B
http://bioguid.osu.edu/xbiod_concepts/309300
Figures 58–61; Morphbank[24]

Description. *Female*. Body length 3.5 mm (n = 1).

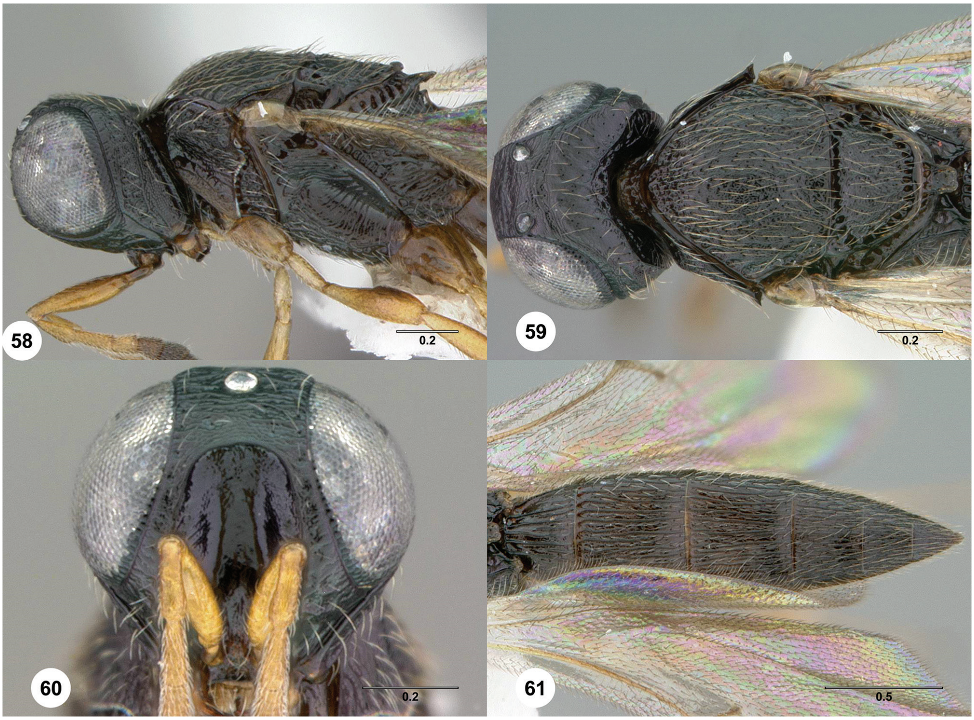
Radicle color: same as scape. A4: longer than broad. A5: broader than long. Upper frons: not hood-like. Frontal depression sculpture: with 3 or more broadly interrupted transverse carinae. Median longitudinal elevation in frontal depression: absent. Major sculpture of gena anteroventrally: umbilicate-foveate. Major sculpture of gena posteroventrally: umbilicate-punctate. Microsculpture of gena anteroventrally: granulate. Microsculpture of gena posteroventrally: granulate. Hyperoccipital carina: complete as a sharp carina. Median carina extending posteriorly from hyperoccipital carina: present, complete. Lateral connection between hyperoccipital and occipital carinae: present as a distinct carina. Area between vertex and occipital carina: rugose; umbilicate-punctate. Occipital carina medially: sinuate with a more strongly arched median portion. Lateral corners of occipital carina: sharp and protruding corners present.

Mesoscutum anteriorly: not steep. Mesoscutal median carina: present and complete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe posteriorly: absent; granulate. Major sculpture of mesoscutellum: umbilicate-foveate. Microsculpture of mesoscutellum medially: granulate. Microsculpture of mesoscutellum laterally: granulate. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: more than 5. Setae along anterior limit of femoral depression: arising from rows of foveae. Metascutellum dorsally: concave. Metascutellar sculpture centrally: smooth. Metascutellar apex: convex or straight. Metapleuron above ventral metapleural area: crossed by carinae. Lateral propodeal carinae antero-medially: weakly diverging. Metasomal depression setae: absent. Anterior areoles of metasomal depression: one or more areoles present. Anterior longitudinal carinae in metasomal depression: median carina present. Postmarginal vein: present. Fore wing apex: reaching beyond T6. Hind wing vein (Sc+R): not interrupted.

Carinae between T1 midlobe and T1 lateral carina: absent. T1 midlobe: with 5 longitudinal carinae. T1: without anterior bulge. T6: longer than broad. Metasomal apex: tapering to a sharp point. Major sculpture of T6: longitudinally striate or rugose. Microsculpture of T6: granulate.

Diagnosis. Both sexes: Hyperoccipital carina present and sharp, connected to occipital carina by lateral carina; median carina present between hyperoccipital and occipital carinae. Gena with granulate sculpture posteroventrally but not anteroventrally. Mesoscutellum with granulate sculpture throughout. Metasomal depression without setae, with median carina; lateral propodeal carinae weakly diverging. Hind wing Sc+R vein complete. Female: A4 longer than broad.

Etymology. Latin noun, genitive case, meaning “dust.”



Figures 58–61. *Oxyscelio pulveris* sp. n., holotype female (OSUC 369388) **58** Head and mesosoma, lateral view **59** Head and mesosoma, dorsal view **60** Head, anterior view **61** Metasoma, dorsal view. Morphbank[24]

Link to distribution map. [http://hol.osu.edu/map-full.html?id=309300]

Material examined. Holotype, female: **RWANDA:** primary rainforest, Nyungwe Forest, 02°46'10"S 29°21'09"E, 24.VIII–26.VIII.1993, pan trap/flight intercept trap/ malaise trap, L. Leblanc, OSUC 369388 (deposited in CNCI).

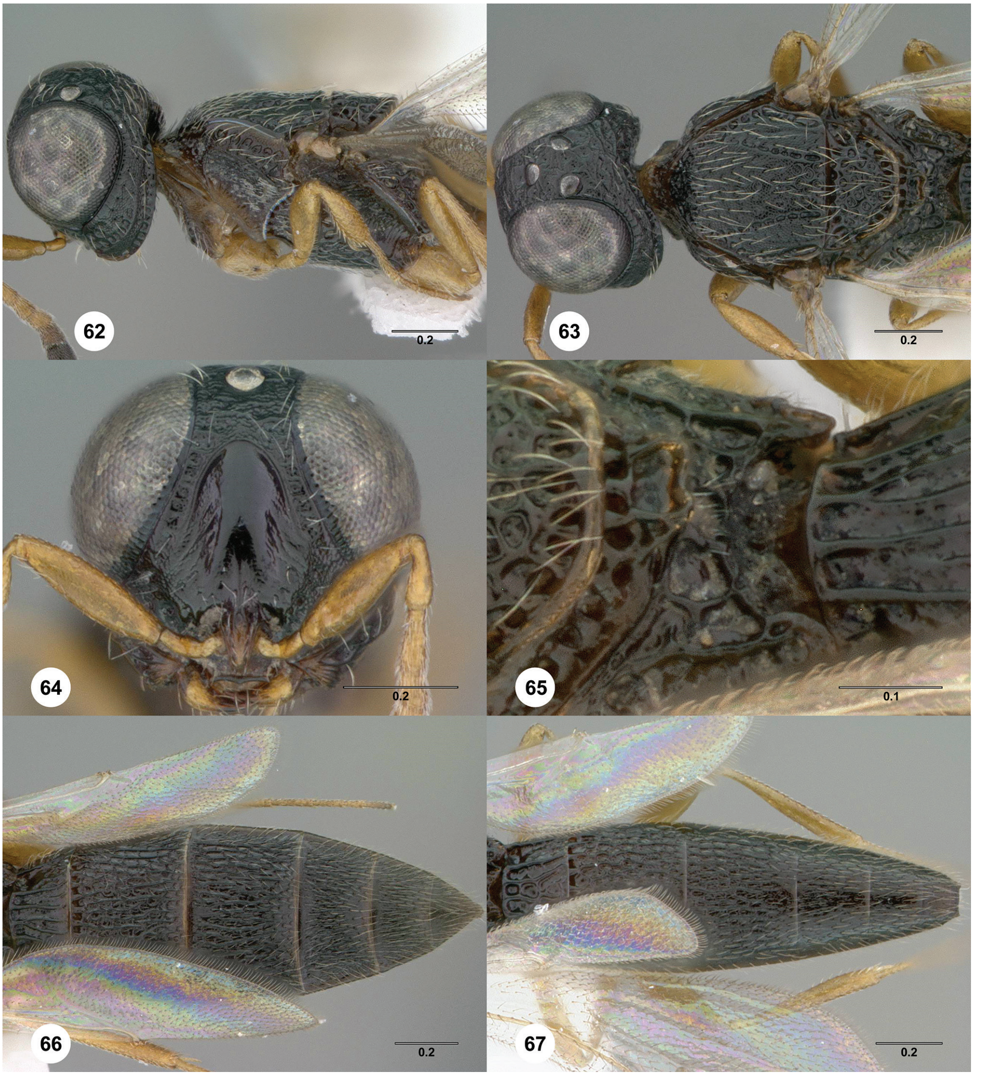
Comments. See the discussion under *O. lunae* for comparison of these two very similar species.

Oxyscelio quassus Burks, sp. n.

http://zoobank.org/372D126A-218D-4044-B4AD-F5C84DEC6924
http://bioguid.osu.edu/xbiod_concepts/309301
Figures 62–67; Morphbank[25]

Description. *Female*. Body length 2.95–3.55 mm (n = 4).

Radicle color: same as scape. A4: longer than broad. A5: longer than broad. Upper frons: not hood-like. Frontal depression sculpture: with 1–2 broadly interrupted transverse carinae. Median longitudinal elevation in frontal depression: absent. Major sculpture of gena anteroventrally: umbilicate-foveate. Major sculpture of gena pos-



Figures 62–67. *Oxyscelio quassus* sp. n., holotype female (OSUC 369398) **62** Head and mesosoma, lateral view **63** Head and mesosoma, dorsal view **64** Head, anterior view **65** Propodeum, dorsolateral view **66** Metasoma, dorsal view. Paratype male (OSUC 369402) **67** Metasoma, dorsal view Morphbank[25]

teroventrally: absent; umbilicate-punctate. Microsculpture of gena anteroventrally: granulate. Microsculpture of gena posteroventrally: granulate. Hyperoccipital carina: wrinkle-like. Median carina extending posteriorly from hyperoccipital carina: absent. Lateral connection between hyperoccipital and occipital carinae: absent. Area between vertex and occipital carina: umbilicate-foveate; rugose. Occipital carina medially: uniformly rounded. Lateral corners of occipital carina: absent.

Mesoscutum anteriorly: not steep. Mesoscutal median carina: absent or incomplete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe posteriorly: granulate. Major sculpture of mesoscutellum: umbilicate-foveate; longitudinally rugose. Microsculpture of mesoscutellum medially: absent. Microsculpture of mesoscutellum laterally: absent. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: more than 5. Setae along anterior limit of femoral depression: arising from rows of foveae. Metascutellum dorsally: concave. Metascutellar sculpture centrally: smooth. Metascutellar apex: shallowly emarginate. Metapleuron above ventral metapleural area: foveate or rugose. Lateral propodeal carinae anteromedially: weakly diverging. Metasomal depression setae: present. Anterior areoles of metasomal depression: one or more areoles present. Anterior longitudinal carinae in metasomal depression: absent. Postmarginal vein: present. Fore wing apex: reaching middle of T6; reaching apex of T6. Hind wing vein (Sc+R): not interrupted.

Carinae between T1 midlobe and T1 lateral carina: absent. T1 midlobe: with 5 longitudinal carinae. T1: without anterior bulge. T6: broader than long. Metasomal apex: rounded. Major sculpture of T6: umbilicate-punctate. Microsculpture of T6: granulate.

Male. Body length 2.7–3.15 mm (n = 5). A5 tyloid: carina-like, not expanded. A11: longer than broad. T1 midlobe: with 4 longitudinal carinae. Metasomal apex: with acuminate lateral corners.

Diagnosis. Both sexes: Hyperoccipital carina wrinkle-like, not connected to occipital carina laterally; median carina between hyperoccipital and occipital carinae absent. Gena with granulate sculpture anteroventrally and posteroventrally. Mesoscutellum without granulate sculpture. Metasomal depression setose, without median carina; lateral propodeal carinae weakly diverging. Hind wing Sc+R vein complete. Female: A4 longer than broad.

Etymology. Latin noun (4th declension), genitive case, meaning “the act of shaking.”

Link to distribution map. [http://hol.osu.edu/map-full.html?id=309301]

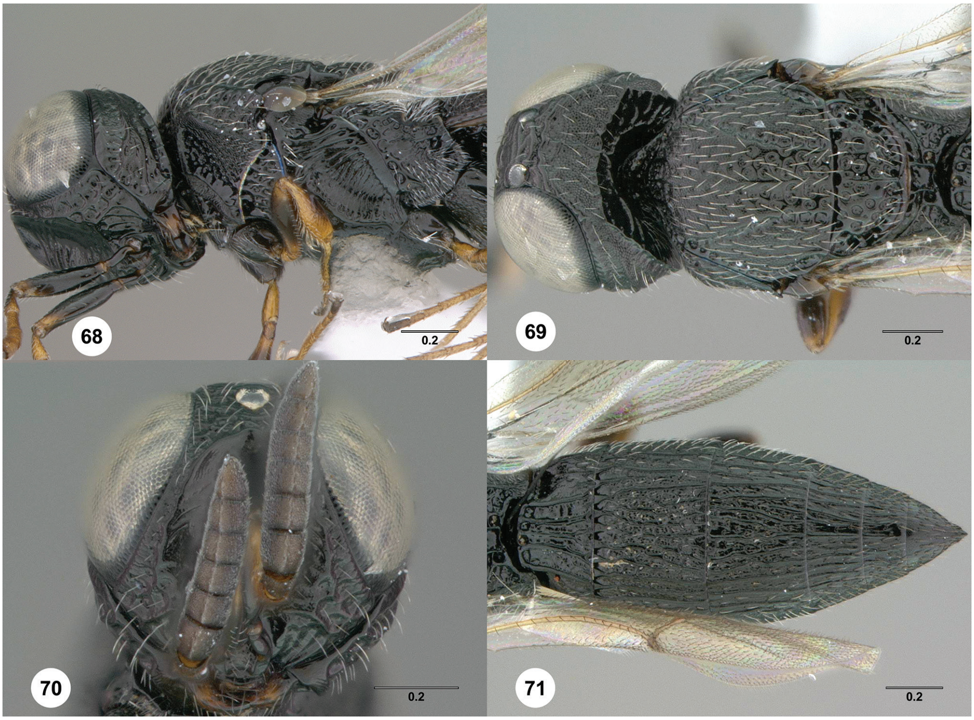
Material examined. Holotype, female: **GUINEA:** Lola Pref., Gouan River, rainforest, Mount Nimba, 07°42'N 08°23'W, 514m, 7.I–15.I.1991, flight intercept trap, L. Leblanc, OSUC 369398 (deposited in CNCI). *Paratypes*: (3 females, 5 males) **CAMEROON:** 1 female, OSUC 369361 (BMNH). **GHANA:** 1 male, OSUC 429536 (OSUC). **GUINEA:** 4 males, OSUC 369396–369397, 369402, 369410 (CNCI). **SOMALIA:** 2 females, OSUC 369412–369413 (CNCI).

Oxyscelio teli Burks, sp. n.

http://zoobank.org/936A2811-698F-49A3-8ACF-C3DCA5D61F7F
http://bioguid.osu.edu/xbiod_concepts/309304
Figures 68–71; Morphbank[26]

Description. *Female*. Body length 3.2–3.35 mm (n = 4).

Radicle color: same as scape; darker than scape. A4: broader than long; as long as broad. A5: broader than long. Upper frons: not hood-like. Frontal depression sculp-



Figures 68–71. *Oxyscelio teli* sp. n., holotype female (OSUC 381658) **68** Head and mesosoma, lateral view **69** Head and mesosoma, dorsal view **70** Head, anterior view **71** Metasoma, dorsal view. Morphbank[26]

ture: with 2–4 complete transverse carinae. Median longitudinal elevation in frontal depression: absent. Major sculpture of gena anteroventrally: umbilicate-foveate; rugose. Major sculpture of gena posteroventrally: umbilicate-foveate; rugose. Microsculpture of gena anteroventrally: absent; granulate. Microsculpture of gena posteroventrally: granulate. Hyperoccipital carina: wrinkle-like. Median carina extending posteriorly from hyperoccipital carina: present, complete. Lateral connection between hyperoccipital and occipital carinae: present as a rounded elevation. Area between vertex and occipital carina: rugose; umbilicate-punctate. Occipital carina medially: with nearly flat angular median portion. Lateral corners of occipital carina: sharp and protruding corners present.

Mesoscutum anteriorly: steep. Mesoscutal median carina: present and complete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe posteriorly: absent. Major sculpture of mesoscutellum: umbilicate-foveate. Microsculpture of mesoscutellum medially: absent. Microsculpture of mesoscutellum laterally: absent. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: more than 5. Setae along anterior limit of femoral depression: arising from rows of foveae. Metascutellum dorsally: concave. Metascutellar sculpture centrally: smooth. Metascutellar apex:

shallowly emarginate. Metapleuron above ventral metapleural area: foveate or rugose. Lateral propodeal carinae antero-medially: weakly diverging. Metasomal depression setae: absent. Anterior areoles of metasomal depression: absent. Anterior longitudinal carinae in metasomal depression: absent. Postmarginal vein: present. Fore wing apex: reaching middle of T5; reaching apex of T5. Hind wing vein (Sc+R): not interrupted.

Carinae between T1 midlobe and T1 lateral carina: absent. T1 midlobe: with 5 longitudinal carinae. T1: without anterior bulge. T6: broader than long. Metasomal apex: tapering to a sharp point. Major sculpture of T6: umbilicate-punctate. Microsculpture of T6: absent; granulate.

Diagnosis. Both sexes: Hyperoccipital carina wrinkle-like, connected to occipital carina by lateral elevation; median carina between hyperoccipital and occipital carinae present. Mesoscutellum without granulate sculpture. Metasomal depression without setae, without median carina; lateral propodeal carinae weakly diverging. Hind wing Sc+R vein complete. Female: A4 broader than long; T6 sharply acuminate apically.

Etymology. Latin noun, genitive case, meaning "dart."

Link to distribution map. [http://hol.osu.edu/map-full.html?id=309304]

Material examined. Holotype, female: **KENYA:** Eastern Prov., nr. Ewaso Ngiro River, next to headquarters, riverine forest, Samburu National Reserve, 00.56797°N 37.53563°E, 874m, 18.IX–2.X.2007, malaise trap, R. Copeland, OSUC 381658 (deposited in NMKE). *Paratypes*: **KENYA:** 3 females, OSUC 381659 (NMKE); OSUC 381657 (OSUC); OSUC 381657 (USNM).

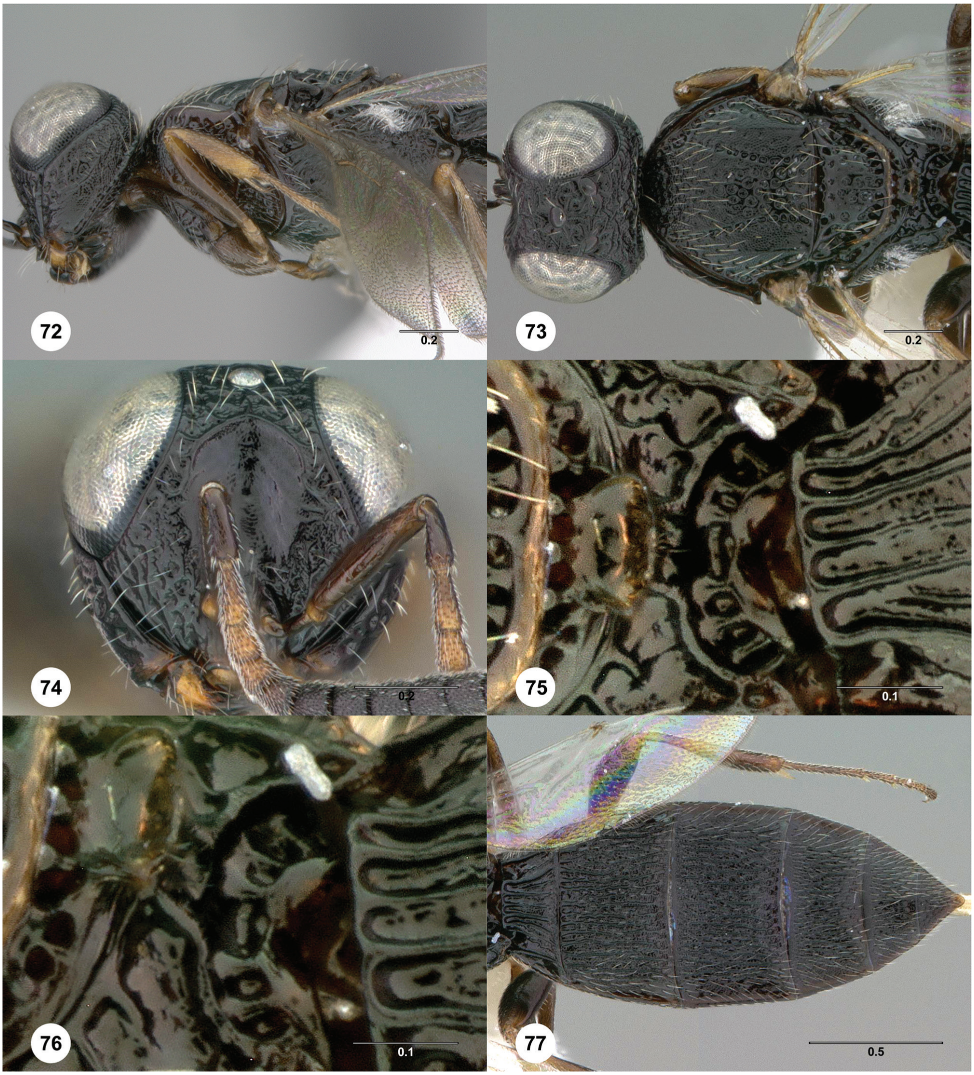
Oxyscelio xenii Burks, sp. n.

http://zoobank.org/AB2F63F2-0E61-4C82-9469-3D242ED29D44
http://bioguid.osu.edu/xbiod_concepts/309302
Figures 72–77; Morphbank[27]

Description. *Female*. Body length 3.15–3.35 mm (n = 2).

Radicle color: darker than scape. A4: longer than broad. A5: broader than long. Upper frons: not hood-like. Frontal depression sculpture: with 2–4 complete transverse carinae. Median longitudinal elevation in frontal depression: absent. Major sculpture of gena anteroventrally: umbilicate-foveate; rugose. Major sculpture of gena posteroventrally: absent; rugose. Microsculpture of gena anteroventrally: granulate. Microsculpture of gena posteroventrally: granulate. Hyperoccipital carina: wrinkle-like. Median carina extending posteriorly from hyperoccipital carina: absent. Lateral connection between hyperoccipital and occipital carinae: absent. Area between vertex and occipital carina: umbilicate-foveate; rugose. Occipital carina medially: uniformly rounded. Lateral corners of occipital carina: absent.

Mesoscutum anteriorly: not steep. Mesoscutal median carina: absent or incomplete. Major sculpture of mesoscutal midlobe anteriorly: umbilicate-foveate. Major sculpture of mesoscutal midlobe posteriorly: umbilicate-foveate. Microsculpture of mesoscutal midlobe anteriorly: granulate. Microsculpture of mesoscutal midlobe



Figures 72–77. *Oxyscelio xenii* sp. n., holotype female (OSUC 369376) **72** Head and mesosoma, lateral view **73** Head and mesosoma, dorsal view **74** Head, anterior view **75** Propodeum, dorsal view **76** Propodeum, dorsolateral view **77** Metasoma, dorsal view. Morphbank[27]

posteriorly: absent; granulate. Major sculpture of mesoscutellum: umbilicate-foveate. Microsculpture of mesoscutellum medially: punctate. Microsculpture of mesoscutellum laterally: punctate. Number of carinae crossing femoral depression: 4 or more. Mesepimeral sulcus pits: more than 5. Setae along anterior limit of femoral depression: arising from rows of foveae. Metascutellum dorsally: concave. Metascutellar sculpture centrally: smooth. Metascutellar apex: convex or straight. Metapleuron above ventral metapleural area: foveate or rugose. Lateral propodeal carinae antero-medially: weakly diverging. Metasomal depression setae: present. Anterior areoles of metasomal depression: one or more areoles present. Anterior longitudinal carinae in metasomal depression: absent. Postmarginal vein: present. Fore wing apex: reaching middle of T6; reaching apex of T6. Hind wing vein (Sc+R): interrupted.

Carinae between T1 midlobe and T1 lateral carina: absent. T1 midlobe: with 6 or more longitudinal carinae. T1: without anterior bulge. T6: broader than long. Metasomal apex: rounded. Major sculpture of T6: umbilicate-punctate. Microsculpture of T6: granulate.

Diagnosis. Both sexes: Hyperoccipital carina wrinkle-like, not connected to occipital carina laterally or medially. Gena with granulate sculpture anteroventrally and posteroventrally. Mesoscutellum without granulate sculpture, with some punctate sculpture between foveae. Metasomal depression setose, without median carina; lateral propodeal carinae weakly diverging. Hind wing Sc+R interrupted. T1 without carinae between midlobe and lateral carina. Female: A4 longer than broad.

Etymology. Latin noun, genitive case, meaning “a present intended for a guest.”

Link to distribution map. [http://hol.osu.edu/map-full.html?id=309302]

Material examined. Holotype, female: **MALAWI:** Chitipa Dist., 18km SSE Chisenga, Jembya Forest Reserve, 10°08'S 33°27'E, 1870m, 1.I–10.I.1989, J. Rawlins & S. Thompson, OSUC 369376 (deposited in CNCI). *Paratype*: **MALAWI:** 1 female, OSUC 369375 (CNCI).

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Endnotes

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2 http://biocol.org/urn:lsid:biocol.org:col:1009
3 http://biocol.org/urn:lsid:biocol.org:col:1012
4 http://biocol.org/urn:lsid:biocol.org:col:33453
5 http://biocol.org/urn:lsid:biocol.org:col:33791
6 http://biocol.org/urn:lsid:biocol.org:col:33943
7 http://grbio.org/cool/h6fg-emd8
8 http://biocol.org/urn:lsid:biocol.org:col:1014
9 http://biocol.org/urn:lsid:biocol.org:col:34157
10 http://biocol.org/urn:lsid:biocol.org:col:34161
11 http://biocol.org/urn:lsid:biocol.org:col:1018
12 http://biocol.org/urn:lsid:biocol.org:col:1019
13 http://biocol.org/urn:lsid:biocol.org:col:34593
14 http://www.morphbank.net/?id=854135
15 http://www.morphbank.net/?id=854136

16 http://www.morphbank.net/?id=854137
17 http://www.morphbank.net/?id=854138
18 http://www.morphbank.net/?id=854139
19 http://www.morphbank.net/?id=854140
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21 http://www.morphbank.net/?id=854142
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24 http://www.morphbank.net/?id=854145
25 http://www.morphbank.net/?id=854146
26 http://www.morphbank.net/?id=854147
27 http://www.morphbank.net/?id=854148
28 http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:20940
29 http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:23995
30 http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:26980
31 http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:404
32 http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:21506
33 http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:339
34 doi: 10.1111/j.1096-0031.2008.00217.x
35 http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:26986
36 http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:986
37 http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:21219
38 http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:311
39 http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:21300
40 http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:486

Appendix I

Characters. * = used in phylogenetic analysis.

1. Radicle color
   1. same as scape
   2. darker than scape
2. A4 (female)
   1. broader than long
   2. longer than broad
   3. as long as broad
3. A5 (female)
   1. broader than long
   2. longer than broad
   3. as long as broad
4. Upper frons
   1. not hood-like

2. hood-like, protruding over pedicel when antenna at rest

5. Frontal depression sculpture
   1. without transverse or oblique carinae below submedian carina
   2. with 3 or more broadly interrupted transverse carinae
   3. with 2–4 complete transverse carinae
   4. with 1–2 broadly interrupted transverse carinae
6. Median longitudinal elevation in frontal depression
   1. absent
   2. present
7. Major sculpture of gena anteroventrally
   1. umbilicate-foveate
   2. rugose
   3. umbilicate-punctate
8. Major sculpture of gena posteroventrally
   1. absent
   2. umbilicate-foveate
   3. rugose
   4. umbilicate-punctate
9. Microsculpture of gena anteroventrally
   1. absent
   2. granulate
10. Microsculpture of gena posteroventrally
    1. absent
    2. granulate
11. Hyperoccipital carina*
    1. complete as a sharp carina
    2. not indicated medially
    3. wrinkle-like
12. Median carina extending posteriorly from hyperoccipital carina*
    1. absent
    2. present, complete
    3. present, anteriorly incomplete
13. Lateral connection between hyperoccipital and occipital carinae*
    1. absent
    2. present as a distinct carina
    3. present as a rounded elevation
14. Area between vertex and occipital carina
    1. umbilicate-foveate
    2. rugose
    3. umbilicate-punctate
15. Occipital carina medially*
    1. uniformly rounded
    2. sinuate with a more strongly arched median portion

3. with nearly flat angular median portion

16. Lateral corners of occipital carina*
1. absent
2. sharp and protruding corners present

17. Mesoscutum anteriorly
1. steep
2. not steep

18. Mesoscutal median carina
1. present and complete
2. absent or incomplete

19. Major sculpture of mesoscutal midlobe anteriorly
1. umbilicate-foveate
2. umbilicate-punctate

20. Major sculpture of mesoscutal midlobe posteriorly
1. umbilicate-foveate
2. transversely rugose
3. obliquely rugose

4. longitudinally rugose

21. Microsculpture of mesoscutal midlobe anteriorly
1. granulate

22. Microsculpture of mesoscutal midlobe posteriorly
1. absent
2. granulate

23. Major sculpture of mesoscutellum
1. umbilicate-foveate
2. longitudinally rugose
3. obliquely rugose

24. Microsculpture of mesoscutellum medially
1. absent
2. granulate
3. punctate

25. Microsculpture of mesoscutellum laterally
1. absent
2. granulate
3. punctate

26. Number of carinae crossing femoral depression
1. more than 5

27. Mesepimeral sulcus pits
1. 3–5
2. more than 5

28. Setae along anterior limit of femoral depression
1. arising from rows of foveae
2. arising from tiny pits

29. Metascutellum dorsally
    1. concave
    2. flat or convex
30. Metascutellar sculpture centrally
    1. smooth
    2. rugose
    3. with longitudinal carinae
    4. foveate
31. Metascutellar apex
    1. convex or straight
    2. deeply emarginate
    3. sharply acuminate
    4. shallowly emarginate
32. Metapleuron above ventral metapleural area
    1. crossed by carinae
    2. foveate or rugose
33. Lateral propodeal carinae antero-medially (female)
    1. strongly diverging
    2. weakly diverging
34. Metasomal depression setae*
    1. absent
    2. present
35. Anterior areoles of metasomal depression
    1. absent
    2. one or more areoles present
36. Anterior longitudinal carinae in metasomal depression
    1. absent
    2. median carina present
37. Postmarginal vein*
    1. present
    2. absent
38. Fore wing apex (female)
    1. reaching middle of T5
    2. reaching apex of T5
    3. reaching middle of T6
    4. reaching apex of T6
    5. reaching beyond T6
39. Hind wing vein (Sc+R)*
    1. not interrupted
    2. interrupted
40. Carinae between T1 midlobe and T1 lateral carina*
    1. present
    2. absent

41. T1 midlobe (female)*
 1. with 4 longitudinal carinae
 2. with 5 longitudinal carinae
 3. with 6 or more longitudinal carinae
 4. obscured by other raised sculpture
42. T1 (female)*
 1. without anterior bulge
 2. with long anterior bulge that reaches metascutellum
 3. with weak anterior bulge that does not closely approach metascutellum
43. T6
 1. broader than long
 2. longer than broad
 3. as long as broad
44. Metasomal apex (female)*
 1. rounded
 2. tapering to a sharp point
45. Major sculpture of T6
 1. umbilicate-punctate
 2. longitudinally striate or rugose
46. Microsculpture of T6
 1. absent
 2. granulate
47. A5 tyloid
 1. carina-like, not expanded
 2. expanded, teardrop-shaped or sinuate
48. A11 (male)*
 1. longer than broad
49. T1 midlobe (male)
 1. with 4 longitudinal carinae
 2. with 5 longitudinal carinae
 3. with 6 or more longitudinal carinae
50. Metasomal apex (male)*
 1. with acuminate lateral corners
 2. with no distinct corners

Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bracalba cuneata	1	0	0	0	0	0	0	0	0	2	0	0	0	1
Oxyscelio absentiae	1	0	0	0	0	0	0	1	0	3	1	0	?	?
Oxyscelio bicolor	2	0	0	0	0	1	0	1	0	2	0	0	0	0
Oxyscelio galeri	0	0	0	1	0	0	0	0	1	?	?	?	0	1
Oxyscelio gyri	0	0	0	0	0	0	0	0	0	[12]	0	0	0	0
Oxyscelio idoli	2	0	0	0	0	0	0	1	0	2	0	0	0	0
Oxyscelio intensionis	2	0	0	0	0	1	0	0	1	?	?	?	0	1
Oxyscelio io	2	[02]	0	2	1	0	1	0	0	0	0	0	0	0
Oxyscelio kylix	0	[12]	1	0	1	0	0	0	0	3	2	0	0	0
Oxyscelio lunae	0	1	1	1	1	0	0	0	1	2	0	[01]	0	0
Oxyscelio nemesis	2	0	0	2	1	1	1	0	1	0	0	0	?	?
Oxyscelio pulveris	0	1	1	1	1	0	0	0	1	1	0	1	?	?
Oxyscelio quassus	2	0	0	0	0	1	0	0	1	1	0	0	0	0
Oxyscelio teli	2	1	2	2	1	0	0	0	1	1	0	1	?	?
Oxyscelio xenii	2	0	0	0	0	1	0	1	1	2	0	0	?	?

Supplementary material 1

Taxonomic records used in the present paper
Authors: Roger A. Burks, Lubomír Masner, Norman F. Johnson, Andrew D. Austin
Data type: specimen data
Explanation note: File format: DarwinCore Archive.

Supplementary material 2

Locality records used in the present paper
Authors: Roger A. Burks, Lubomír Masner, Norman F. Johnson, Andrew D. Austin
Data type: specimen data
Explanation note: File format: DarwinCore Archive.

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An illustrated guide to the identification of the known species of *Diatraea* Guilding (Lepidoptera, Crambidae, Crambinae) based on genitalia

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Abstract
The genus *Diatraea* Guilding is one of the most economically important groups of moths in the Western Hemisphere. The larvae are stem borers that feed on species of Poaceae, or grasses, such as sugarcane, corn, rice, and sorghum, as well as many other native grasses. Interest in this group has risen considerably since sugarcane and other grasses have been utilized and/or investigated as biofuels. This is the first modern study to treat all 41 valid described species. Most type specimens were examined and we provide a checklist with 19 new synonyms. We provide keys for the identification of most species in this genus based on morphology of the male and female genitalia and modern illustrations of male and female genitalia. We also provide an updated table of species distribution by country.

Keywords
Diatraea, sugarcane moths, Poaceae, biofuels, genitalia

Introduction

The genus *Diatraea* Guilding is composed of externally similar species, i.e. species cannot be identified using external characters only, and occur in the Western Hemisphere. The type species is *Diatraea saccharalis* (Fabricius, 1794) (Fig. 1), a major pest of sugarcane. The literature is abundant with studies on the biology of this and other closely related species that are economically important beginning with Guilding (1828). In this paper we consider 41 distinct taxa represented by 41 valid names and 46 synonyms. Some synonyms (e.g., *D. busckella* Dyar & Heinrich, 1927) at one time were considered valid species or subspecies based on insignificant amounts of variation and/or locally disparate distributions. Fortunately, the morphology of the genitalia has provided excellent characters for identification for most species. This study treats the entire genus as it is currently circumscribed throughout the Western Hemisphere. We provide a table of the species distributions as is currently known (Suppl. material 1) compiled from Box (1931) and the USNM collection (National Museum of Natural History, Smithsonian Institution, Washington, DC). Absence of a country from this table may not indicate that it does not occur there; it indicates that we have not seen material of that species from that country. During the course of this study we discovered more new species and the potential for cryptic species (e.g. Joyce et al. 2014, Solis et al. 2015), but we decided to publish keys to the identification of described species due to the number of identification requests and workshop requests that were being submitted to MAS (e.g. Solis 2004, Vargas et al. 2013). We provide a key to adults of the Crambinae as modified from Munroe and Solis (1998). The *Diatraea* diagnosis is from an excellent study of the North American Crambinae by Landry (1995).

Over eighty species names have been associated with *Diatraea* or related genera since Fabricius described the type species as *Phalaena saccharalis* in 1794. Early studies by Dyar and Heinrich (1927) and Box (1931) listed 39 and 48 species, respectively. More modern checklists list more, various numbers of species. Bleszynski (1967) lists 55 species, Munroe et al. (1995) lists 57 species, and Nuss et al. (2015) list 58 species. The first overview of *Diatraea* and related genera was in the 1927 treatment by Dyar & Heinrich. They treated the 22 known species and described 9 new species; they created entirely new species concepts. Several species names were unrecognized, that is, their only reference was a species description and not specimens. They were the first to comparatively use and illustrate the male and female genitalia using pen and ink. The last major overview of *Diatraea* and related genera was Box (1931). He recognized 48 species, including 10 new species. He illustrated the genitalia with black and white photos when he deemed the pen and ink illustrations deficient. Unfortunately, his photographs were often with insufficient magnification. For the first time, he provided a distribution chart by country for the 48 species. He provided a key to external characters primarily using the frons, forewing color, and venation, although he suggested that genitalia dissections be done whenever possible.

Methods

Type specimens of *Diatraea* species were studied to confirm identity of species. Approximately 50% of the types are located at the Natural History Museum (BMNH) in London, United Kingdom, and most of the others are located at the National Museum of Natural History (USNM) in Washington, DC, USA. Almost all of the type specimens at the USNM had been previously dissected for the study by Dyar and Heinrich (1927). Dissections of material from the Carnegie Museum of Natural History (CMNH), Pittsburgh, PA, USA, were labeled CMNH and given sequential numbers.

Genitalia preparation for identification (Clarke 1941, Robinson 1976): the abdomen is removed by pushing the abdomen up with forceps. If the metathorax is still attached to the abdomen it should be separated from the abdomen. The male or female abdomen is then placed in a vial with 10% + KOH. The vial is then placed in a beaker with boiling water. The abdomen in KOH is boiled until air bubbles can be seen in the abdomen. Alternatively, the abdomen can be left in cold 10% KOH overnight. The abdomen is then removed from the KOH and placed in water. Then a brush is used to clean the scales from the abdomen, particularly the anal area if it is a male. For males the genitalia can be removed by holding the valvae and uncus with forceps, and then pulling posteriorly at the same time that the abdomen is being held anteriorly with either the brush or the forceps. The male genitalia of *Diatraea* can be very sclerotized so often staining is not required to see the structures. At this point, when the genitalia is in water, the male can be identified using the key to males below. A pair of forceps can force the valvae apart or a small piece of glass can be placed on the genitalia to flatten it out to be able to see certain structures. For structure recognition in the male genitalia, two views, lateral (Fig. 1) and flattened (Fig. 2), are given and labeled.

To remove the female genitalia, the abdomen should be cut laterally the entire length and then around the abdomen between segments VI and VII. The female may

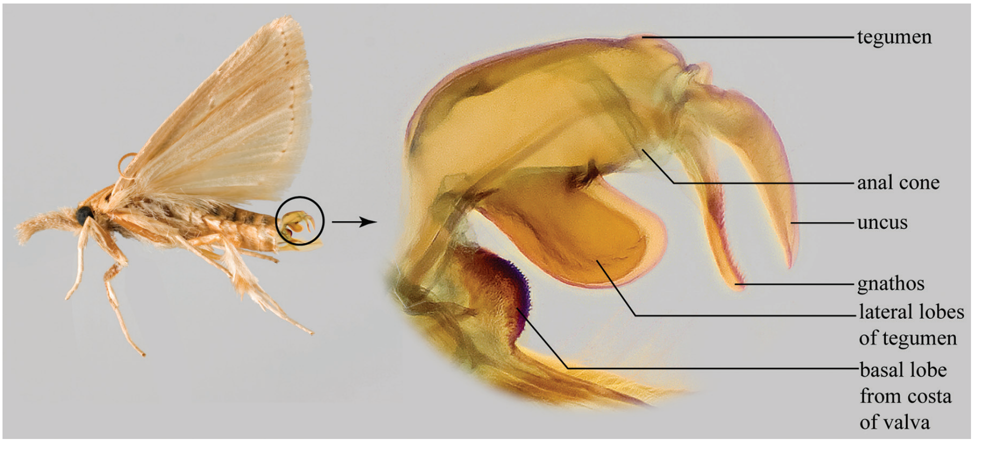

Figure 1. Lateral habitus and male genitalia of *Diatraea saccharalis* (Fabricius, 1794), the type species of *Diatraea* (modified from Solis and Metz 2011).

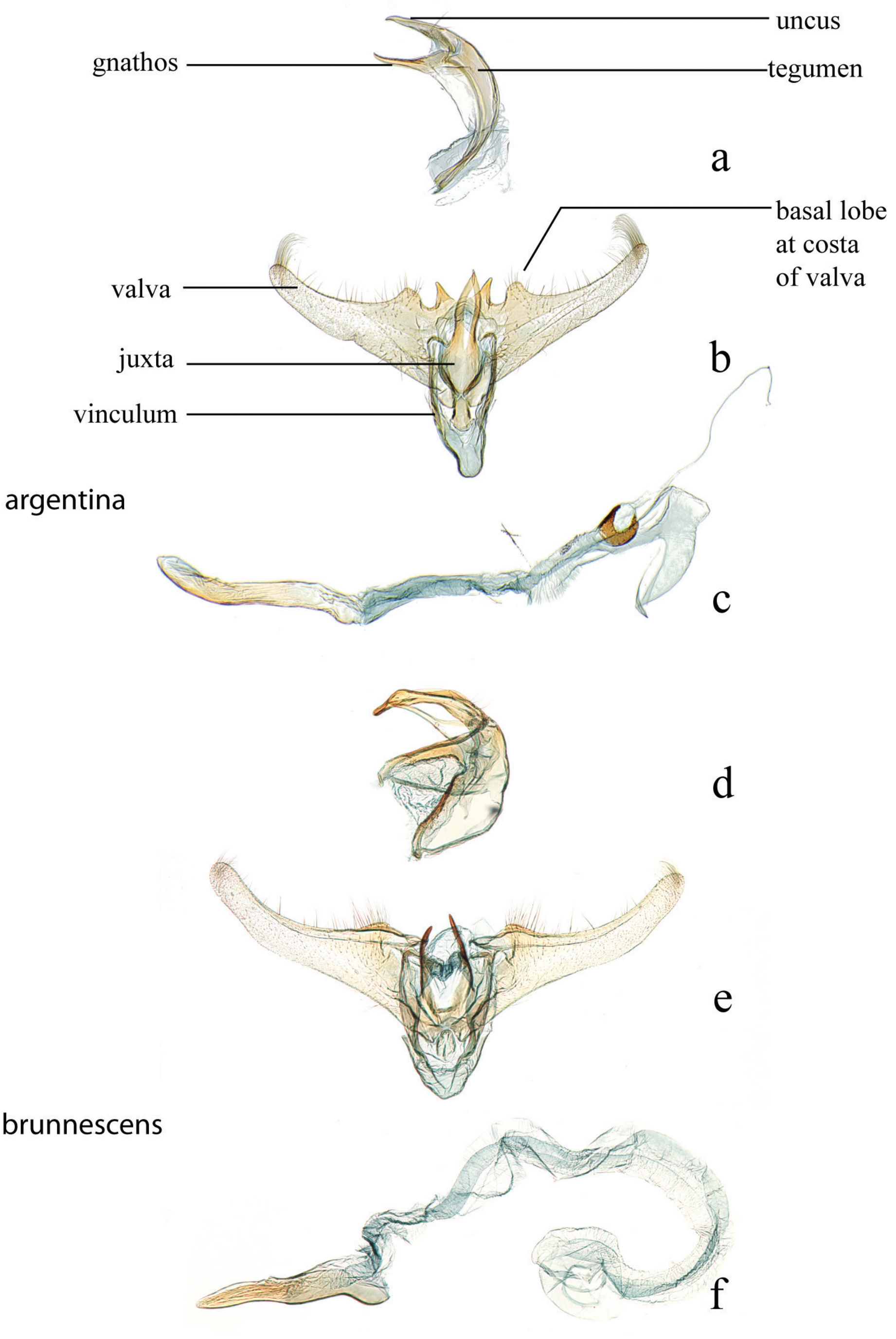

Figure 2. Male genitalia: *D. argentina*, CMNH #002, Santa Cruz, Provincia del Sara, Bolivia **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae **c** phallus; *D. brunnescens*, USNM #114612, New Bremen, Brazil **d** lateral view uncus, gnathos, tegumen **e** ventral view vinculum, juxta, valvae **f** phallus.

have more tissues surrounding the genitalia and must be cleaned with a brush carefully. The corpus bursae varies in length and width, so it is better to examine it when it is still turgid. If slide mounted, care should be taken to not fold, tear or collapse the corpus bursae. The female apparatus is usually membranous, but may not need staining. If staining is required to see structures use a saturated solution of chlorazol black for only a few seconds. The female can then be identified using the key to females below. The genitalia can then be stored in genitalia vials with glycerin if available, or in 70% alcohol that may harden, but will also preserve, the genitalia as vouchers. Two videos are also available to view dissection techniques in great detail (Brown et al. 2009, 2011).

Terminology within the keys and the major structures of the male genitalia are as follows (Figs 1, 2): valva (e) (harpe of Dyar and Heinrich 1927), basal lobe from the costa of the valvae, juxta (anellus of Dyar and Heinrich 1927), gnathos, tegumen, lateral lobe of the tegumen (but see Landry 1995, p. 69, "a pair of extensions posterad from base of ventral margin"), vinculum, and the phallus (aedoeagus of Dyar and Heinrich 1927) that includes a vesica with a cornutus (or cornuti).

The female genitalia (Figs 27, 29) consists of the papillae anales or ovipositor, anterior and posterior apophyses, an ostium bursae (genital opening of Dyar and Heinrich 1927), ductus bursae, and corpus bursae; bursae copulatrix is the term used for the ductus bursae + corpus bursae. Associated with the corpus bursae in a few *Diatraea* species is a sclerotized signum or many signa that may take various forms and may be diagnostic of species. Associated with the ostium bursae are: sterigma (= ostiolar sclerites (Gaskin 1971)), sclerotized structures, sometimes very complex, surrounding the ostium bursae; lamella antevaginalis, the anterior, often the ventral, side, of the sterigma; lamella postvaginalis, the posterior, often dorsal side, of the sterigma. The section of the ductus bursae near the ostium bursae is called the antrum, and a sclerotized structure just below it, or anterior to it, if present, is called a colliculum.

Results

The adapted key below using external and tympanal characters from Munroe and Solis (1998) can aid in identifying a species as Crambinae.

Key to Crambinae in Relation to the other Subfamilies of Pyraloidea

(adapted from Munroe and Solis 1998)

1 Praecinctorium absent; tympanal case "closed" medially and open anteriorly only; tympanum and conjunctiva in the same plane .... **Pyralidae**

– Praecinctorium present; tympanal case "open" anteromedially; tympanum meeting conjunctiva at a distinct angle .... **Crambidae, 2**

2 Chaetosema absent; forewing with distal part of CuP developed as a tubular vein; proboscis present, but reduced; tympanal cases reduced and widely separated; praecinctorium reduced ....other **Crambidae**

– Chaetosema present; forewing with CuP absent, not developed as a tubular vein; proboscis usually present and tympanal organs almost always normally developed..**3**

3 R_2 of forewing at least closely apposed to and usually stalked with R_{3+4}; labial palpus usually upturned, basal segment often longer than second segment; wings mostly with conspicuous pattern of transverse bands on a pale ground; larvae aquatic, rarely in damp terrestrial habitats................other **Crambidae**

– R_2 of forewing well separated from R_{3+4}; labial palpus often porrect, basal segment much shorter than second segment; wings usually without conspicuous pattern of transverse bands on a pale ground; larvae usually terrestrial, sometimes stem borers in aquatic graminaceous plants **4**

4 Forewing usually with weakly raised patches of black scales; cubitus of hindwing usually not pectinated with hairlike scales; lateral arms of tegumen of male genitalia about as long as uncus, little tapered ventrally; uncus of moderate length, pyriform, hoodshaped or bilobed, not obviously decurved from base to tip; gnathos with median element spikelike, sword-shaped, or digitate, straight or decurved, rarely reduced; uncus and gnathos not forming a jawlike structure, and not widely separated dorsad from valvae; valva sometimes with a ventral process but, except in *Heliothela*, without strong costal or medial armature; known larvae on mosses, lycopods, ferns, and roots of seed-bearing vascular plants.................**Scopariinae**

– Forewing without raised patches of black scales; cubitus of hindwing usually pectinated with hairlike scales, lateral arms of tegumen of male genitalia much longer than uncus or narrowed ventrally, usually both; uncus usually long, acuminate, and more or less decurved from base to tip; gnathos with lateral arms articulating at base of uncus, medial element various in shape, often rodlike or forming a dorsally directed hook; uncus and gnathos forming a jawlike structure, widely separated dorsad from valvae; valva often with strong costal process or medial armature; larvae mostly feeding at bases, roots, stems of grasses (Poaceae) ....**Crambinae**

Diagnosis of *Diatraea*

In the Crambinae *Diatraea* is morphologically defined by a combination of derived characters including a lack of ocelli on the head (absent or reduced in the externally similar *Donacoscaptes* and *Xubida* (B. Landry, pers. comm.)), the presence of pockets with specialized scales on the male second abdominal segment, hair tufts on the male hind tibia, in the male genitalia basal extensions of the tegumen in some or most species (Landry 1995). Landry (1995) also suggested that the shape of the female sterigma with shallow sclerotized, often spinose, depressions on each side of the ostium bursae, may be unique to *Diatraea* (in contrast to the externally similar *Donacoscaptes* and *Xubida* where "the setation of the female segment VIII is concentrated apico-dorsally" and "the female sterigma and segment VIII are sometimes linked by a narrow sclerotized bridge which may be single or double" (Landry 1995)). Another potentially derived structure in the male genitalia could be the lack of muscle attachments in the lateral lobes of the tegumen (Solis and Metz 2011).

Checklist of *Diatraea* Guilding, 1828

***Diatraea* Guilding, 1828**: 148. Type species: *Diatraea sacchari* Guilding, 1828: 149 by monotypy.

Diatrea Guilding, 1828: plate 12. Misspelling.

Diaraetria Grote, 1882: 56. Misspelling.

Iesta Dyar, 1909: 29. Type species: *Iesta lisetta* Dyar, 1909: 29 by original designation.

Diatraerupa Schaus, 1913: 240. Type species: *Diatraerupa guapilella* Schaus, 1913: 240 by original designation.

Trinidadia Dyar & Heinrich, 1927: 5. Type species: *Diatraea minimifacta* Dyar, 1911: 202 by original designation.

Eodiatraea Box, 1953: 178. Type species: *Chilo centrellus* Möschler, 1883: 360 by original designation.

Crambidiatraea Box & Capps, 1955: 175. Type species: *Diatraea cayennella* Dyar & Heinrich, 1927: 27 by original designation.

Zeadiatraea Box, 1955: 197. Type species: *Leucania lineolata* Walker, 1856: 100 by original designation.

***Diatraea albicrinella* Box, 1931**: 34. Type locality: Fonte Boa, Amazonas, Brazil.

***Diatraea andina* Box, 1951**: 393. Type locality: near Cordero, Upper Rio Torbes, Tachira, Venezuela.

***Diatraea argentina* Box, 1931**: 18. Type locality: nr. Florenzia, Gran Chaco, Argentina.

***Diatraea bellifactella* Dyar, 1911**: 205. Type localities: Sáo [São] Paulo, Brazil (male) and Castro, Parana, Brazil (female).

Diatraea balboana Box, 1956: 769. Type locality: Summit Botanical Gardens, Panama City, Panama. **Syn. n.**

***Diatraea brunnescens* Box, 1931**: 29. Type locality: Ciudad Bolivar, Venezuela.

Diatraea incertella Box, 1931: 30. Type locality: Rio de Janeiro, Brazil.

***Diatraea busckella* Dyar & Heinrich, 1927**: 16. Type locality: Porto Bello, Panama.

Diatraea luteella Box, 1931: 32. Type locality: Rio Cayapas, Esmeraldas, Ecuador. **Syn. n.**

Diatraea rosa Heinrich, 1931: 4. Type locality: Carabobo, Venezuela. **Syn. n.**

Diatraea busckella forma falconensis Box, 1951: 389. Type localities: Piritú and Cumarebo, Falcon, and Ocumare de la Costa, Aragua,Venezuela. **Syn. n.**

Diatraea busckella setariae Box, 1951: 391. Type locality: near Yuma promontory, Carabobo, Venezuela. **Syn. n.**

Diatraea setariaeoides Box, 1951: 390. Type locality: Ocumare de la Costa, Aragua, Venezuela. **Syn. n.**
Diatraea colombiana Box, 1956: 768. Type locality: Condoto, Prov. Choco, Colombia. **Syn. n.**
***Diatraea castrensis* Dyar & Heinrich, 1927**: 28. Type locality: Castro, Parana, Brazil.
***Diatraea cayennella* Dyar & Heinrich, 1927**: 27. Type locality: Cayenne, Fr. Guiana.
Diatraea cayenella Box, 1931: 38. Misspelling.
***Diatraea centrella* (Möschler, 1883)**: 360 (*Chilo*). Type locality: Paramaribo, Surinam.
Phalaena sacchari Sepp, 1848: 135. Type locality: Surinam.
Diatraea canella Hampson, 1895: 349. Type localities: Balthazar, Grenada or Mount Gay Estate, [Barbados], or Brazil.
Diatraea amnemonella Dyar, 1911: 203. Type locality: Castro, Parana, Brazil. **Syn. n.**
Diatraea anathericola Dyar & Heinrich, 1927: 21. Type locality: São Paulo, Brazil.
Diatraea amazonica Box, 1931: 36. Type locality: Calama, R. Madeira, Brazil. **Syn. n.**
***Diatraea considerata* Heinrich, 1931**: 3. Type locality: Eldorado, Sinaloa, Mexico.
***Diatraea crambidoides* (Grote, 1880)**: 50 (*Chilo*). Type locality: Kansas, USA.
Diatraea zeacolella Dyar, 1911: 203. Type locality: Tryon (Polk County), North Carolina, USA.
Diatraea tripsacicola Dyar, 1921: 193. Type locality: Miami, Florida, USA.
***Diatraea dyari* Box, 1930**: 307. Type locality: San Pedro de Jujuy, Jujuy, Argentina.
***Diatraea evanescens* Dyar, 1917**: 84. Type locality: Audubon Park, Louisiana, USA.
Diatraea sobrinalis Schaus, 1922: 140. Type locality: Cayuga, Izabal, Guatemala.
***Diatraea fuscella* Schaus, 1922**: 139. Type locality: Carillo, Costa Rica.
***Diatraea gaga* Dyar, 1914**: 319. Type locality: Corozal, Canal Zone, Panama.
Diatraea solipsa Dyar, 1914: 319. Type locality: Porto Bello, Colón, Panama, or Trinidad River, Panama.
Diatraea savannarum Box, 1935: 332. Type locality: Rupununi savannahs, base of Shiriri Mt., Guyana. **Syn. n.**
***Diatraea grandiosella* Dyar, 1911**: 205. Type locality: Guadalajara, Mexico.
***Diatraea guatemalella* Schaus, 1922**: 138. Type locality: Cayuga, Guatemala.
***Diatraea impersonatella* (Walker, 1863)**: 163 (*Crambus*). Type locality: Venezuela.

Note: Described from a series of 7 specimens from Venezuela and Brazil. Box (1931: Plate III) figured two female genitalia dissections (BMNH #141 and #142) that we studied. Figured in this paper is Figure 26d that is BMNH #142 (= Box #3). Box considered the dissected female, BMNH #141, to be the last remaining syntype of Walker's original series. The locality is unknown, but presumed by Box (1931:41-42) to be Venezuela: "The only specimen which we can to-day assert to have been included among the above, is the female type in the British Museum from Venezuela."

Note: This appears to be a variable species based on the number of specimens available and barring numerous dissections. Despite differences in size and coloration, the male genitalia are consistent throughout with the same morphology for the uncus and gnathos, lateral process of the tegumen, and costal processes. The females, however, are not consistent. In the *impersonatella* form, the lamella postvaginalis has the transverse ridges at an angle so that medially they are farther from the ostium bursae than the lateral ends and the membranous area in the middle is wide and widens past the ridges forming an hourglass shape. In the *moorella* form it is either like the *impersonatella* form or has the transverse ridges completely absent and the lamella postvaginalis a large roughened patch without a wide membranous area in the middle. The *pallidostricta* and *flavipennella* (and some *moorella*) form females have a much rounder lamella postvaginalis that is often glabrous and the transverse ridges are arcuate. Nomenclaturally, the synonomy for this group of names is also confounded by the lack of single typification for the syntype series and that some of these species are represented by female holotypes among what seems to be variable female genitalia.

Diatraea angustella Dyar, 1911: 205. Type locality: Castro, Parana, Brazil. **Syn. n.**
Diatraea angustellus Dyar, 1911. Schaus, 1922: 140. Misspelling.
Diatraea moorella Dyar & Heinrich, 1927: 17. Type locality: Georgetown, Guyana.
Diatraea flavipennella Box, 1931: 42. Type locality: Castro, Parana, Brazil. **Syn. n.**
Diatraea pallidostricta Dyar, 1911: 205. Type locality: São Paulo, Brazil. **Syn. n.** Note: Bleszynski (1967) considered *D. pallidostricta* a junior synonym of *Zeadiatraea lineolata* in the World Catalog, but this was a mistake; it was repeated in Munroe et al. (1995).
***Diatraea indigenella* Dyar & Heinrich, 1927**: 13. Type locality: Popayán, Colombia.
***Diatraea instructella* Dyar, 1911**: 201. Type locality: Popocatepetl Park, Mexico.
Note: Only known from two specimens, the female holotype in the USNM and a male that Box determined to be conspecific based on external characters and type locality. The male and female may not actually be conspecific.
***Diatraea lativittalis* (Dognin, 1910)**: 117 (*Chilo*). Type locality: Tucuman, Argentina.
Diatraea obliqualis Hampson, 1919: 543. Type locality: Goya, Corrientes, Argentina. **Syn. n.**
Chilo latmiadelis Dognin, 1923: 38. Unjustified emendation/replacement of *lativittalis* (Dognin, 1910) (nec. *lativittalis* (Walker, 1863: 171) (*Chilo*)).
***Diatraea lentistrialis* Hampson, 1919**: 546. Type locality: Florenzia, Gran Chaco, Argentina.
Diatraea silvicola Box, 1951: 396. Type locality: Guasdualito El Amparo road, Upper Apure, Venezuela. **Syn. n.**
***Diatraea lineolata* (Walker, 1856)**: 100 (*Leucania*). Type locality: Venezuela.
Chilo culmicolellus Zeller, 1863: 7. Type locality: Colombia.
Chilo neuricellus Zeller, 1863: 8. Type locality: Venezuela.
***Diatraea lisetta* (Dyar, 1909)**: 29 (*Iesta*). Type locality: Dade City, Florida, USA.
Iesta cancellalis Dyar, 1914: 320. Type locality: Corozal, Canal Zone, Panama.
Iesta adulcia Dyar, 1916: 37. Type locality: Teapa, Tabasco, Mexico.
***Diatraea magnifactella* Dyar, 1911**: 201. Type localities: Orizaba, Cuernavaca, and Oaxaca, Mexico.

***Diatraea maronialis* Schaus, 1922**: 139. Type locality: St. Jean, Maroni River, French Guiana.

Diatraea umbrialis Schaus, 1922: 139. Type locality: St. Jean, Maroni River, French Guiana. **Syn. n.**

***Diatraea minimifacta* Dyar, 1911**: 202. Type locality: Trinidad, B.W. I.

Diatraerupa guapilella Schaus, 1913: 240. Type locality: Guápiles, Limón, Costa Rica. **Syn. n.**

Iesta morobe Dyar, 1916: 37. Type locality: Teapa, Tabasco, Mexico. **Syn. n.**

Diatraea pittieri Box, 1951: 394. Type locality: Rancho Grande, Aragua, Venezuela. **Syn. n.**

***Diatraea mitteri* Solis, 2015**: 649. Type locality: Woodward, Oklahoma, United States.

***Diatraea muellerella* Dyar & Heinrich, 1927**: 25. Type locality: Guerrero, Mexico.

***Diatraea myersi* Box, 1935**: 331. Type locality: Recreio, Amazons, Brazil.

***Diatraea pedibarbata* Dyar, 1911**: 202. Type locality: St. Laurent du Maroni, French Guiana.

Diatraea maritima Box, 1935: 333. Type localities: Plantation Ogle, Plantation Albion and Georgetown, Guyana. **Syn. n.**

***Diatraea postlineella* Schaus, 1922**: 138. Type locality: Quirigua, Guatemala.

***Diatraea ragonoti* Box, 1948**: 421. Type locality: Petropolis, Rio de Janeiro, Brazil.

***Diatraea rufescens* Box, 1931**: 37. Type locality: Buenavista, Bolivia.

***Diatraea saccharalis* (Fabricius, 1794)**: 238, 411 (*Phalaena*). Type locality: America Meridionalis [presumably Surinam (Box, 1931: 23)].

Crambus sacchari Fabricius, 1798: 469, 31. Unjustified emendation of *saccharalis* Fabricius, 1794: 469.

Diatraea sacchari Guilding, 1828: 149. Junior homonym of *sacchari* Fabricius, 1798: 469.

Crambus leucaniellus Walker, 1863: 161. Type locality: St. Domingo, West Indies.

Crambus lineosellus Walker, 1863: 162. Type locality: Honduras.

Chilo obliteratella Zeller, 1863: 8. Type locality: Brazil.

Diatraea grenadensis Dyar, 1911: 200. Type locality: Grenada, West Indies.

Diatraea pedidocta Dyar, 1911: 201. Type locality: Cordoba, Mexico.

Diatraea continens Dyar, 1911: 202. Type locality: Castro, Parana, Brazil.

Diatraea brasiliensis van Gorkum & de Waal, 1913: 181. Type locality: Brazil.

Diatraea incomparella Dyar & Heinrich, 1927: 13. Type locality: Taperinha, Para [Amazonas], Brazil.

Diatraea centinens Dyar & Heinrich, 1927: 7. Misspelling.

***Diatraea schausella* Dyar & Heinrich, 1927**: 24. Type locality: Chejel, Alta Verapaz, Guatemala.

Note: Known only from male specimens. The single female specimen noted by Box (1931:45) and labeled "COLOMBIA, Choko Prov., Condoto (H. G. F. Spurrell)" is likely *D. busckella* Dyar & Heinrich, 1927.

***Diatraea strigipennella* Dyar, 1911**: 206. Type localities: "Guianas" and Castro, Parana, Brazil.

Diatraea entreriana Box, 1931: 39. Type locality: La Soledad, Entre Rios, Argentina. **Syn. n.**

***Diatraea suffusella* Box, 1931**: 33. Type locality: St. Jean du Maroni, French Guiana.

***Diatraea tabernella* Dyar, 1911**: 200. Type locality: Tabernilla, Panama Canal Zone, Panama.

***Diatraea venosalis* (Dyar, 1917)**: 87 (*Haimbachia*). Type locality: Audubon Park, Louisiana, USA.

***Diatraea veracruzana* Box, 1956**: 770. Type locality: Teocelo, near Coatepec, Veracruz, Mexico.

Key to the species of *Diatraea* based on male genitalia

[*Diatraea lativittalis* (Dognin, 1910) and *D. suffusella* Box, 1931 are known from only female specimens, so they cannot be identified with this key.]

1	Uncus broad at apex, paddle-shaped (*bellifactella* group) (Figs 8d; 9a, c).....	**2**
1’	Uncus triangular, narrowing at apex, beaklike..	**4**
2 (1)	Tegumen with crenulate, lateral lobes; uncus stiff, extended ventrolaterally, but not bilobed (Fig. 8d)	***fuscella***
2’	Tegumen at most carinate laterally, lacking lobes; uncus less sclerotized and bilobed (Figs 9a, c)..	**3**
3 (2’)	Juxta with four lateral projections, two central, long, and two lateral, short (Fig. 9d)	***andina***
3’	Juxta with three projections, two lateral, long, and one central, shorter, (Fig. 9a)	***bellifactella***
4 (1’)	Juxta with three projections, two lateral and one central (*strigipennella* group) (Figs 7b,d; 8b)	**5**
4’	Juxta with two lateral projections..	**7**
5 (4)	Central projection of juxta more than five times longer than wide (Fig.7b)	***strigipennella***
5’	Central projection of juxta less than three times longer than wide (Figs 7d, 8b)...	**6**
6 (5)	Medial portion of basal costal lobe on valva crenulate almost as broad as long (Fig. 8b)..	***cayennella***
6’	Medial portion of basal costal lobe on valva smooth, slender, acutely pointed (Fig. 7d)	***castrensis***
7 (4’)	Valva costal margin with narrow, accessory process (Fig. 10b, e, red arrow); basal costal lobe present or absent (*centrella* group)	**8**
7’	Valva costal margin lacking narrow accessory process, basal costal lobe present or absent..	**9**
8 (7)	Valva accessory process on costal margin curved, face of juxta arms with denticles (Fig. 10e)	***rufescens***

8’	Valva accessory process on costal margin straight, juxta arms with denticles only on posterior edge (Fig. 10b)	***centrella***
9 (7’)	Apex of juxta arms bidentate, with two distinct points (*lineolata* group) (Figs 11b,e, red arrow; 12b, e)	**10**
9’	Apex of juxta arms with a single point or rounded with a small, subapical tooth, but never bidentate	**13**
10 (9)	Apex of juxta arms cylindrical, apical teeth subequal in size, clawlike (Fig. 11b)	***lineolata***
10’	Apex of juxta arms flat, apex pointed with smaller subapical tooth (Figs 11e, 12b, e)	**11**
11 (10’)	Apex of lateral juxta arms spatulate, gnathos with large, pointed process in middle (Fig. 11d)	***muellerella***
11’	Apex of lateral juxta arms attenuate, gnathos without process (Fig. 12b, e)	**12**
12 (12’)	Apex of gnathos bluntly rounded and denticulate, apex of uncus pointed (Fig. 12d)	***schausella***
12’	Apex of gnathos and uncus spatulate (Fig. 12a)	***grandiosella***
13 (9’)	Teeth on gnathos 6× longer than wide or longer, like setae (Figs 12g, j; 19d) (*crambidoides* group)	**14**
13’	Teeth on gnathos no more than 4×longer than wide, short like serrations on a butter knife, or completely absent	**16**
14 (13)	Uncus drastically narrowing before apex, then apex slightly capitate and cleft, lateral edges of uncus rough; gnathos recurving back on itself noticeably (Fig. 19d)	***mitteri***
14’	Uncus slightly narrowing towards apex, but not noticeably capitate, apex rounded or pointed, lateral edges smooth or carinate; gnathos slightly hooked, but not recurving back towards base (Fig. 12g, j)	**15**
15 (14’)	Ventrolateral edges of uncus medially expanded into wide blades, apex broadly spatulate (Fig. 12g)	***crambidoides***
15’	Ventrolateral edges of uncus medially carinate, but not expanded, apex flat, but not broadly spatulate (Fig. 12j)	***postlineella***
16 (13’)	Lateral edge of tegumen without lobelike process (lateral lobes of D. & H., 1927) (*lisetta* group) (Figs 2a, d; 4d; 5c)	**17**
16’	Lateral edge of tegumen with lobelike process, sometimes small and hard to see (as in *gaga*) (Fig. 3d)	**25**
17 (16)	Juxta constricted laterally before base of juxta arms, juxta arms emerging more medially (Fig. 5d)	***minimifacta***
17’	Juxta evenly rounded to base of juxta arms, juxta arms emerging more laterally	**18**
18 (17’)	Valva costal margin significantly extended posteriorly, apically of basal costal lobe, basal costal lobe present (Figs 2b, 4e)	**19**
18’	Valva costal margin not significantly extended posteriorly, apically of basal costal lobe, basal costal lobe absent or present (Fig. 4b)	**20**
19 (18)	Apex of basal costal lobe of valva sharply pointed (Fig. 2b)	***argentina***

19’ Apex of basal costal lobe of valva evenly rounded (Fig. 4e)................. ***lisetta***
20 (18’) Apex of juxta arms rounded with subapical tooth (Fig. 4b).........***lentistrialis***
20’ Apex of juxta arms pointed (Figs 2e, 3e, 6g) **21**
21 (20’) Gnathos thin and cylindrical (Fig. 2d)..................................... ***brunnescens***
21’ Gnathos flattened and beaklike (Fig. 6e)..**22**
22 (21’) Gnathos with a pronounced mound of teeth subapically (Fig. 6e, f) .....***venosalis***
22’ Gnathos with teeth, but not on a distinct, subapical mound.....................**23**
23 (22’) Valva without basal costal extension (Fig. 3e) .... ***gaga*** in part
23’ Valva with bluntly pointed basal costal extension, but no real lobe (Figs 5b, 6c) **24**
24 (23’) Gnathos in lateral view more-or-less straight from base to tip, dorsal surface slightly undulate, but not arcuate, only tip with slight hook; tegumen in lateral view larger at the base than at the point of articulation with uncus/gnathos; brush of setae at tip of valva dense and long, length more than twice width of valva where brush emerges from valva (Fig. 5a, b)…..... ***maronialis***
24’ Gnathos in lateral view arcuate, middle of dorsal surface “lower” than base and tip; tegumen in lateral view more-or-less equal in width throughout length; brush of setae at tip of valva only slightly more conspicuous than rest of setae on valva, length subequal to width of valva where brush emerges from valva (Fig. 6a, b) .... ***myersi***
25 (16’) Small species, juxta arms acutely pointed apically with no subapical tooth (Fig. 3b, e) **26**
25’ Large species, juxta arms rounded apically, subapical tooth absent or present (*saccharalis* group) (Fig. 13b, e)...**27**
26 (25’) Lateral lobes of tegumen conspicuous, at least as long as wide at base (Fig. 3a) ....***evanescens***
26’ Lateral lobes of tegumen obscure, no more than half as long as wide at base (Fig. 3d) .... ***gaga*** in part
27 (25’) Lateral lobe of tegumen square, either with corners sharp or rounded (Figs 16d, 17d)..**28**
27’ Lateral lobe of tegumen rounded or pointed..**29**
28 (27) Lateral lobe of tegumen square with rounded corners (Fig. 16d).....***magnifactella***
28’ Lateral lobe of tegumen square with sharp corners (Fig. 17d) .... ***ragonoti***
29 (27’) Lateral lobe of tegumen broadly rounded, basal width 2/3 length of tegumen (Fig. 13a)... ***albicrinella***
29’ Lateral lobe of tegumen less broad, basal width at most 1/2 length of tegument...**30**
30 (29’) Valva basal costal lobe triangular, not significantly produced, lacking crenulations, carinae, or denticulation, setose only (Fig. 14e).......................... ***dyari***
30’ Valva basal costal lobe globular, at least partially, significantly produced, with at least some crenulation, carinae, or denticulation **31**
31 (30’) Valva basal costal lobe weakly crenulate dorsally (Fig. 17b).......***pedibarbata***
31’ Valva basal costal lobe strongly crenulate, carinate and/or denticulate.......**32**

32 (31')	Lateral lobe of tegumen sharply pointed, apex flattened anteroposteriorly (Figs 14g, 16a)	**33**
32'	Lateral lobe of tegumen bluntly pointed or rounded	**34**
33 (32)	Uncus with ventrolateral, carinate margin constricting sharply and is not carinate just before apex of uncus, thus making apex slightly spatulate; basal costal lobe of valva capitate, posterior surface evenly rounded and lacking a depression; transition between basal costal lobe and following section of costa smooth, not notched (Fig. 16a, b)	***indiginella***
33'	Uncus with a ventrolateral, carinate margin that is complete, not tapered before reaching apex; basal costal lobe of valva protruding posteriorly only, not widened laterally at apex, with small depression in posterior surface; with roughened notch between base of basal costal lobe and following section of costa (Fig. 14g, h)	***instructella***
34 (32')	Valva basal costal lobe base with basal and apical widths subequal, entire lobe wider than long (Fig. 14b)	***considerata***
34'	Valva basal costal lobe narrower at base than apex, essentially capitate (Figs 18e, 19b) (subtle or not clearly evident in *D. saccharalis*)	**35**
35 (34')	Lateral lobe of tegumen clearly ovate (Fig. 18a)	**36**
35'	Lateral lobe of tegumen bluntly pointed (Figs 15a, 19a)	**37**
36 (35)	Lateral lobe of tegumen as long as wide (Fig. 18a)	***saccharalis***
36'	Lateral lobe of tegumen longer than wide (Fig. 18d)	***tabernella***
37 (35')	Anterior edge of lateral lobe of tegumen angled, perpendicular to tegumen at base, then turning posteroventrally (Fig. 19a)	***veracruzana***
37'	Anterior edge of lateral lobe of tegumen straight or arcuate, but not angled	**38**
38 (37')	Anterior edge of lateral lobe of tegumen straight, denticulation on valva basal costal lobe large and densely packed on lobe (Fig. 15a, b)	***guatemalella***
38'	Anterior edge of lateral lobe of tegumen arcuate, denticulation on valva basal costal lobe large or small, but not densely packed on lobe (Figs 13d, e; 15d, e)	**39**
39 (38')	Denticulation of valva basal costal lobe small, lobe essentially not darkened more than rest of cuticle as a result of denticulation (Fig. 15e)	***impersonatella***
39'	Denticulation of valva basal costal lobe large, lobe darkened more than rest of cuticle as a result of denticulation (Fig. 13e)	***busckella***

Simple key to *Diatraea* species based on female genitalia

[The female is unknown for the following species and therefore not included in the key below: *castrensis* Dyar & Heinrich, 1927; *schausella* Dyar & Heinrich, 1927. We did not have female specimens on hand of *ragonoti* Box, 1948 and *suffusella* Box, 1931.]

1	Corpus bursae with darkly sclerotized, teethlike spines or flattened plates (Figs 21c, 22d)	**2**

1’ Corpus bursae completely membranous, at most with areas of darkened cuticle...**3**
2 (1) Lamella antevaginalis hardened and darkened, appearing as a medially-bisected plate that protrudes posteriorly over the genital opening; corpus bursae with a ring of sclerotized flattened plates (Fig. 22d) ....***strigipennella***
2’ Lamella antevaginalis membranous, possibly sclerotized as much as sternites, but not dark or protruding over the genital opening; corpus bursae with opposite patches of sclerotized teethlike spines (Fig. 21c)................***lentistrialis***
3 (1’) Sternite VIII with a broad, transverse “pocket” mostly concealing ostium bursae; lamella antevaginalis composed of a pair of hardened, posteriorly projecting extensions that may cover the genital opening or surround it laterally; lamella postvaginalis with lateral areas of wrinkled and/or densely setose cuticle contrasting strikingly with medial area that is smooth and glabrous; or if lamella postvaginalis immediately posterad ostium bursae smooth and concave then with a pair of densely setose transverse ridges posterad concavity that project ventrally (*saccharalis* group) (Fig. 28a) **4**
3’ Sternite VIII with ventral surface continuous with ostium and membranous never forming a transverse pocket concealing ostium; or if lamella antevaginalis and/or lamella postvaginalis varously sclerotized and ostium concealed then without contrasting lateral areas of roughened or densely setose cuticle and a pair of densely setose transverse ridges posterad **12**
4 (3) Corpus bursae more than 5× longer than wide; corpus bursae shape cylindrical, more or less parallel sided (Fig. 26c) ....***guatemalella***
4’ Length of corpus bursae variable, but if longer than wide then less than 5× longer than wide; corpus bursae shape variable, but usually irregular to ovate...**5**
5 (4’) Lateral, wrinkled and densely setose cuticle of lamella postvaginalis continuous with and continuing laterally along posterior margin of sternite VIII, not forming subcircular patches (Fig. 27b)…..................................***instructella***
5’ Lateral, wrinkled and/or densely setose cuticle of lamella postvaginalis not reaching posterior margin of sternite VIII, or if approximate to posterior margin forming distinct subcircular patches contrasting with the rest of sternite VIII cuticle (Fig. 27d)...**6**
6 (5’) Lamella postvaginalis lacking a distinct pair of transverse ridges posterad, cuticle wrinkled or densely setose, but solitary set of transverse ridges undetectable (Figs 26a; 27a, c, d) **7**
6’ Lamella postvaginalis with a distinct pair of transverse ridges posterad, ridges distinct from surrounding cuticle...**9**
7 (6) Corpus bursae only slightly longer than wide, not extending or barely extending beyond anterior margin of sternite VIII (Fig. 27d).............***pedibarbata***
7’ Corpus bursae length at least 2X greater than width, extending well beyond anterior margin of sternite VIII...**8**

8 (7') Ductus bursae with longitudinal grooves, uniformly darkened throughout length from ostium to corpus bursae; corpus bursae with pair of acuminate strips of darker cuticle descending from ductus bursae (Figs 26a, 27c) .... ***considerata*** **or** ***magnifactella***

8' Ductus bursae more or less smooth, lightly darkened except for contrasting colliculum at junction with corpus bursae that is considerably darker; corpus bursae without any darkened areas at base, completely membranous (Fig. 27a) .... ***indigenella***

9 (6') Corpus bursae length 4× greater than width, long and narrow with lateral expansions near middle no wider than width of corpus; posteriorly projecting extensions of lamella antevaginalis reduced, mostly membranous (Fig. 28c) ... . ***veracruzana***

9' Corpus bursae length 2× greater than width or less, irregularly shaped or ovate, width at middle appearing to contribute to overall shape of corpus rather than as lateral expansions; posteriorly projecting extensions of lamella antevaginalis enlarged and conspicuous, middle membranous area much narrower.......... **10**

10 (9') Densely setose, ventrally projecting transverse ridges encompassing posterior half of lamella postvaginalis, flat anterad only, forming broad pillow shapes in posterior half of lamella postvaginalis (Fig. 25f) .... ***busckella***

10' Densely setose, ventrally projecting transverse ridges forming a narrow band in lamella postvaginalis, flat both anterad and posterad, forming an elevated crest at posterior margin of lamella postvaginalis (Fig. 28b) **11**

11 (10') Posterior margin of hardened, posteriorly projecting extensions of lamella antevaginalis smooth and broadly arcuate, forming an almost semicircular arc from medial to lateral edge (Fig. 28b)…. .... ***tabernella***

11' Posterior margin of hardened, posteriorly projecting extensions of lamella antevaginalis irregularly shaped with at least one substantial notch or indentation, bluntly pointed, forming a triangle (Figs 25e, 26d, 28a) .... ***albicrinella*, *impersonatella*, or *saccharalis***

12 (3') Lamella antevaginalis and/or lamella postvaginalis variously sclerotized and adorned with texture markedly different than remaining cuticle of sternite VIII (Figs 23a,c,d) **13**

12' Lamella antevaginalis and/or lamella postvaginalis unadorned, cuticle around ostium not significantly dissimilar to cuticle of rest of sternite VIII........... **15**

13 (12) Lamella antevaginalis with rugose cuticle continuous from sternite VIII to hardened, posteriorly projecting, cylindrical extensions around rim of ostium bursae that are bisected medially by a hardened slot (Fig. 23a)..... ***cayennella***

13' Lamella antevaginalis with a raised ring of semicircular cuticle separating sternite VIII cuticle from margin of ostium bursae by a semimembranous depression... **14**

14 (13') Raised circular cuticle of lamella antevaginalis darkened around entire edge, medially as dark as laterally; lamella antevaginalis laterally with denser/larger

setal sockets, but not rugose; rim of ostium bursae and beginning of antrum irregularly notched and grooved; lamella postvaginalis smooth medially, membranous (Fig. 23d) .... ***andina***

14’ Raised circular cuticle of lamella antevaginalis not darkened medially, noticeably darker on lateral edges; lamella antevaginalis laterally with rugose cuticle in addition to more densely spaced setal sockets; rim of ostium bursae with a single medial notch; lamella postvaginalis medially with semicircular ridges resembling a thumbprint (Fig. 23c) .... ***bellifactella***

15 (12’) Antrum with heavy sclerotization in the shape of a yoke, narrower at dorsal margin of ostium bursae, widening laterally and descending down antrum, lateral edges folded inward forming a trough (Fig. 20b)............ ***brunnescens***

15’ Antrum variously sclerotized, but sclerotization not shaped like a yoke or lateral edges folded into a trough **16**

16 (15’) Antrum and ductus bursae only lightly sclerotized or not at all, colliculum not evident; union of ductus bursae and corpus bursae smooth, not constricted, so that beginning of corpus is indistinct (Fig. 26b)................. ***dyari***

16’ Antrum and ductus bursae with some sclerotization and colliculum usually present; if sclerotization of membrane light or indistinct then terminus of ductus bursae and beginning of corpus bursae always obvious **17**

17 (16’) Terminal end of ductus bursae with a spherical, membranous expansion that is 2× wider than ductus bursae before pinching to opening of corpus bursae (Fig. 22b).. ***myersi***

17’ Ductus bursae with varying shapes and widths, but never with a large, spherical expansion before the opening of the corpus bursae **18**

18 (17’) Corpus bursae medially wider due to presence of shallow lateral pockets on each side about midway, not simply oval-shaped **19**

18’ Corpus bursae oval shaped, without shallow lateral pockets on each side..... **20**

19 (18) Ostium bursae and antrum equal in width, but ductus bursae narrower forming a constriction before corpus bursae (Fig. 20c) ....***evanescens***

19’ Ostium bursae, antrum, and ductus bursae subequal in width, constriction if any before corpus bursae subtle (Fig. 20d) ....***gaga***

20 (18’) Lamella postvaginalis with long setae near ostium bursae (Fig. 21a) ....***lativittalis***

20’ Lamella postvaginalis without long setae near ostium bursae.....................**21**

21 (20’) Corpus bursae length at least 4× width, long and narrow, more cylindrical than oval..**22**

21’ Corpus bursae length no more than 3× width, more oval or irregularly shaped **23**

22 (21) Central America north to southeast United States (Fig. 21d).............. ***lisetta***

22’ Argentina (Fig. 20a)... ***argentina***

23 (21’) Margin of ostium bursae, antrum, AND ductus bursae without wrinkles, ridges, grooves, or undulations (Fig. 23b) ....***fuscella***

23’ At least some part of margin of ostium bursae, antrum, OR ductus bursae with wrinkles, ridges, grooves, and/or undulations **24**

24 (23’) Colliculum a broad band notched in the middle to form a saddle shape; distinctly demarcated and darker than rest of surrounding cuticle **25**

24’ Colliculum variable or indistinct, but if distinct from surrounding cuticle, not a broad, saddle-shaped band notched in the middle **26**

25 (24) Ostium bursae circular, margin less undulate, only slightly uneven; ductus bursae length at least 2× width, with longitudinal ridges (Fig. 22c) .... ***venosalis***

25’ Ostium bursae flattened dorsoventrally, ventral margin distinctly undulate; ductus bursae length subequal to width or only slightly longer, lacking longitudinal ridges (Fig. 24d) .... ***muellerella***

26 (24’) Papillae analis with lobelike ventral extension, distinct from smooth, outer sweep of papillae analis (Fig. 25a, b) .... ***grandiosella***

26’ Papillae analis normally rounded ventrally, outer sweep continuous (Fig. 25c, d) **27**

27 (26’) Ostium bursae completely open to environment, not concealed by any surrounding cuticle of the lamella antevaginalis or lamella postvaginalis other than undulations of margin **28**

27’ Ostium bursae partially enclosed by pinching of lamella antevaginalis or lamella postvaginalis, opening to environment narrower than ostium bursae (Figs 22a, 24a, b) **31**

28 (27) Distance between ostium bursae and posterior margin of sternite VIII subequal to width of ostium bursae; ductus bursae length nearly 2× width, noticeably more darkly sclerotized ventrally (Fig. 21e) .... ***maronialis***

28’ Distance between ostium bursae and posterior margin of sternite VIII at least 2× width of ostium bursae; ductus bursae length subequal to width, ventrally no darker than remaining membrane **29**

29 (28’) Ventral and lateral margins of ostium bursae distinctly undulate with deep invaginations forming ridges in beginning of antrum (Fig. 24c) .....***lineolata***

29’ Ventral and lateral margins of ostium bursae barely roughened, walls of antrum unaffected by shape of margin of ostium bursae (Fig. 25c) **30**

30 (29’) Sclerotized collar on ductus bursae triangular, surface denticulate, edges jagged, midlength shorter than width of ductus bursae (Fig. 25c) .... ***crambidoides***

30’ Sclerotized collar on ductus bursae rectangular, surface and edges smooth, midlength subequal to width of ductus bursae (Fig. 29b) .... ***mitteri***

31 (27’) Lamella antevaginalis expanded posteriorly over ostium bursae, split in the middle forming a notch between cuticle and exposing ostium bursae; lamella postvaginalis widened into circular opening with wrinkled edges (Fig. 22a) .. .. ***minimifacta***

31’ Lamella antevaginalis only slightly extending over ostium bursae with wrinkled ventral margin and without a noticable notch; lamella postvaginalis pinched medially forming a notch over ostium bursae and a groove posterad (Fig. 24a, b) .... ***centrella* or *rufescens***

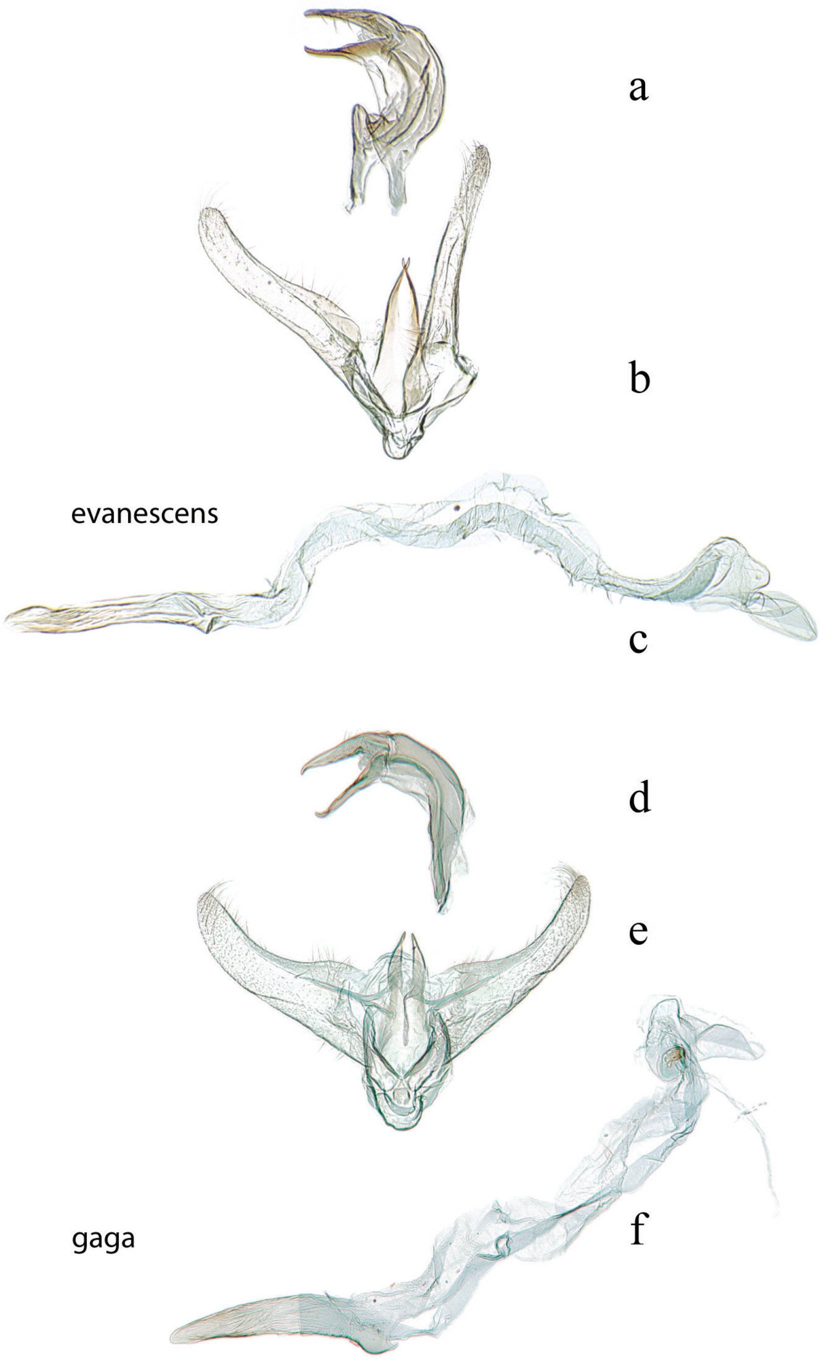

Figure 3. Male genitalia: *D. evanescens*, USNM #114625, Conroe, Texas, USA **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae **c** phallus; *D. gaga*, USNM #114613, El Sombrero, Guarico, Venezuela & USNM #114615, Corazal, Canal Zone, Panama **d** lateral view uncus, gnathos, tegumen **e** ventral view vinculum, juxta, valvae **f** phallus.

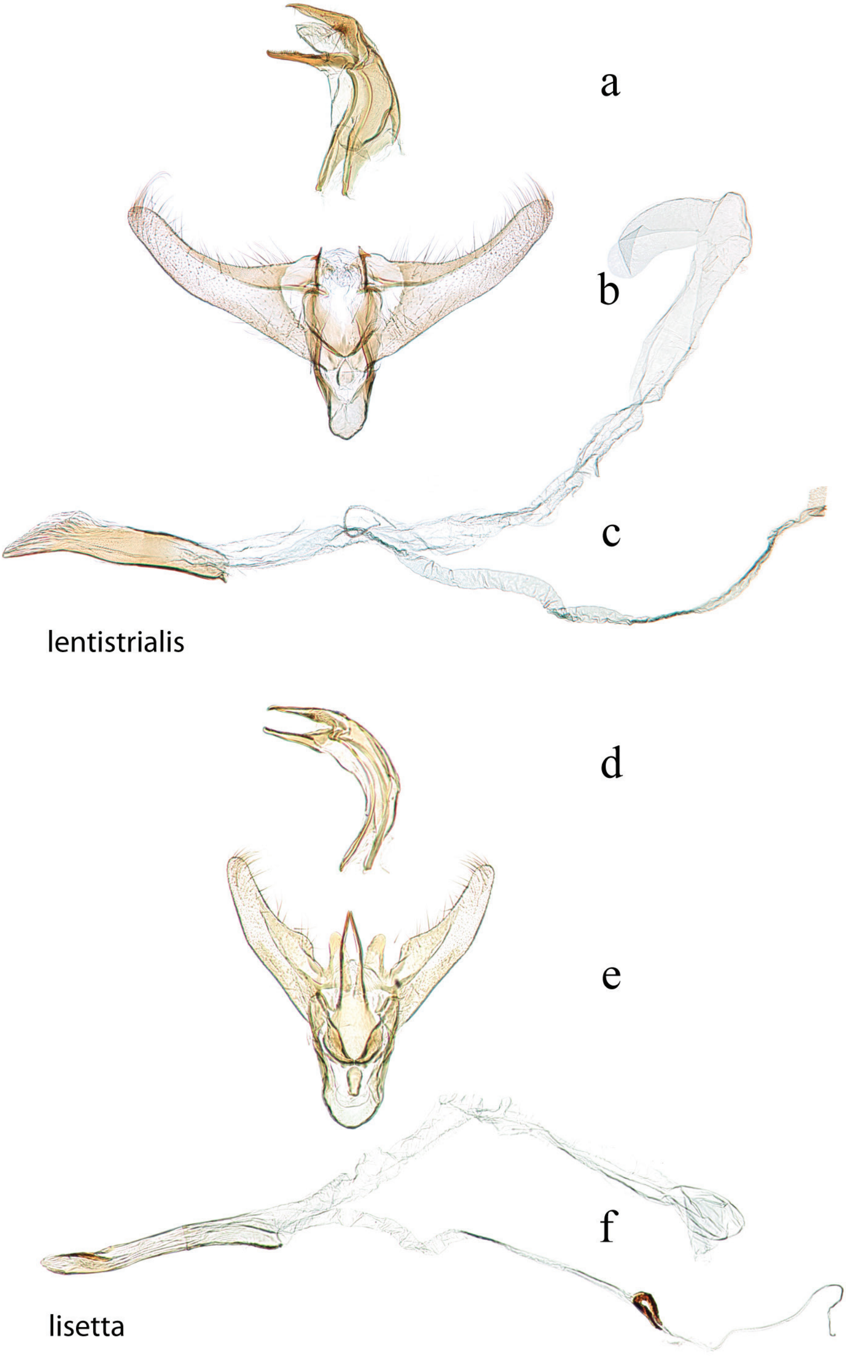

Figure 4. Male genitalia: *D. lentistrialis*, USNM #114616, 30 km. E. of S. Felipe, Yaracuy, Venezuela **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae **c** phallus; *D. lisetta*, holotype, USNM #114618, Dade City, Florida, USA **d** lateral view uncus, gnathos, tegumen **e** ventral view vinculum, juxta, valvae **f** phallus.

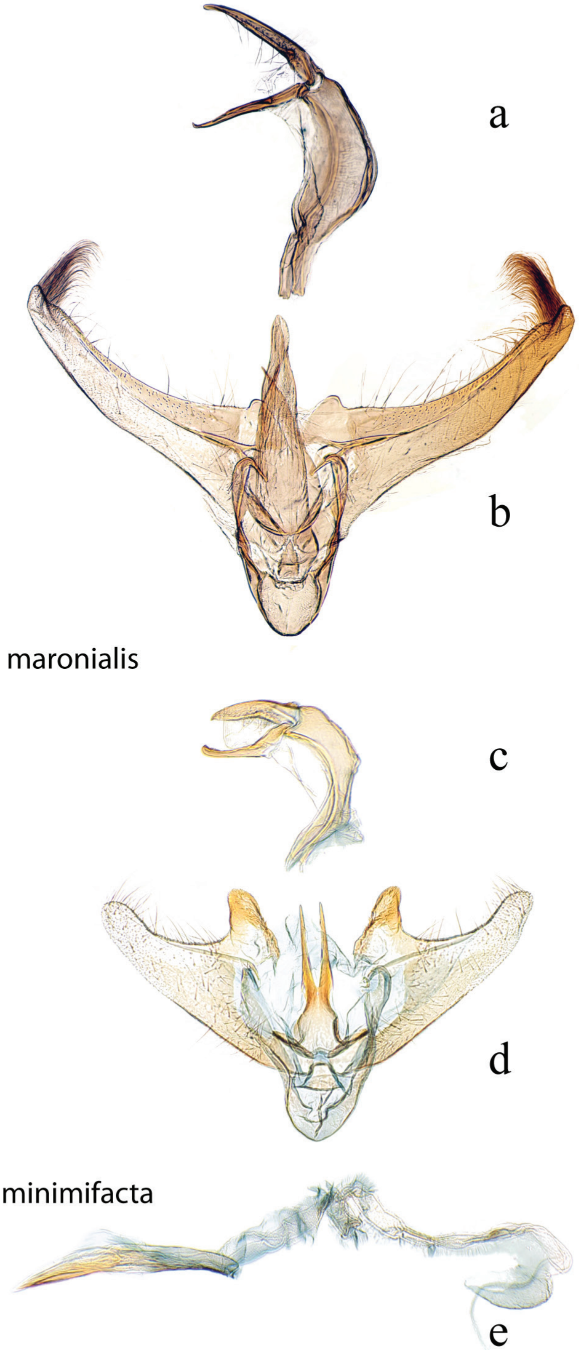

Figure 5. Male genitalia: *D. maronialis*, USNM #97391, St. Jean du Maroni, French Guiana **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae, phallus (attached); *D. minimifacta*, USNM #114621, Yacambu Nat. Pk., Edo. Lara, Venezuela **c** lateral view uncus, gnathos, tegumen **d** ventral view vinculum, juxta, valvae **e** phallus.

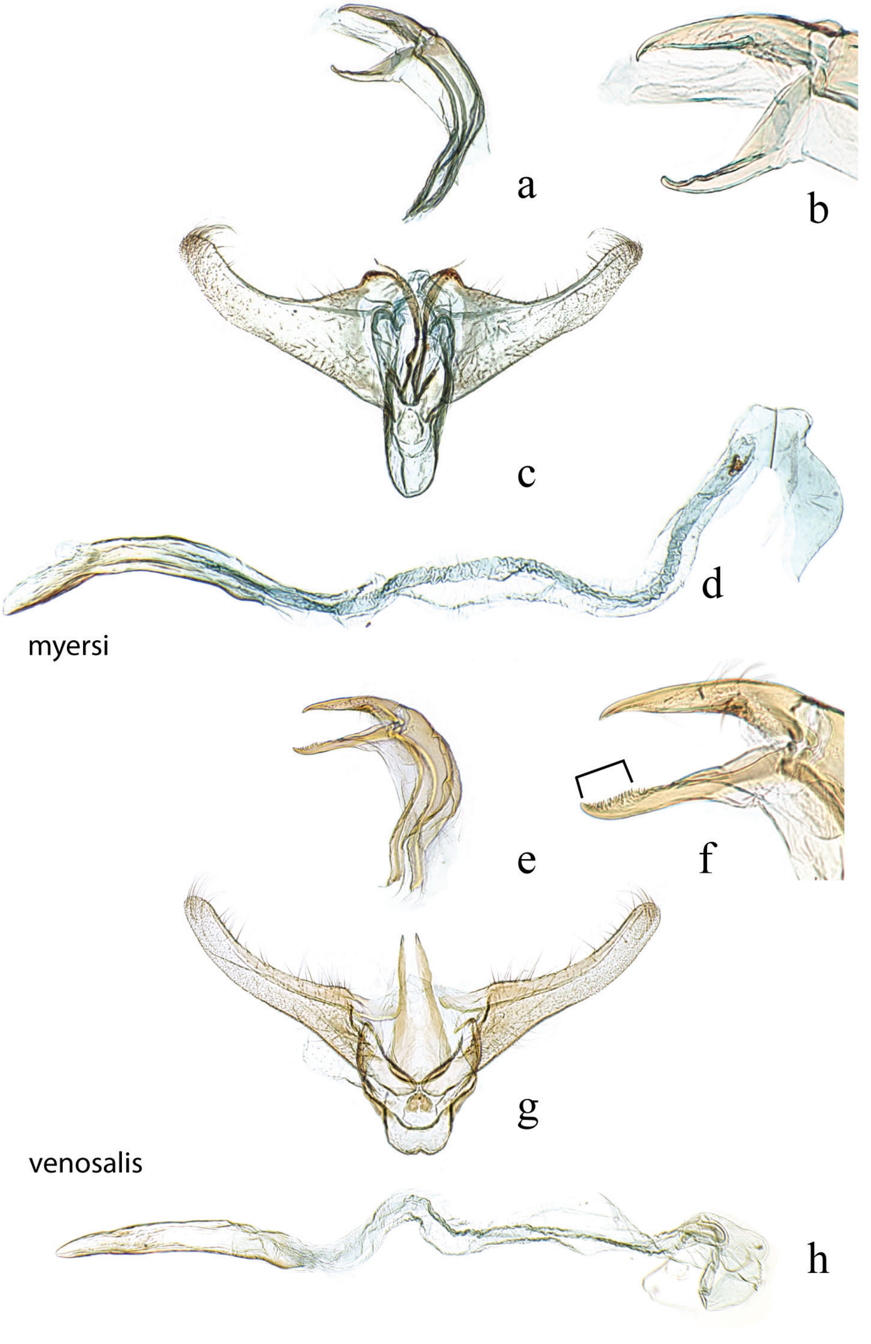

Figure 6. Male genitalia: *D. myersi*, USNM #114622, Rincon National Park, Prov. Guanacaste, Costa Rica **a** lateral view uncus, gnathos, tegumen **b** lateral magnification of gnathos without teeth **c** ventral view vinculum, juxta, valvae **d** phallus; *D. venosalis*, USNM #114623, Bastrop State Park, Bastrop County, Texas, USA **e** lateral view uncus, gnathos, tegumen **f** lateral magnification of gnathos with teeth shown by bracket **g** ventral view vinculum, juxta, valvae **h** phallus.

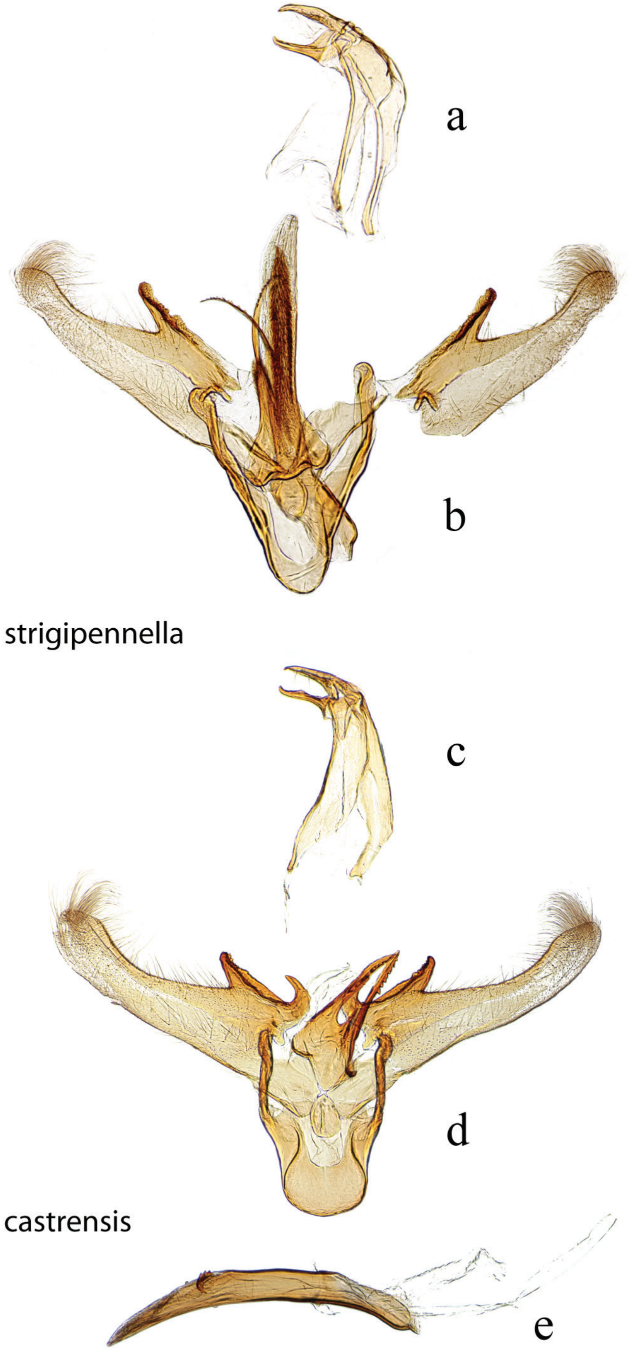

Figure 7. Male genitalia: *D. strigipennella*, USNM #97404, Castro, Parana, Brazil **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae, phallus (attached); *D. castrensis*, USNM #97490, Castro, Parana, Brazil **c** lateral view uncus, gnathos, tegumen **d** ventral view vinculum, juxta, valvae **e** phallus.

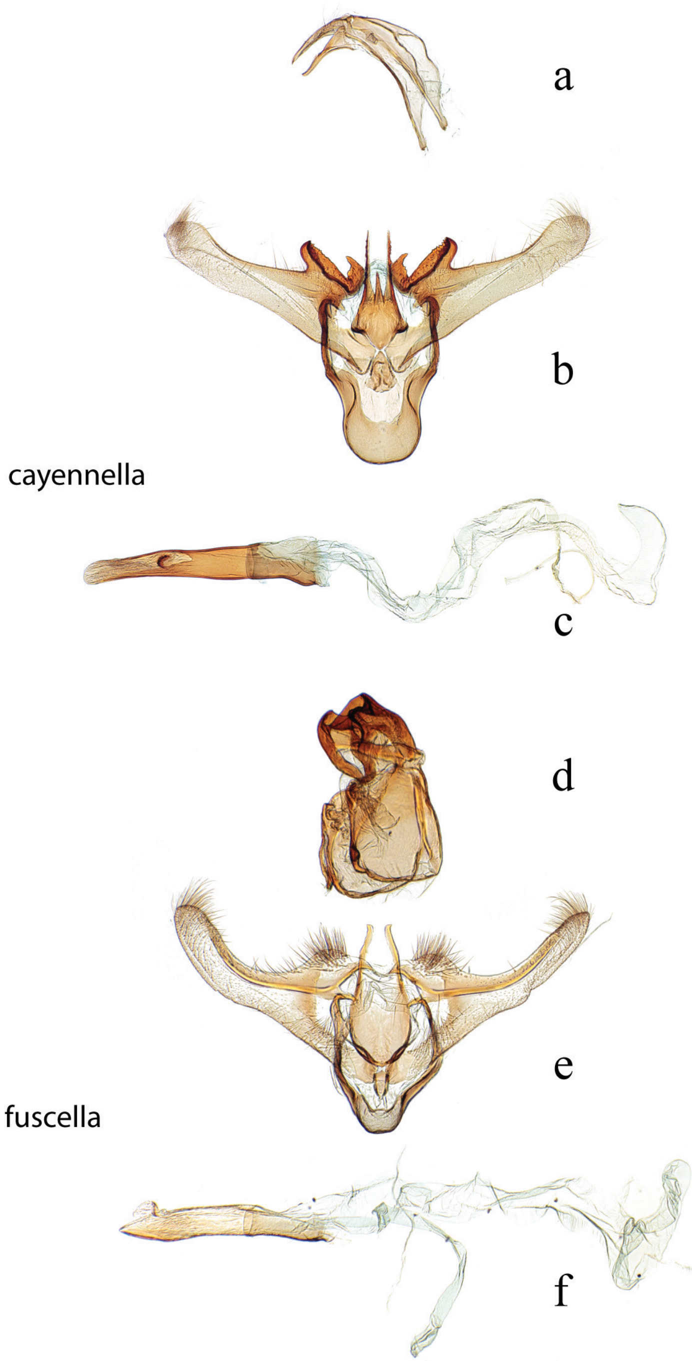

Figure 8. Male genitalia: *D. cayennella*, USNM #114627, Pilcopata, Cuzco, Peru **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae **c** phallus; *D. fuscella*, USNM #114629, Upata, Estacion San Gerardo, Alajuela, Costa Rica **d** lateral view uncus, gnathos, tegumen **e** ventral view vinculum, juxta, valvae **f** phallus.

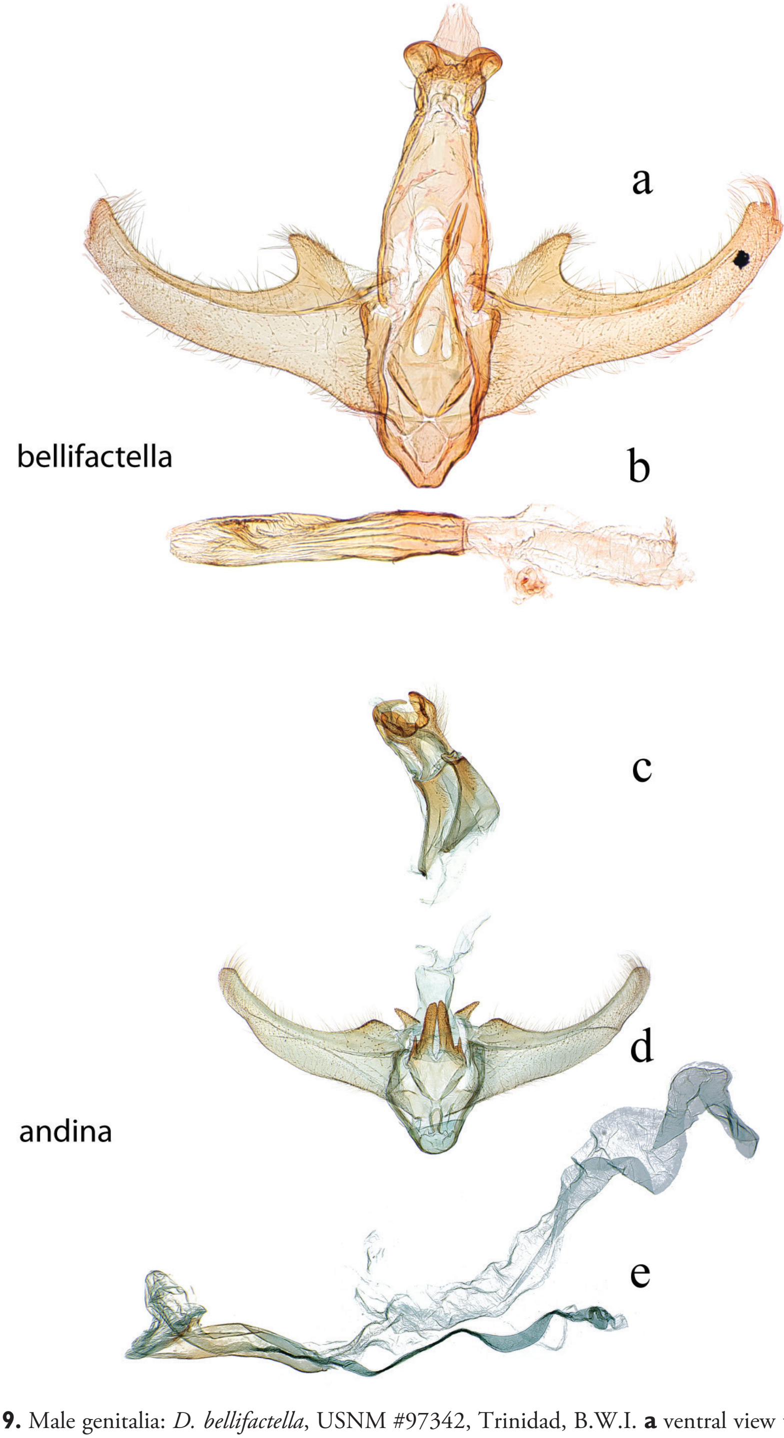

Figure 9. Male genitalia: *D. bellifactella*, USNM #97342, Trinidad, B.W.I. **a** ventral view uncus, gnathos, tegumen, vinculum, juxta, valvae **b** phallus; *D. andina*, USNM #114632, Yacambu Nat. Pk, Edo. Lara, Venezuela **c** lateral view uncus, gnathos, tegumen **d** ventral view vinculum, juxta, valvae **e** phallus.

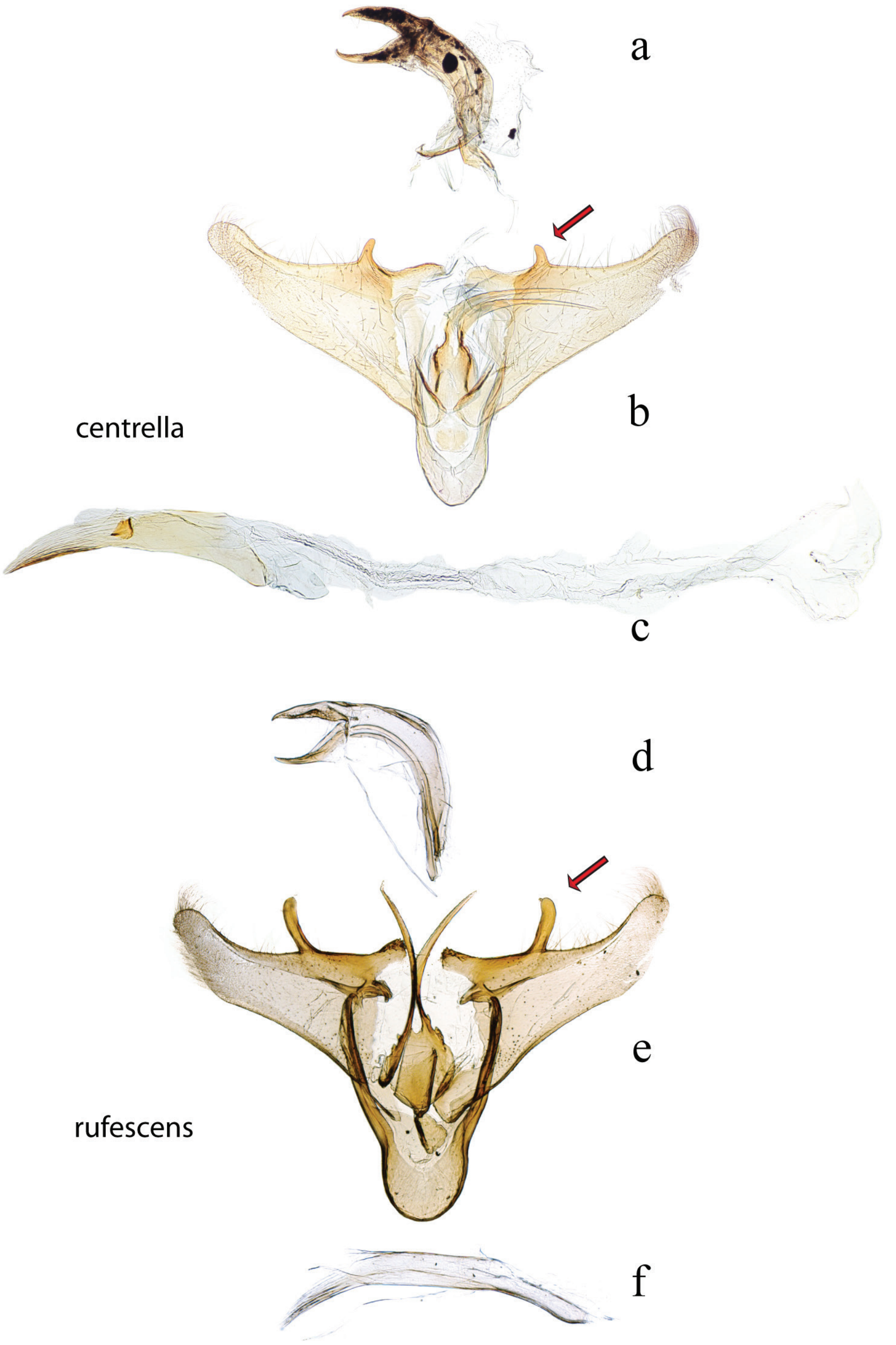

Figure 10. Male genitalia: *D. centrella*, USNM #97425, El Tocuyo, Venezuela **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae, red arrow indicates accessory process **c** phallus; *D. rufescens*, holotype, BMNH #5409, Buenavista, Bolivia **d** lateral view uncus, gnathos, tegumen **e** ventral view vinculum, juxta, valvae, red arrow indicates accessory process **f** phallus.

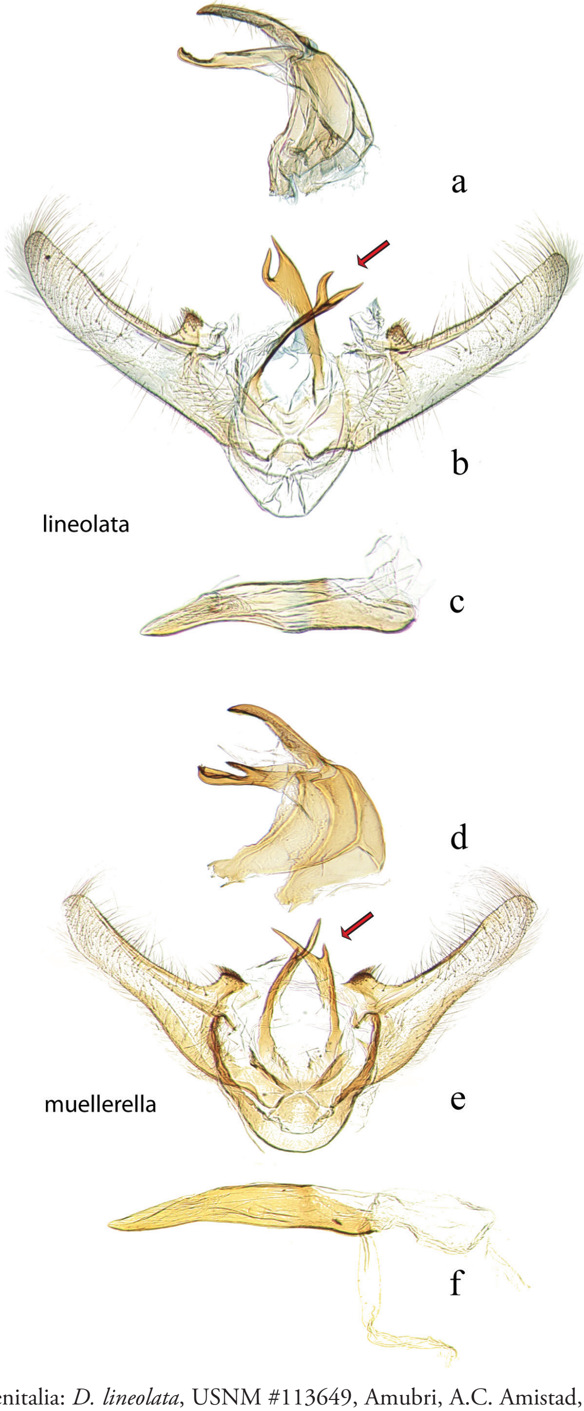

Figure 11. Male genitalia: *D. lineolata*, USNM #113649, Amubri, A.C. Amistad, Prov. Limon, Costa Rica **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae, red arrow indicates juxta **c** phallus; *D. muellerella*, USNM #97436, Iguala, Guerrero, Mexico **d** lateral view uncus, gnathos, tegumen **e** ventral view vinculum, juxta, valvae, red arrow indicates juxta **f** phallus.

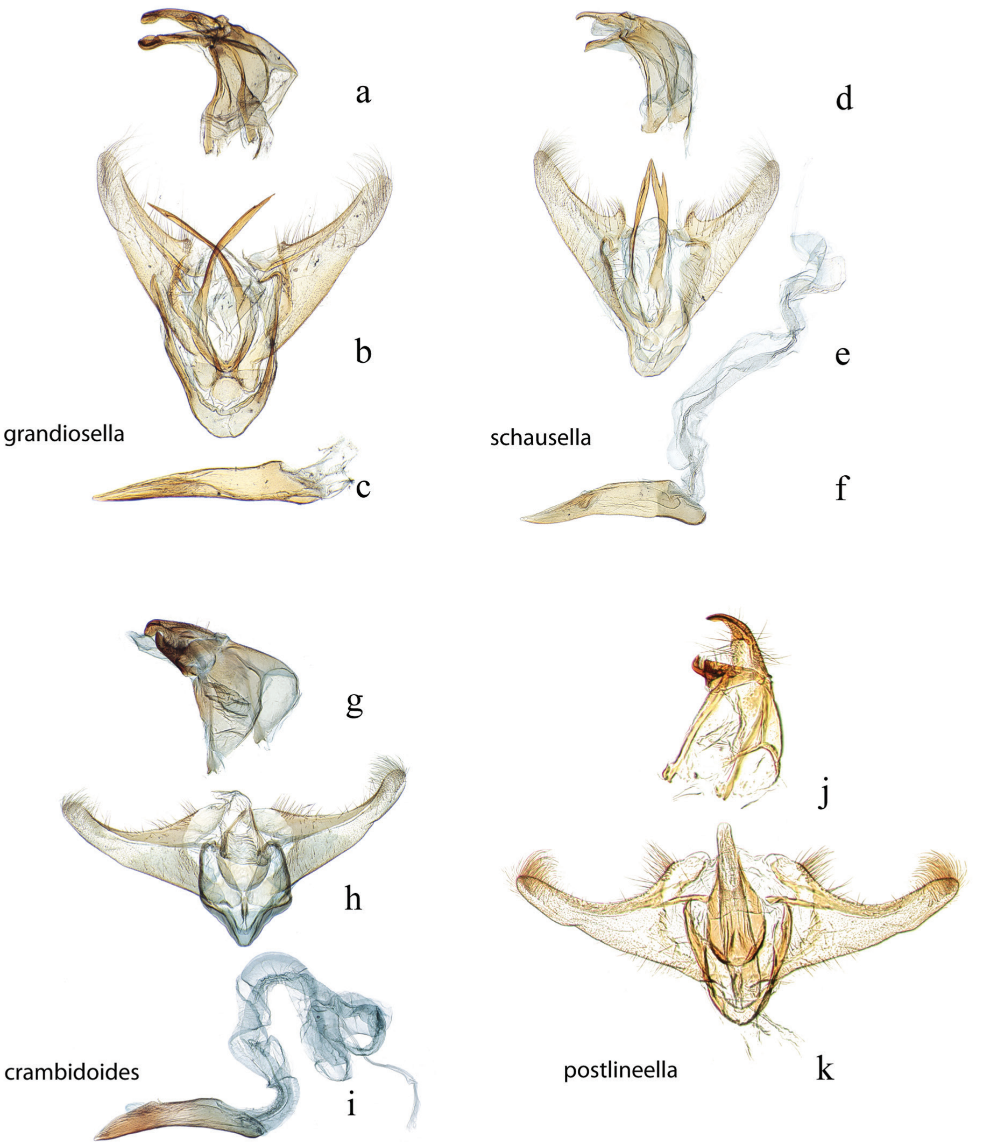

Figure 12. Male genitalia: *D. grandiosella*, USNM #114633, CIMMVT, Mexico **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae **c** phallus; *D. schausella*, USNM #114634, Lancetilia, Honduras **d** lateral view uncus, gnathos, tegumen **e** ventral view vinculum, juxta, valvae **f** phallus.; *D. crambidoides*, USNM #114636, Wedge Plantation, McClellanville, South Carolina, USA **g** lateral view uncus, gnathos, tegumen **h** ventral view vinculum, juxta, valvae **i** phallus; *D. postlineella*, holotype, USNM #97493, Quirigua, Guatemala **j** lateral view uncus, gnathos, tegumen, ventral view vinculum, juxta, valvae **k** phallus.

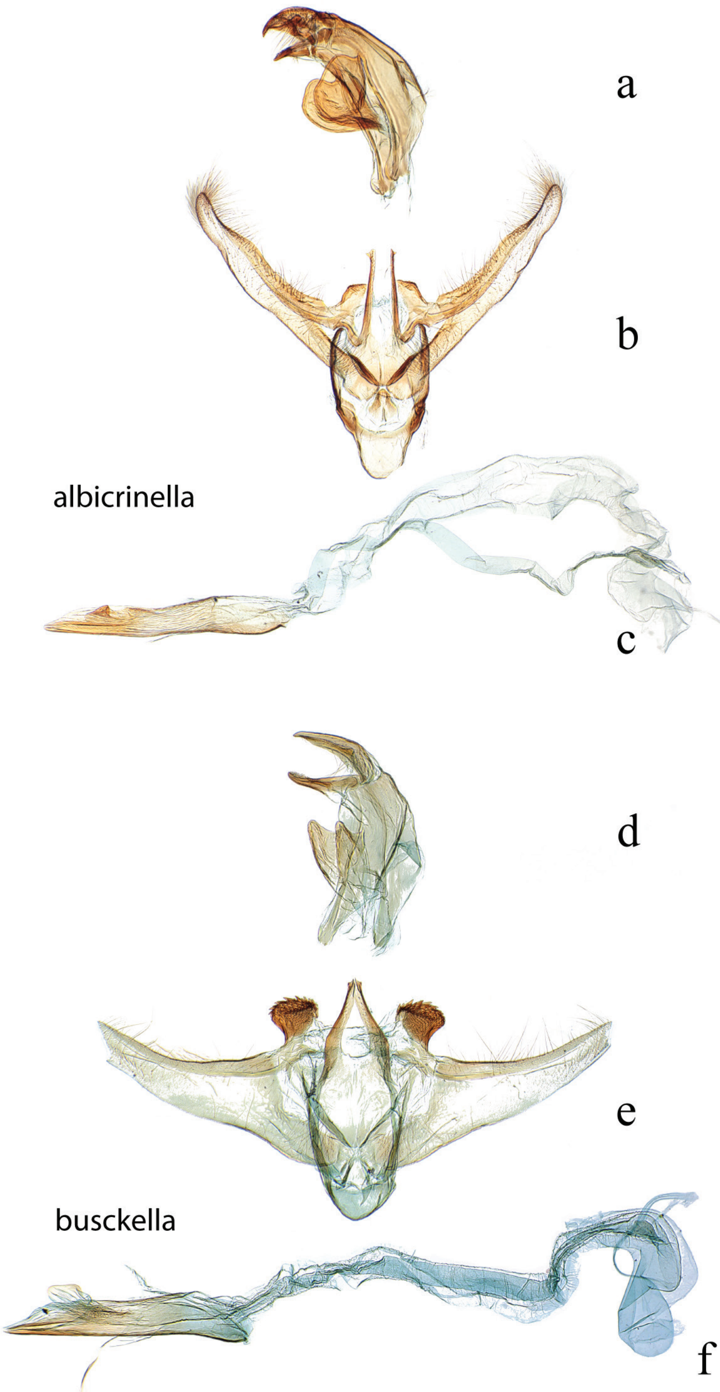

Figure 13. Male genitalia: *D. albicrinella*, USNM #114637, Capitão Poço, PA, Brazil **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae **c** phallus; *D. busckella*, USNM #114640, Baranquilla, Brazil **d** lateral view uncus, gnathos, tegumen **e** ventral view vinculum, juxta, valvae **f** phallus.

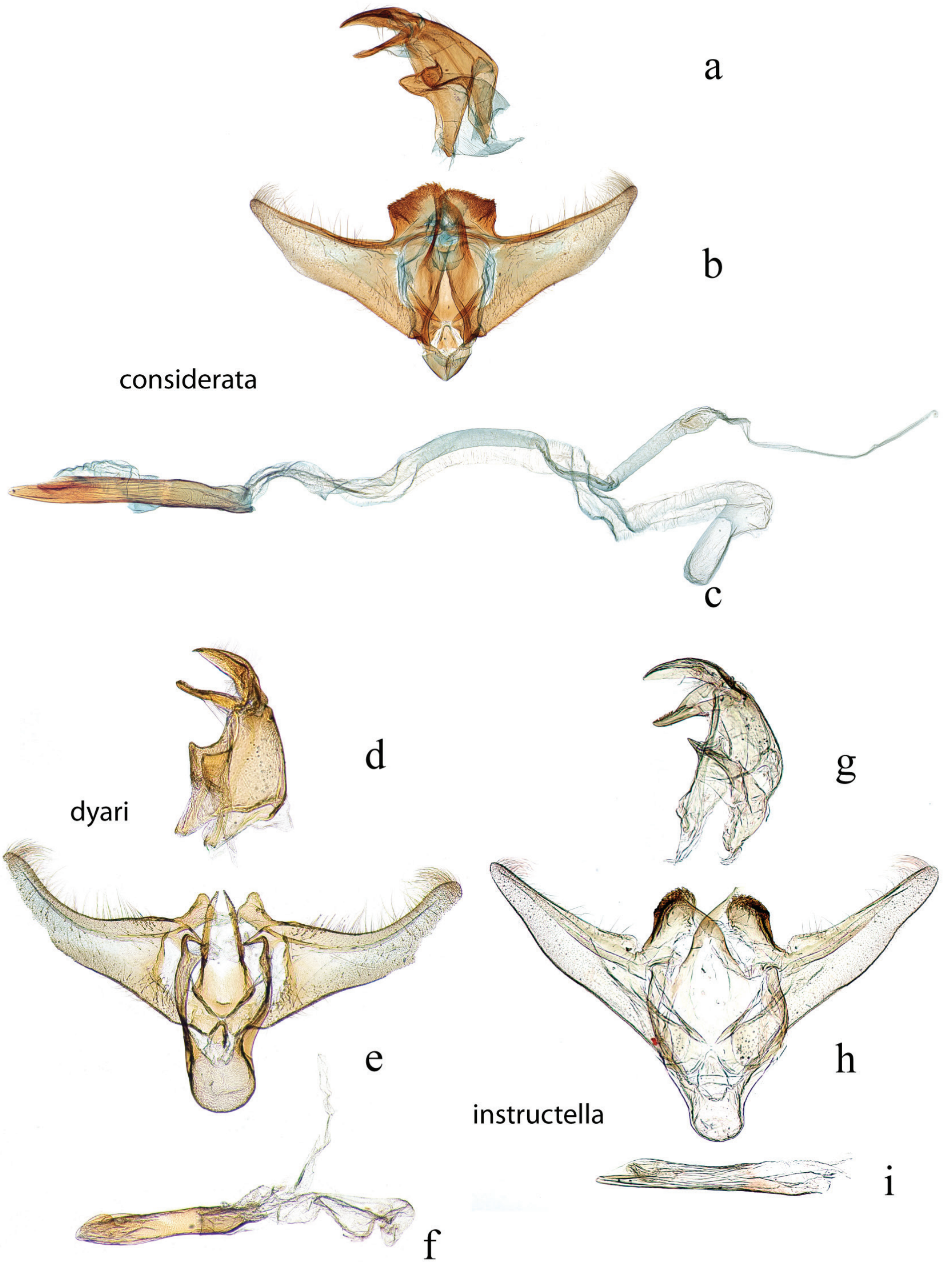

Figure 14. Male genitalia: *D. considerata*, USNM #114642, Villa Union, Sinaloa, Mexico **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae **c** phallus; *D. dyari*, holotype, USNM #22946 **d** lateral view uncus, gnathos, tegumen **e** ventral view vinculum, juxta, valvae **f** phallus; *D. instructella*, USNM #97499, San Jacinto, DF, Mexico **g** lateral view uncus, gnathos, tegumen **h** ventral view vinculum, juxta, valvae **i** phallus.

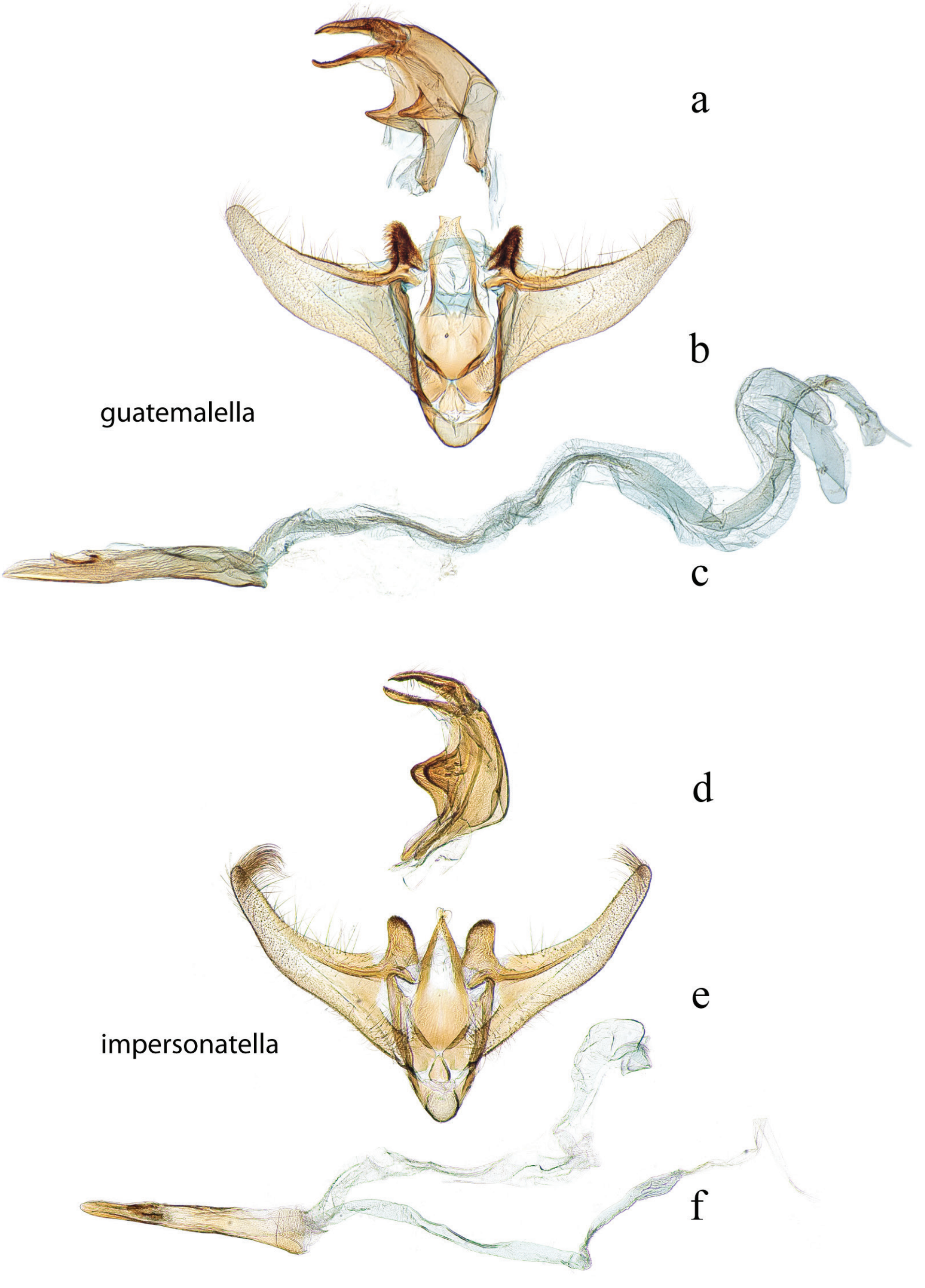

Figure 15. Male genitalia: *D. guatemalella*, USNM #114643, Cayuga, Guatemala **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae **c** phallus; *D. impersonatella*, BMNH #22950, locality unknown, prob. Venezuela (det. Box) **d** lateral view uncus, gnathos, tegumen **e** ventral view vinculum, juxta, valvae **f** phallus.

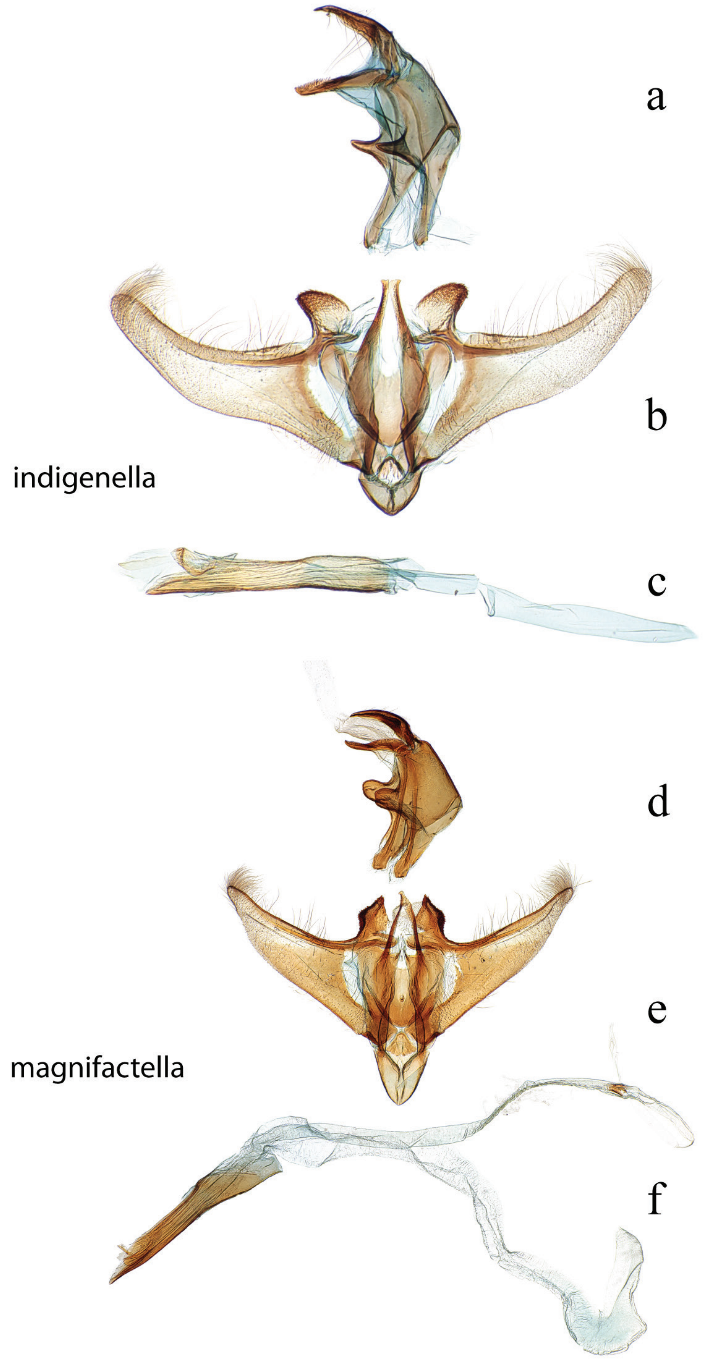

Figure 16. Male genitalia: *D. indiginella*, USNM #114645, Riopaila, Colombia **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae **c** phallus; *D. magnifactella*, USNM #114646, near Jalapa, Veracruz, Mexico **d** lateral view uncus, gnathos, tegumen **e** ventral view vinculum, juxta, valvae **f** phallus.

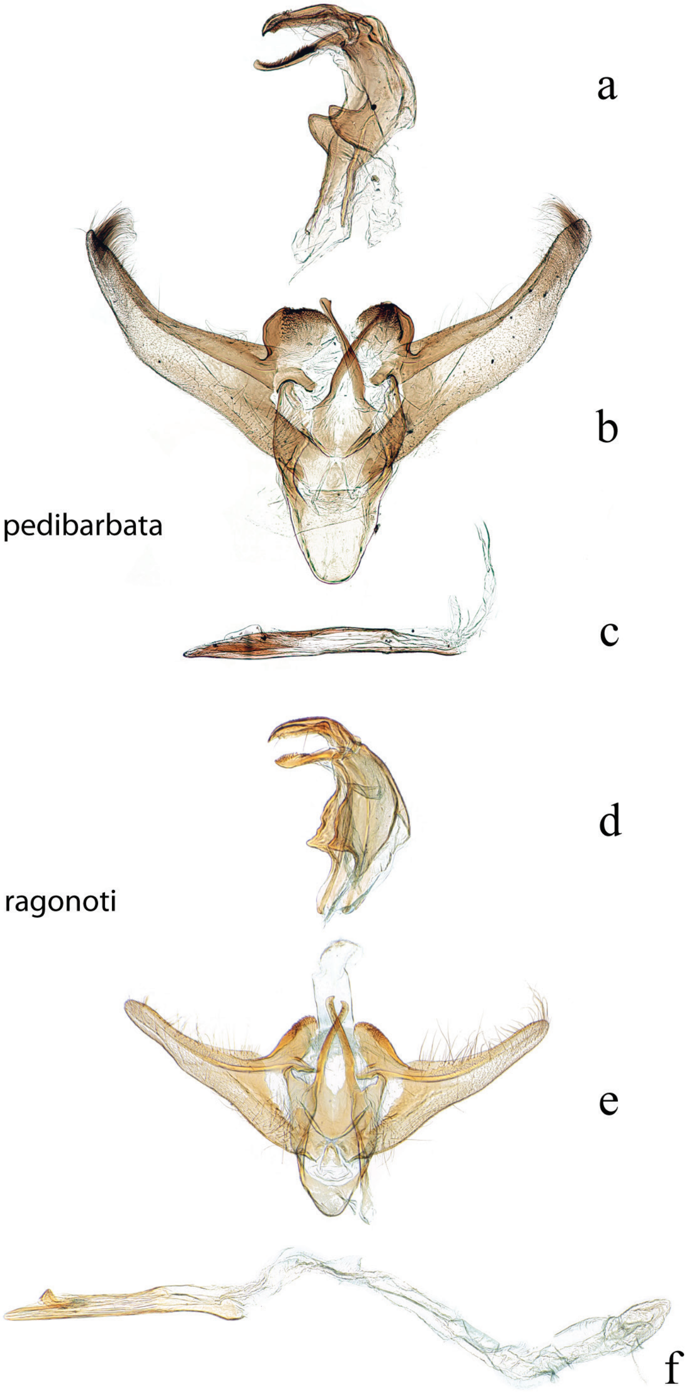

Figure 17. Male genitalia: *D. pedibarbata*, USNM #97322, Venezuela **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae **c** phallus; *D. ragonoti*, USNM #114648, Petropolis, Brazil **d** lateral view uncus, gnathos, tegumen **e** ventral view vinculum, juxta, valvae **f** phallus.

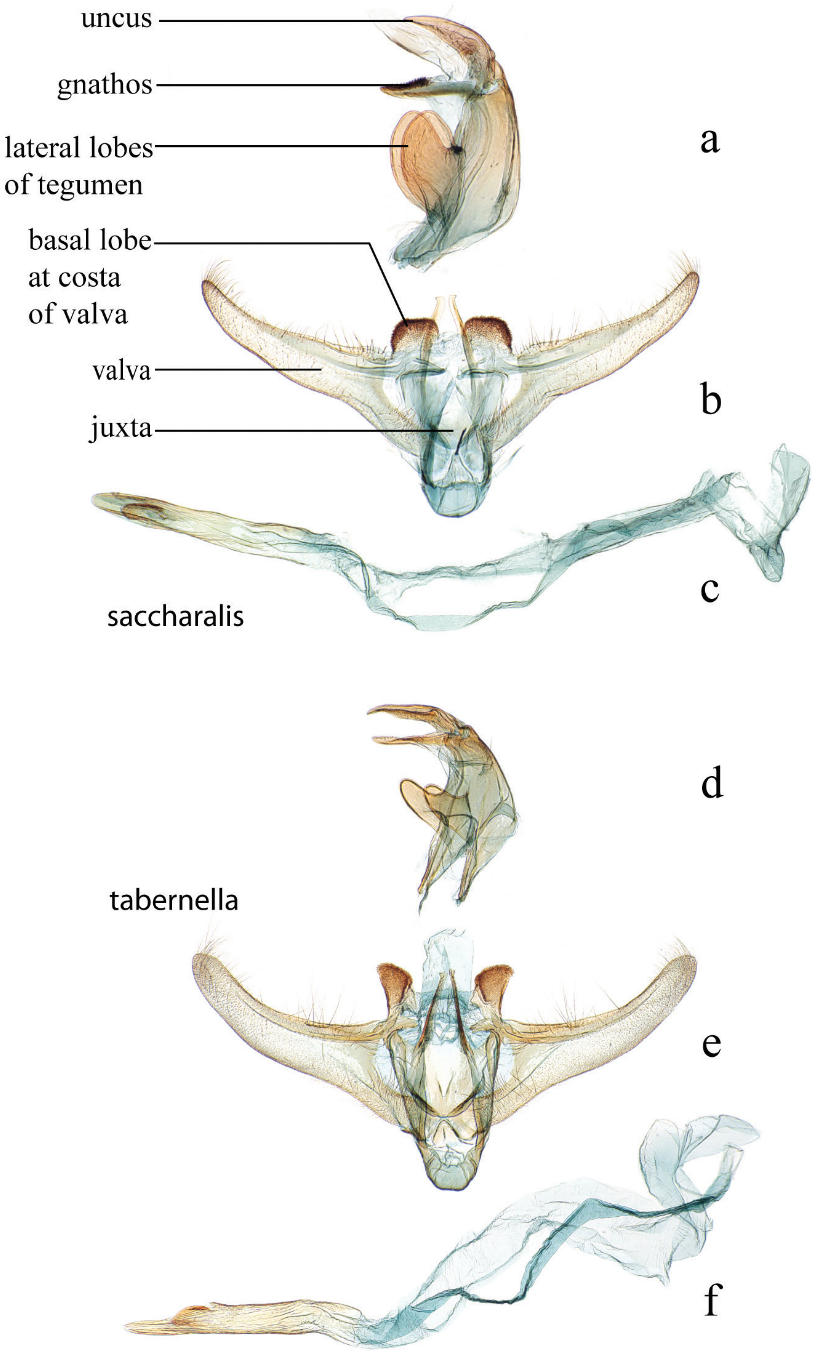

Figure 18. Male genitalia: *D. saccharalis*, USNM #114649, Deutschburg, Jackson Co., Texas, USA **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae **c** phallus; *D. tabernella*, USNM #114654, Rio Trinidad, Panama, #114656, Rio Trinidad, Panama **d** lateral view uncus, gnathos, tegumen **e** ventral view vinculum, juxta, valvae **f** phallus.

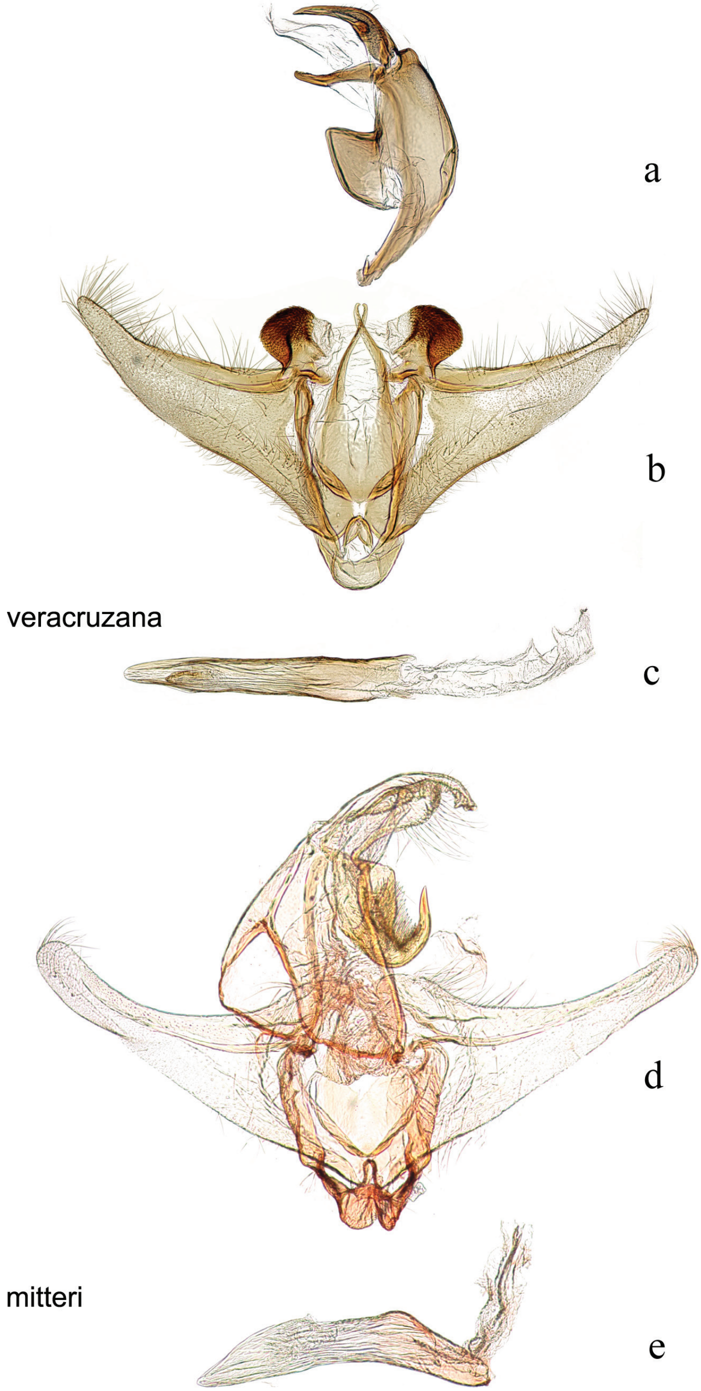

Figure 19. Male genitalia: *D. veracruzana*, USNM #97476, nr. San Cristobal, Veracruz, Mexico **a** lateral view uncus, gnathos, tegumen **b** ventral view vinculum, juxta, valvae **c** phallus; *D. mitteri*, USNM #97234, Churchill, Texas, USA **d** ventral view uncus, gnathos, tegumen, vinculum, juxta, valvae **e** phallus.

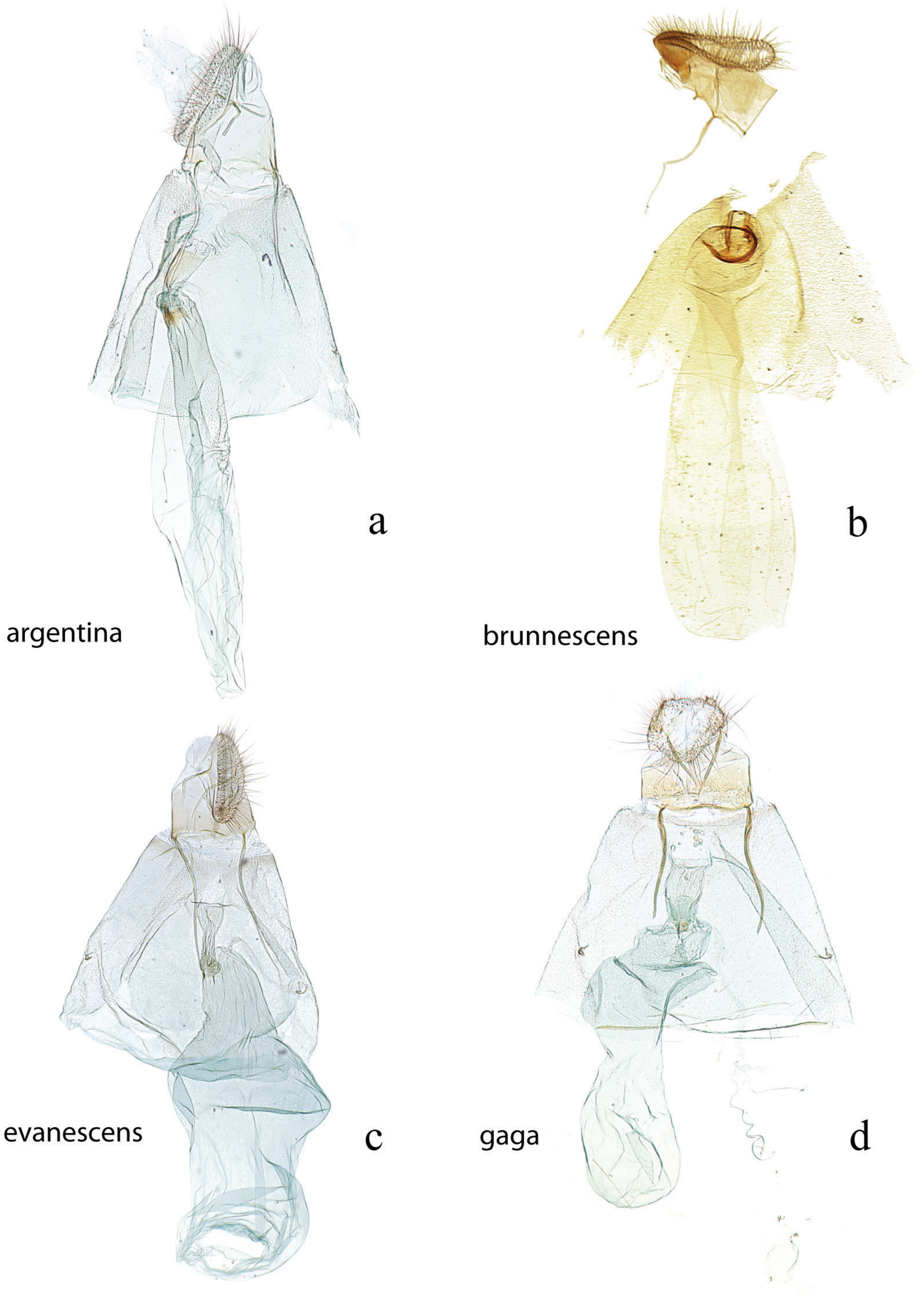

Figure 20. Female genitalia, ventral view: **a** *D. argentina*, CMNH #004, Santa Cruz, Provincia del Sara, Bolivia **b** *D. brunnescens*, paratype, BMNH #120, Ciudad Bolivar, Venezuela **c** *D. evanescens*, USNM #114624, Camp Strake, Montgomery Co, Texas, USA **d** *D. gaga*, USNM #114614, El Sombrero, Guarico, Venezuela.

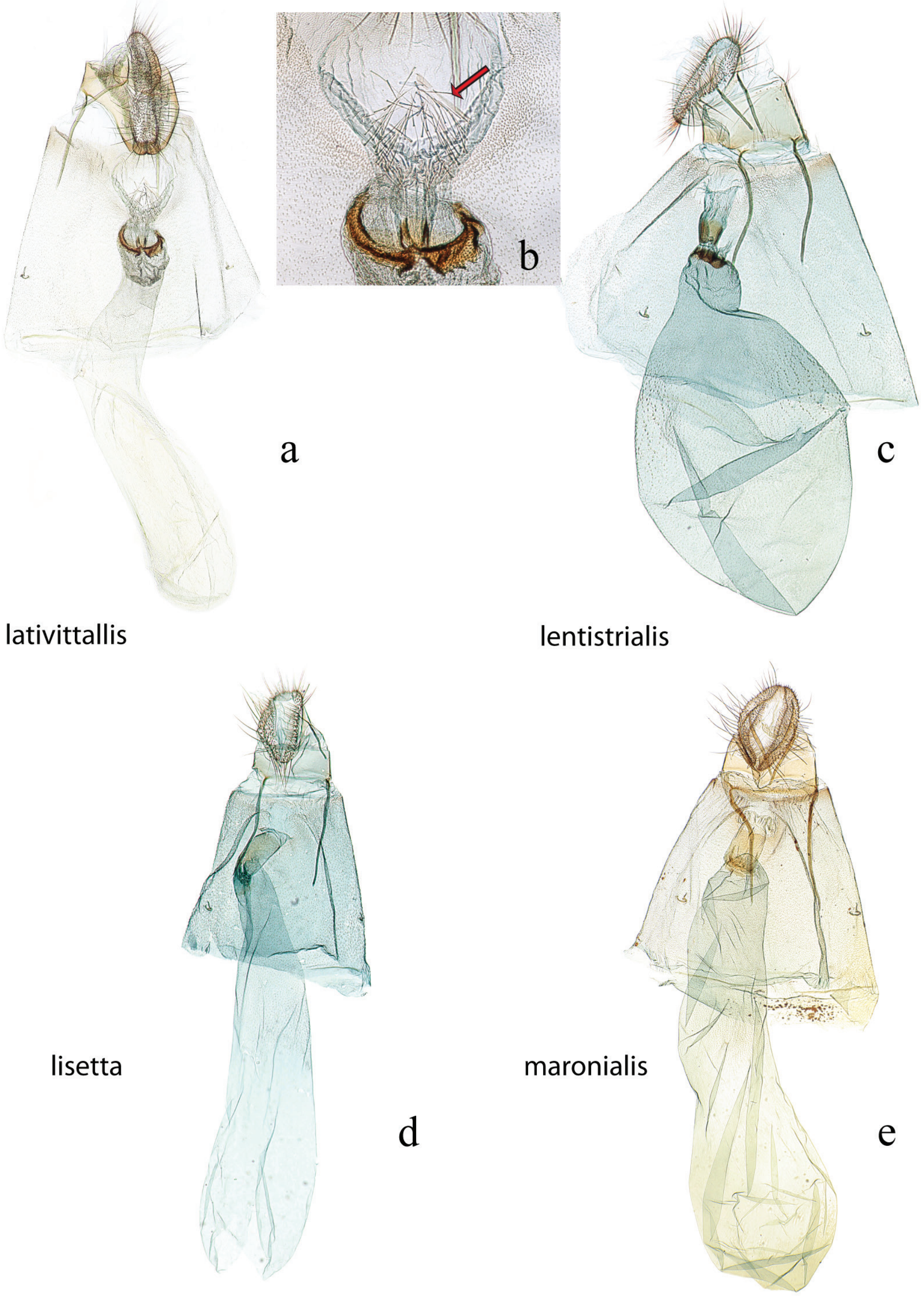

Figure 21. Female genitalia, ventral view: **a** *D. lativittalis*, CMNH #024, Puerto Suarez, Bolivia **b** magnification of setae near ostium bursae shown by red arrow **c** *D. lentistrialis*, USNM #114617, Santa Rosa National Park, Prov. Guanacaste, Costa Rica **d** *D. lisetta*, USNM #114619, Oneco, Manatee Co., Florida, USA **e** *D. marionalis*, USNM #114620, St. Jean du Maroni, French Guiana.

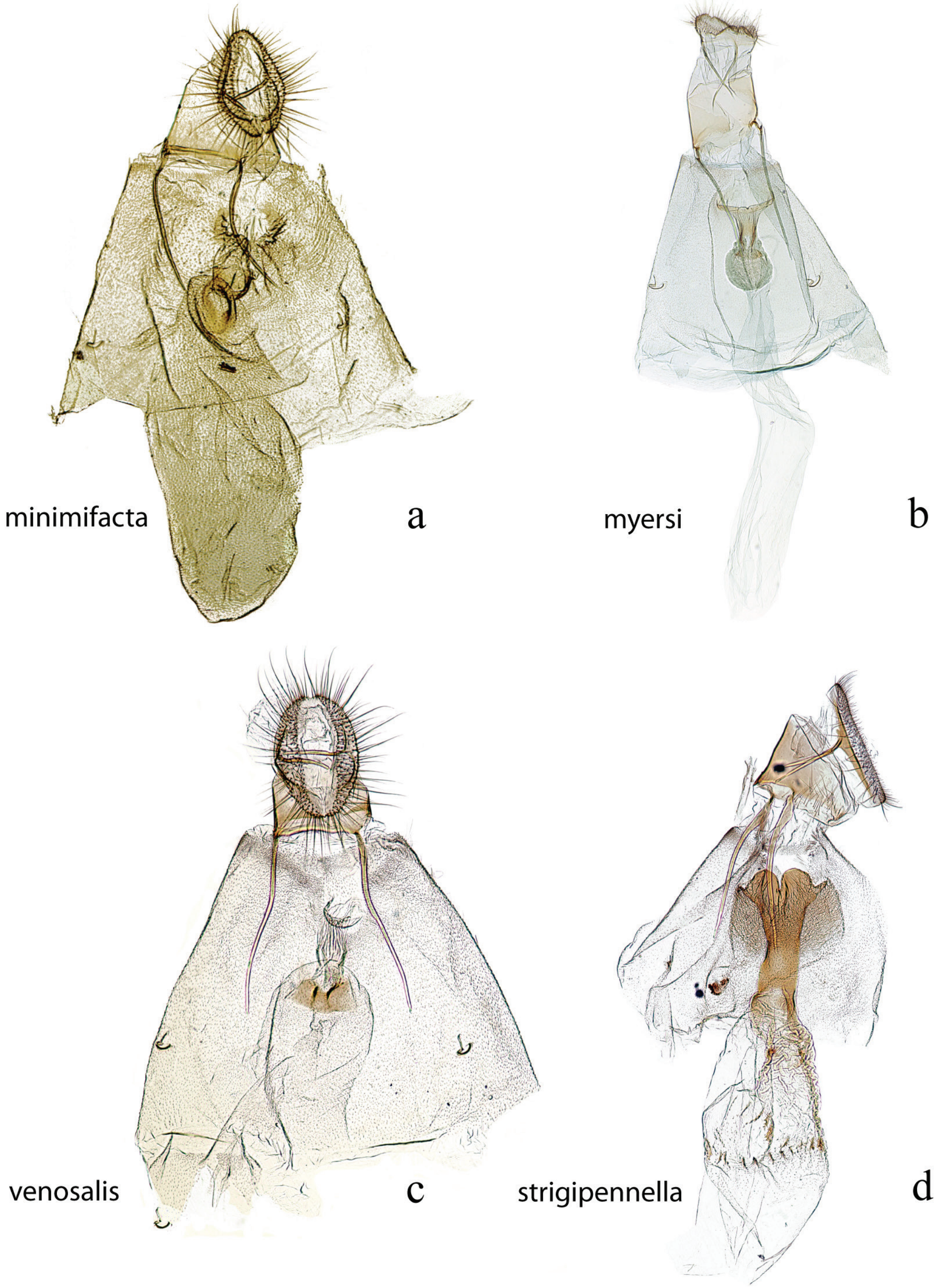

Figure 22. Female genitalia, ventral view: **a** *D. minimifacta*, syntype, USNM #99604, Trinidad, British West Indies **b** *D. myersi*, CMNH #003, Obidos, Brazil **c** *D. venosalis*, USNM #111879, Audubon Park, Louisiana, USA **d** *D. strigipennella*, USNM #97403, Baboquivari Mts., Arizona, USA.

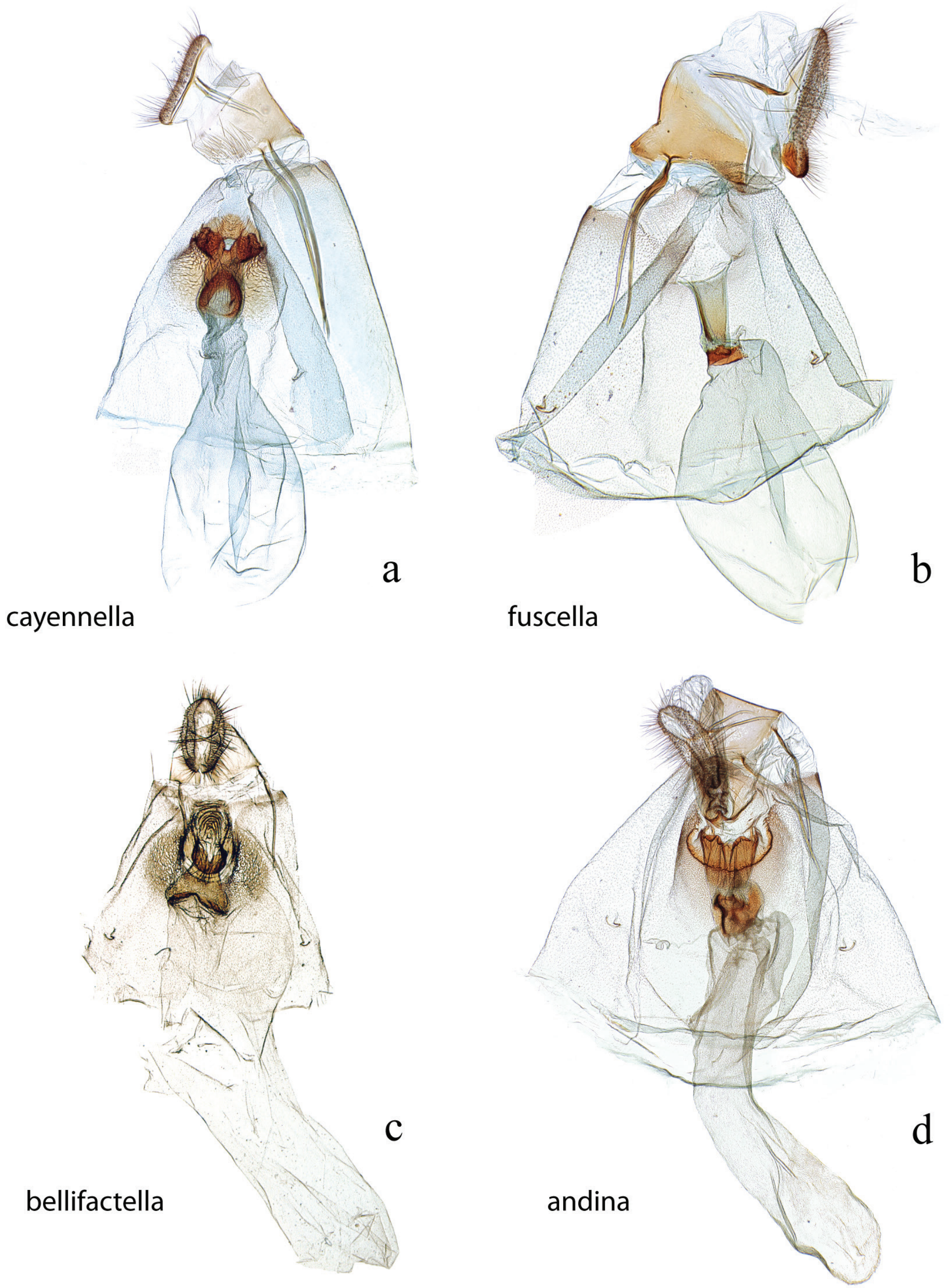

Figure 23. Female genitalia, ventral view: **a** *D. cayennella*, USNM #114628, Pilcopata, Cuzco, Peru **b** *D. fuscella*, USNM #114630, Estacion San Gerardo, Alajuela, Costa Rica **c** *D. bellifactella*, syntype, USNM #97339, Castro, Parana, Brazil **d** *D. andina*, USNM #114631, Portuguesa Alto, Venezuela.

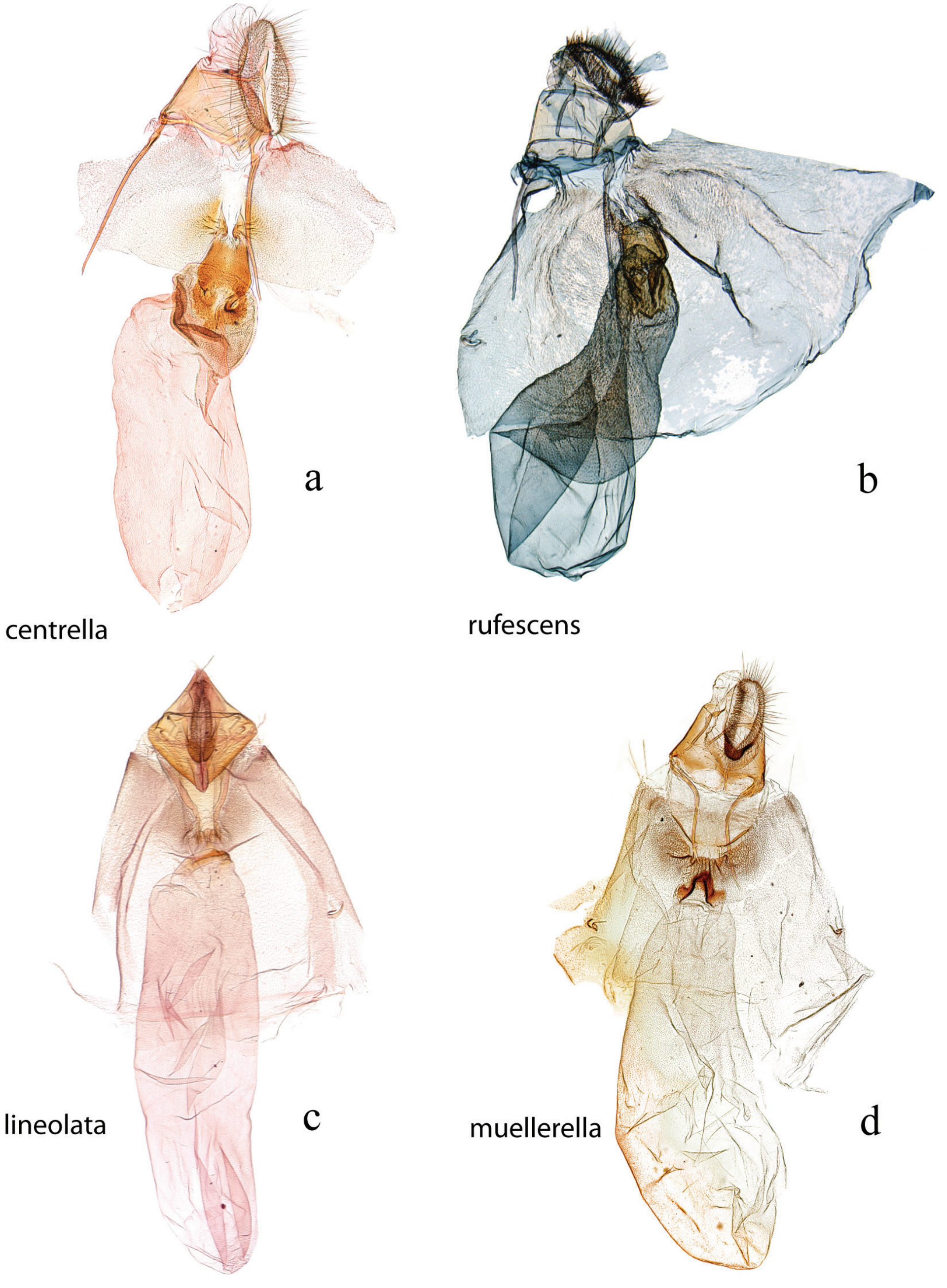

Figure 24. Female genitalia, ventral view: **a** *D. centrella*, USNM #97415, Itacoatiara, Amazon **b** *D. rufescens*, BMNH #17084, Santa Cruz, Bolivia **c** *D. lineolata*, BMNH #10724, Venezuela **d** *D. muellerella*, USNM #97435, Iguala, Mexico.

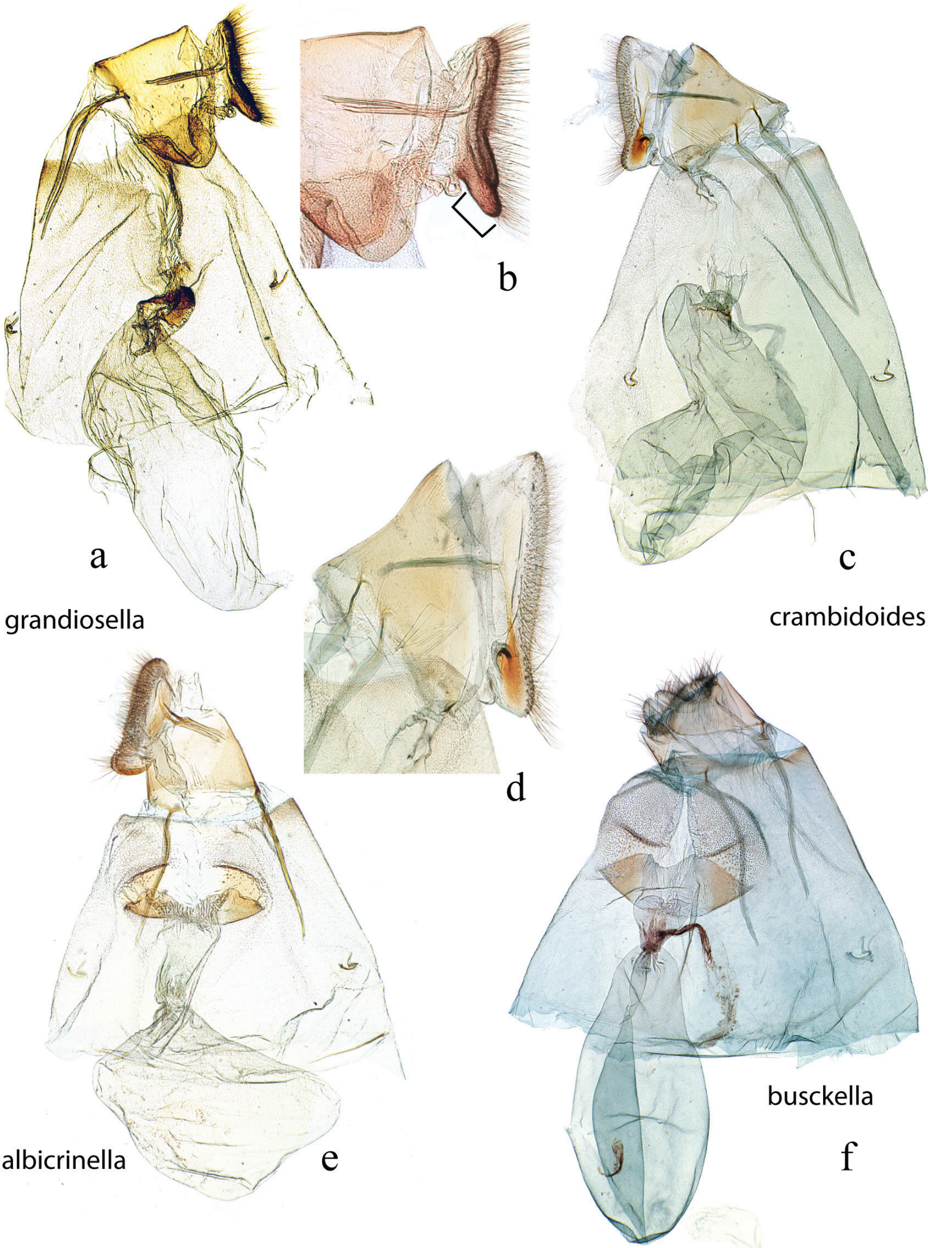

Figure 25. Female genitalia, ventral view: **a** *D. grandiosella*, holotype, USNM #97390, Guadalajara, Mexico **b** magnification of papillae analis with lobe-like ventral extension shown by bracket **c** *D. crambidoides*, USNM #114635, Wedge Plantation, McClellanville, South Carolina, USA **d** magnification of papillae analis without lobe-like ventral extension **e** *D. albicrinella*, USNM #114638, Capitão Poço, PA, Brazil **f** *D. busckella*, USNM #114639, Baranquilla, Brazil.

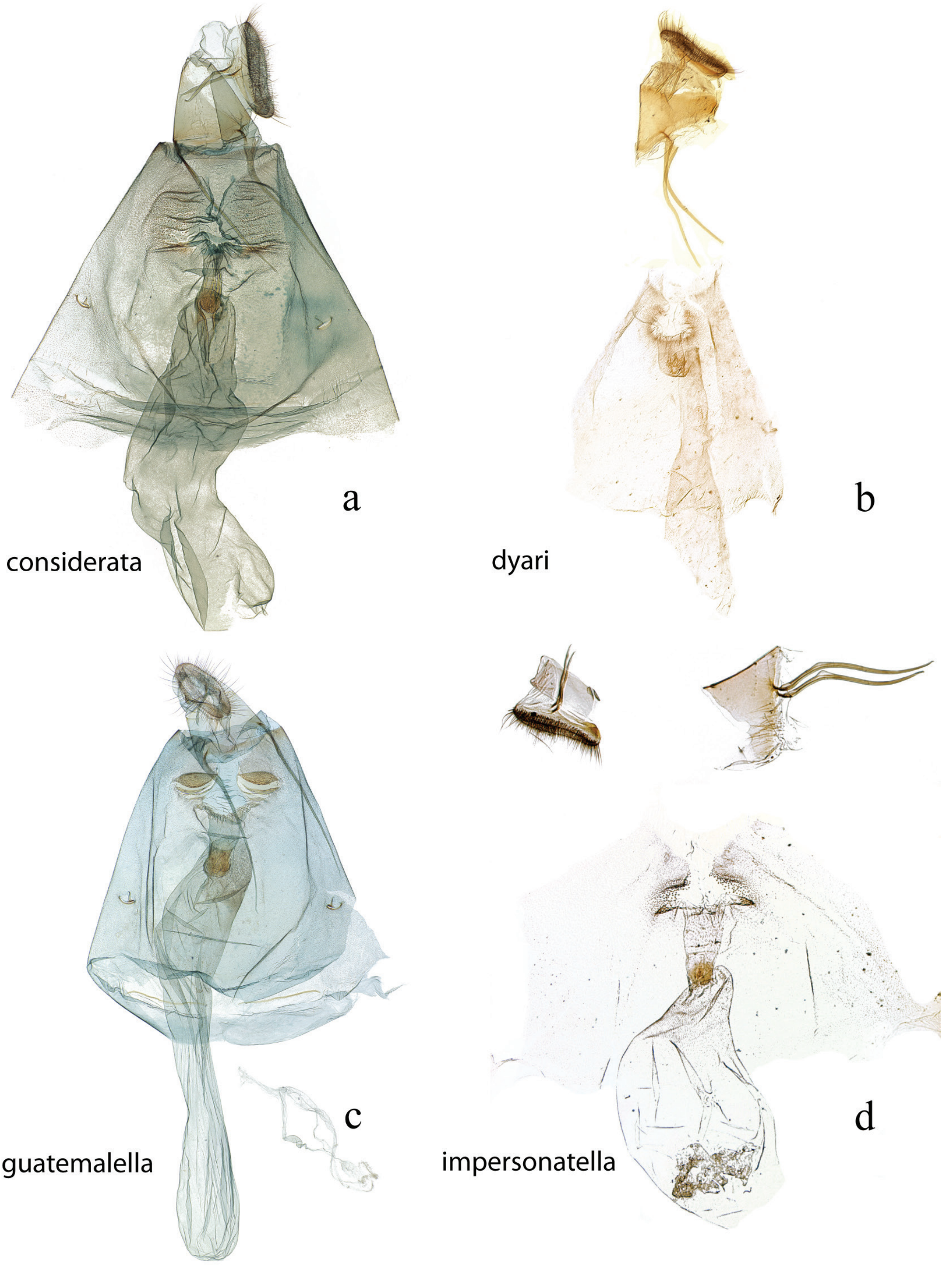

Figure 26. Female genitalia, ventral view: **a** *D. considerata*, USNM #114641, Villa Union, Sinaloa, Mexico **b** *D. dyari*, paratype, BMNH #53, Argentina (disarticulated) **c** *D. guatemalella*, USNM #114644, Cayuga, Guatemala **d** *D. impersonatella* (disarticulated), BMNH #142, Trinidad.

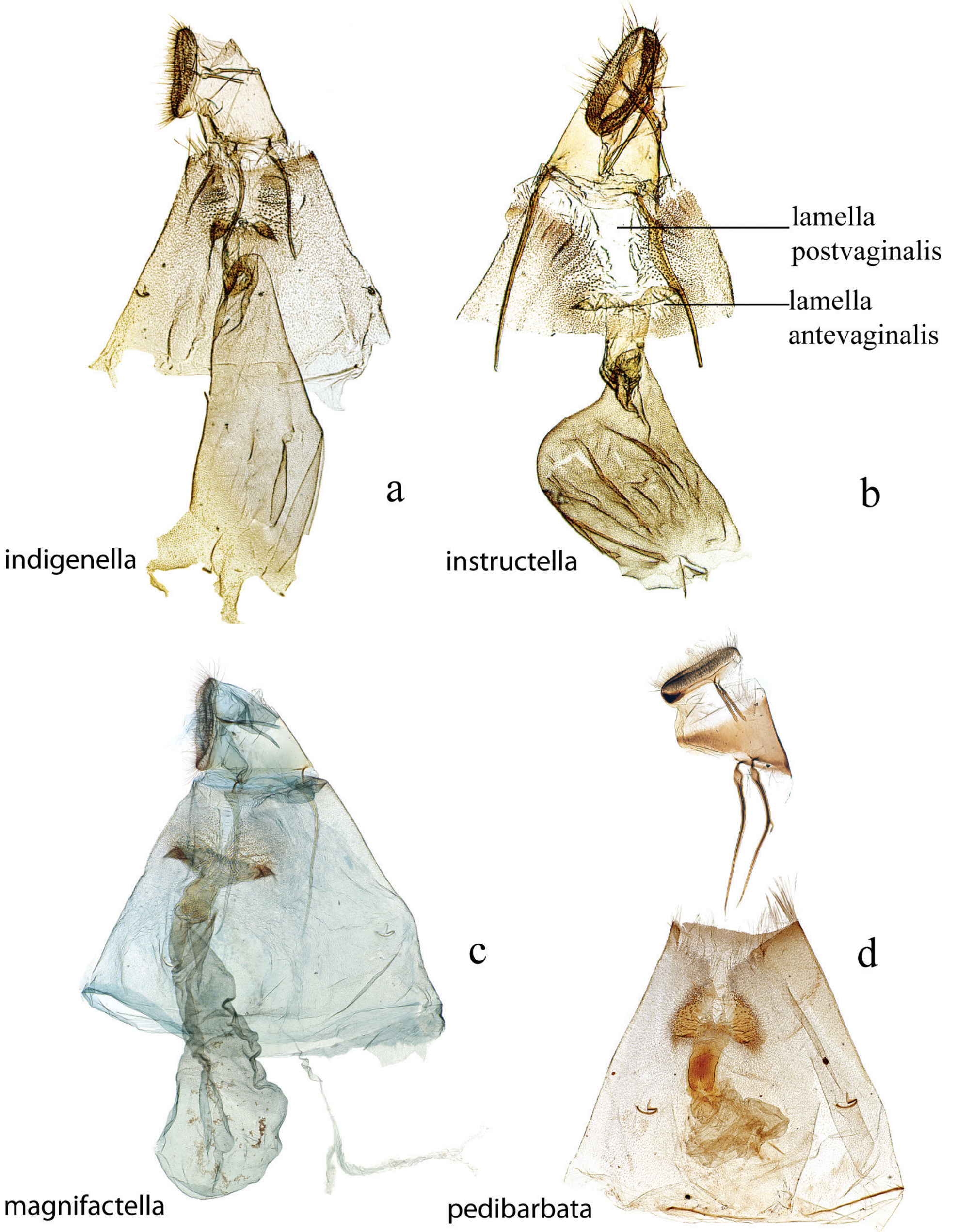

Figure 27. Female genitalia, ventral view: **a** *D. indigenella*, USNM #97389, Papayan, Colombia **b** *D. instructella*, holotype, USNM #97498, Popocatepetl, Mexico **c** *D. magnifactella*, USNM #114647, near Jalapa, Veracruz, Mexico **d** *D. pedibarbata*, USNM #97323, Venezuela.

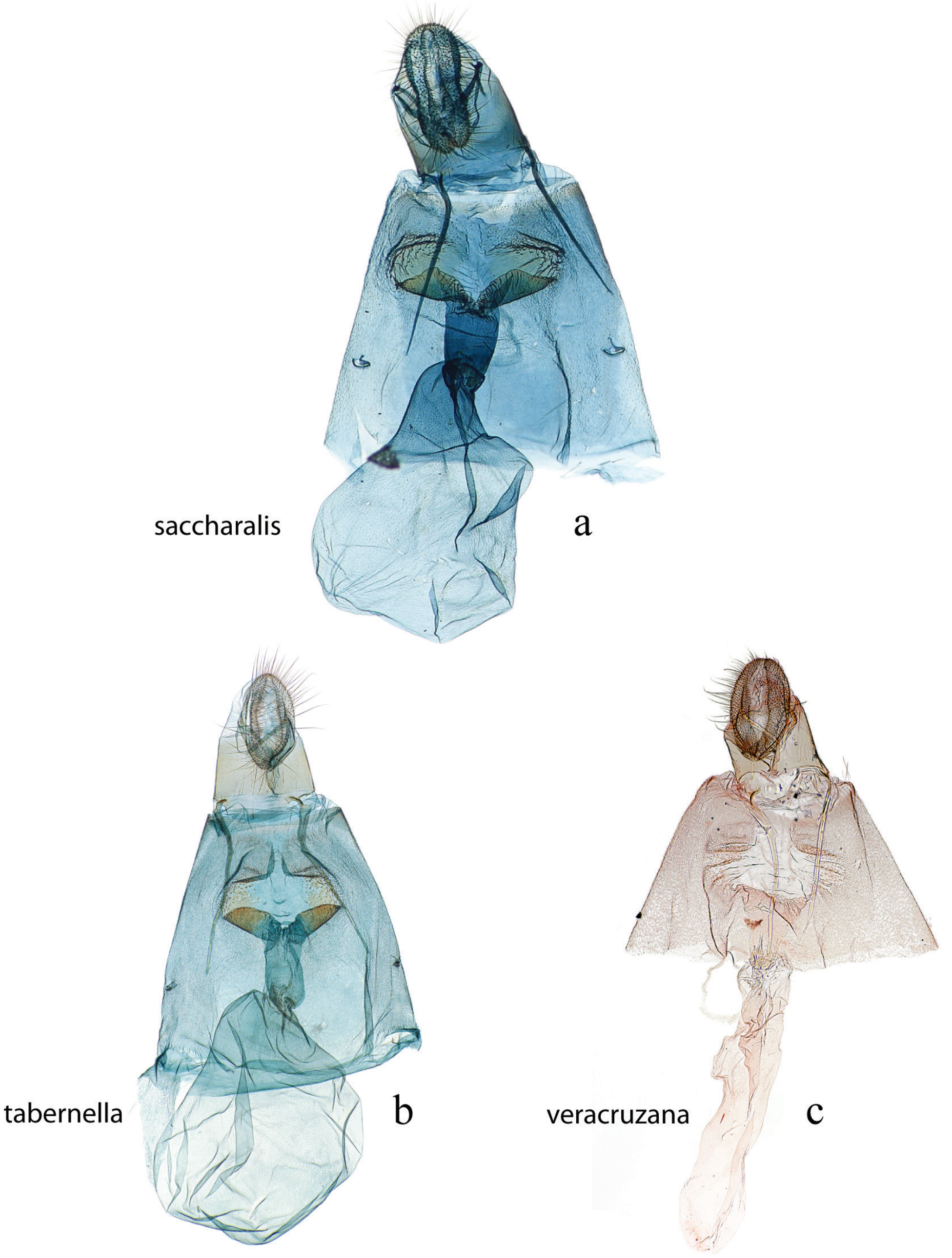

Figure 28. Female genitalia, ventral view: **a** *D. saccharalis*, USNM #115309, Unaí, MG, Brazil **b** *D. tabernella*, USNM #114655, Rio Trinidad, Panama **c** *D. veracruzana*, USNM #97477, nr. San Cristobal, Veracruz, Mexico.

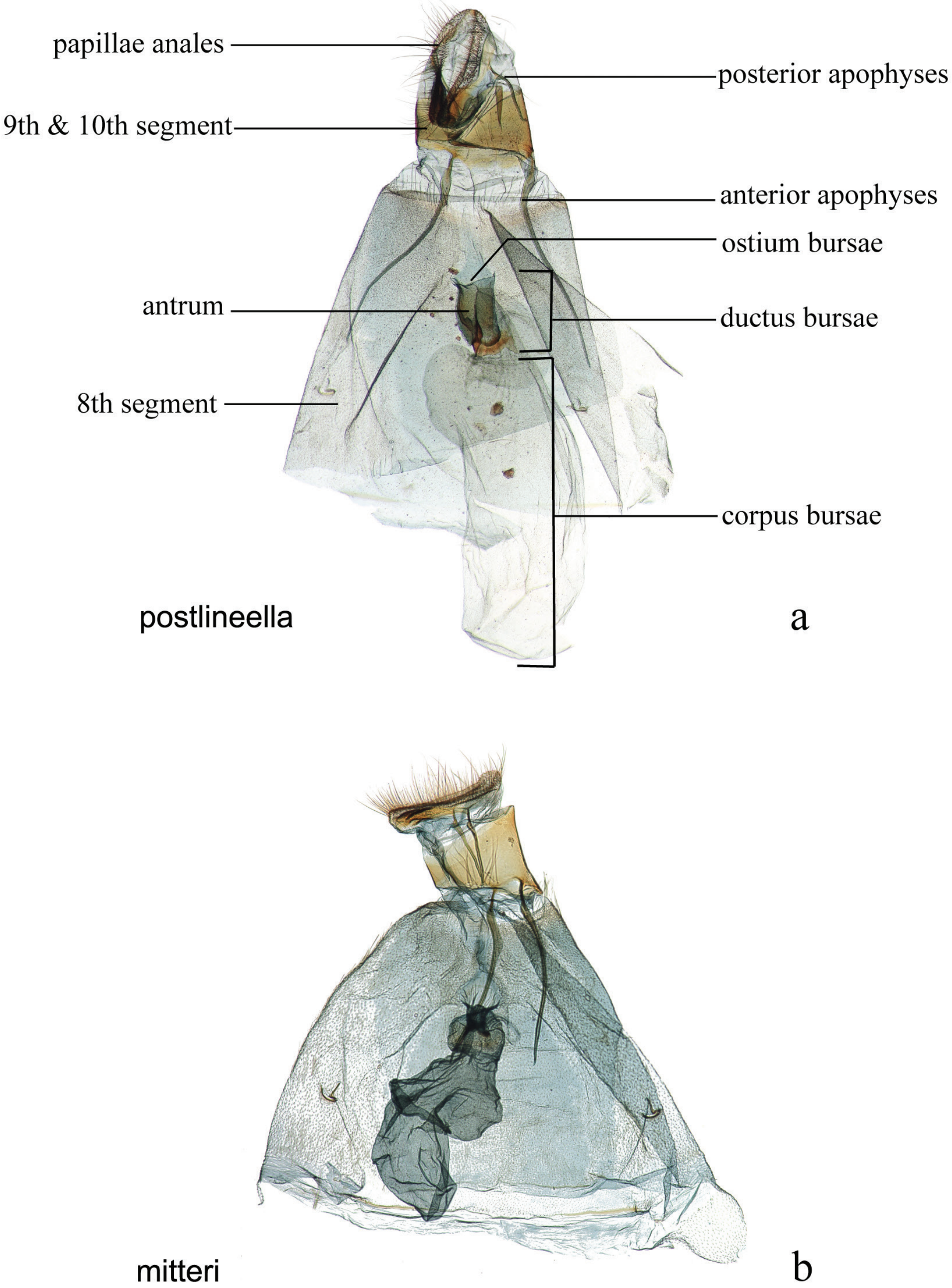

Figure 29. Female genitalia, ventral view: **a** *D. postlineella*, USNM #115510, Escuintla, Km. 64.5 Ca St. Lucia Cotz, Guatemala **b** *D. mitteri*, USNM #112892, Woodward, Oklahoma, USA.

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Supplementary material 1

Distribution of *Diatraea* species by country based on Box (1931) and the USNM collection.

Authors: M. Alma Solis, Mark A. Metz

Data type: xls file

Explanation note: Matrix of species of *Diatraea* and countries by subregion of the Western Hemisphere

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RESEARCH ARTICLE

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Two new species and five newly recorded species of the genus *Udea* Guenée from China (Lepidoptera, Crambidae)

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Abstract
A checklist of the 31 Chinese species of *Udea* is given, including the new species and new records. *Udea curvata* **sp. n**. and *U. albostriata* **sp. n**. are described and illustrated. *Udea exigualis* (Wileman, 1911), *U. stationalis* Yamanaka, 1988, *U. prunalis* (Denis & Schiffermüller, 1775), *U. elutalis* (Denis & Schiffermüller, 1775) and *U. cyanalis* (La Harpe, 1855) are newly recorded for China.

Keywords
Lepidoptera, Crambidae, *Udea*, checklist, taxonomy, China

Introduction

Udea Guenée is a large genus, with more than 210 species, and is mainly distributed in the temperate Eurasia and in the New World, with a remarkable number of endemic species occuring on islands in the Pacific and Atlantic Oceans, on the Hawaiian Islands and some other islands (Nuss et al. 2003-2014; Mally and Nuss 2011; Slamka 2013). *Udea* is usually placed in the Spilomelinae (Munroe 1995; Solis and Maes 2003), but this placement is not confirmed by phylogenetic study (Mally and Nuss 2011).

Morphology and genitalia of *Udea* are simple and uniform throughout the genus. Species of *Udea* are dark to light greyish, brown, reddish-yellow, dark yellowish or pale yellow; the forewing has a circular and a reniform cellular stigmata; the hindwing bears a streak at the anterior angle and a dot at the posterior angle of cell; the wings usually with marginal dots at ends of veins. Male genitalia with uncus inverted T-shaped, apex bulbous, with setae; fibula extending ventrad to distad. Corpus bursae usually with a large lanceolate, denticulate signum in female genitalia.

Important taxonomic contributions on *Udea* were published by Munroe (1950, 1966, 1989, 1995), Zimmerman (1958), Hannemann (1964), Inoue (1982), Yamanaka (1988), Inoue et al. (2008), Mally and Nuss (2011) and Slamka (2013). Chinese species of *Udea* were reported by Walker (1859), Hampson (1899, 1918), Sauber (1899), Leech and South (1901), Zerny (1914), Strand (1918), Caradja (1916, 1925, 1927, 1928), Caradja and Meyrick (1937) and Yamanaka (1972). Two new species and five newly recorded species for China are presented in this study, bringing the total to 31 species recorded in China.

Material and methods

This study is based on the examination of specimens collected by using light traps. Terminology of the genitalia follows Maes (1995), Mally and Nuss (2011) and Slamka (2013). Genitalia dissection and mounting methods follow Robinson (1976) and Li and Zheng (1996), with some modification. The specimens are deposited in the Biology Museum, Sun Yat-sen University (SYSBM) except those specified with the Insect Collection, College of Life Sciences, Nankai University (NKUM).

Results

Checklist of Chinese *Udea* species

***Udea* Guenée, 1845**

Udea Guenée in Duponchel, 1845: 209. Type species: *Pyralis ferrugalis* Hübner, 1796, by monotypy.

Udea albostriata **sp. n.**
Distribution. China (Hebei).

Udea aksualis (Caradja, 1928) (as *Pionea*)
Distribution. China (Xinjiang).

Udea austriacalis (Herrich-Schäffer, 1851) (as *Botys*)
Scopula donzelalis Guenée, 1854
Botys sororialis Heyden, 1860

Botys nitidalis Heinemann, 1865
Pyrausta austriacalis altaica Zerny, 1914
Pyrausta austriacalis juldusalis Zerny, 1914
Distribution. China (Xinjiang), Russia (Altai), France, Switzerland, Austria, Romania, Bulgaria, Albania.

Udea conubialis Yamanaka, 1972
Distribution. China (Taiwan).

Udea costalis (Eversmann, 1852) (as *Botys*)
Botys hilaralis Christoph, 1881
Botys hyperborealis var. *hoffmanni* Krulikovsky, 1898
Pionea costalis var. *alaicalis* Caradja, 1916
Pionea costalis var. *alaicalis* f. *brunnealis* Caradja, 1916
Mesographe itysalis maurinalis Curtis, 1934
Distribution. China (Xinjiang), Mongolia, Russia (Far East, Siberia, Altai), France, Lithuania, Poland.

Udea curvata **sp. n.**
Distribution. China (Tibet).

Udea cyanalis (La Harpe, 1855) (as *Botys*), **new record to China**
Distribution. China (Hebei), Spain, France, Herzegovina, Romania, Germany, Central Urals, Russia (Caucasus).

Udea decrepitalis (Herrich-Schäffer, 1848) (as *Botys*)
Pionea decrepitalis ab. *leucoalis* Strand, 1920
Distribution. China (Hebei, Qinghai) (Xu, 1997), Europe.

Udea defectalis (Sauber, 1899) (as *Botys*)
Distribution. China (Qinghai).

Udea elutalis (Denis & Schiffermüller, 1775) (as *Pyralis*), **new record to China**
Pyralis albidalis Hübner, 1796
Distribution. China (Hebei, Xinjiang), Kazakhstan, West Europe, Central Europe, Romania, Balticum, Finland, Russia (Siberia).

Udea endotrichialis (Hampson, 1918) (as *Hapalia*)
Distribution. China (Taiwan).

Udea exigualis (Wileman, 1911) (as *Pionea*), **new record to China**
Distribution. China (Fujian, Guangxi, Guizhou, Hubei, Hunan, Sichuan, Tibet, Yunnan), Japan.

Udea ferrugalis (Hübner, 1796) (as *Pyralis*)
Scopula martialis Guenée, 1854
Scopula hypatialis Walker, 1859
Pionea maculata Costantini, 1923
Pionea obsoleta Costantini, 1923
Pionea granjalis Chrétien, 1925
Udea martialis f. *fusca* Dufrane, 1960
Udea martialis f. *pallida* Dufrane, 1960
Distribution. China (Gansu, Guangdong, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Qinghai, Shaanxi, Shandong, Shanxi, Shanghai, Sichuan, Taiwan, Tianjin, Yunnan, Zhejiang), widely distributed in Asia, Europe and Africa.

Udea flavofimbriata (Moore, 1888) (as *Mabra*)
Botys obealis Snellen, 1899
Distribution. China (Guangdong, Taiwan), Japan, Myanmar, Indonesia (Sumatra, Java), India, Sri Lanka.

Udea fulcrialis (Sauber, 1899) (as *Botys*)
Distribution. China (Qinghai).

Udea incertalis (Caradja in Caradja & Meyrick, 1937) (as *Pionea*)
Distribution. China (Yunnan).

Udea lugubralis (Leech, 1889) (as *Botys*)
Distribution. China (Fujian, Guizhou, Henan, Hubei, Hunan, Shaanxi, Sichuan, Yunnan, Zhejiang), Korea, Japan, Russia (Sakhalin, Shikotan Island, Ussuri, Amur).

Udea nigrostigmalis Warren, 1896
Distribution. China (Guangdong), India.

Udea montensis Mutuura, 1954
Distribution. China (Hubei, Sichuan) (Song, 2001), Japan.

Udea orbicentralis (Christoph, 1881) (as *Botys*)
Distribution. Western China, Korea, Japan, Russia (Vladivostok).

Udea planalis (South in Leech & South, 1901) (as *Pionea*)
Distribution. China (Sichuan).

Udea poliostolalis (Hampson, 1918) (as *Hapalia*)
Distribution. China (Taiwan).

Udea prunalis (Denis & Schiffermüller, 1775) (as *Pyralis*), **new record to China**
Phalaena nivealis Fabricius, 1781
Phalaena Pyralis ferruginalis Villers, 1789
Pyralis leucophaealis Hübner, 1796
Pyralis nebulalis Haworth, 1811
Distribution. China (Gansu, Heilongjiang, Ningxia, Shanxi, Sichuan, Xinjiang), Europe (except some of Mediterranean Islands).

Udea russispersalis (Zerny, 1914) (as *Pionea*)
Distribution. China (Xinjiang).

Udea schaeferi (Caradja in Caradja & Meyrick, 1937) (as *Pionea*)
Distribution. China (Yunnan).

Udea scoparialis (Hampson, 1899) (as *Pionea*)
Distribution. China (Tibet).

Udea stationalis Yamanaka, 1988, **new record to China**
Distribution. China (Fujian), Japan.

Udea subplanalis (Caradja in Caradja & Meyrick, 1937) (as *Pionea*)
Distribution. China (Yunnan).

Udea suisharyonensis (Strand, 1918) (as *Pionea*)
Pionea lolotialis Caradja, 1927
Distribution. China (Sichuan, Taiwan).

Udea thyalis (Walker, 1859) (as *Botys*)
Distribution. China, Japan.

Udea tritalis (Christoph, 1881) (as *Botys*)
Distribution. Northern China, Korea, Japan, Russia (Ussuri) (Inoue, 1993).

Descriptions of new species and diagnoses of new records to China

Udea exigualis (Wileman, 1911), new record to China

Pionea exigualis Wileman, 1911: 388. Type locality: Japan.
Udea exigualis (Wileman): Inoue 1982: 364.

Diagnosis. This species is similar to other species of *U. lugubralis*-complex. It can be distinguished from *U. lugubralis* by smaller size (wingspan 16–21 mm) and longer harpe with sharp point. It differs from *U. stationalis* and *U. montensis* by bent harpe with sharp point. Its phallus apodeme lacking a small lateral tooth-like process is different from *U. montensis*. *U. exigualis* is similar to *U. ferrugalis* and *U. testacea* (Butler) with yellowish-brown forewing bearing dark brown fringe, but can be distinguished in male genitalia by the more slender and shorter fibula and the juxta without dorsal arms.

Material examined. China: Fujian: 1♂, Yong'anyan, Mt. Daiyunshan, 1300 m, 12-IX-2002, coll. Xinpu Wang (NKUM); 1♀, Guadun, Mt. Wuyishan, 27°74'N, 117°64'E, 1220 m, 18-V-2012, coll. Jinwei Li, genitalia slide no. LJW12156; **Guangxi:** 1♂, Gaozhai, Xing'an, 28-VIII-2011, coll. Jinwei Li, genitalia slide no. LJW12253; 7♂, Anjiangping Reserve, 25°33'N, 109°55'E, 1751 m, 10-VII-2013, coll. Xiaohua Chen, genitalia slide no. LJW12207; 1♂, Jiuniutang, Mt. Maoershan, 550 m, 20-IV-2002, coll. Shulian Hao, Huaijun Xue (NKUM); **Guizhou:** 4♂3♀, Mt. Leigongshan, 26°21'N, 108°09'E, 1198 m, 14–15-VII-2013, coll. Xiaohua Chen, genitalia slides no. LJW12255 (♀), LJW12269 (♀), LJW12270 (♂); 4♂7♀, Huguosi, Mt. Fanjingshan, 1300 m, 1–3-VIII-2001, coll. Houhun Li, Xinpu Wang (NKUM); 1♂, Jinding, Mt. Fanjingshan, 2100 m, 31-VII-2001, coll. Houhun Li, Xinpu Wang (NKUM); 1♀, Huixiangping, Mt. Fanjingshan, 1700 m, 1-VI-2002, coll. Xinpu Wang (NKUM); 1♂, Suoluo, Chishui, 390 m, 30-V-2000, coll. Yanli Du (NKUM); **Hubei:** 1♂, Jiuhuping, Shennongjia, 31°30'N, 110°21'E, 1888 m, 9-IX-2012, coll. Lijun Yang; 1♂, Muyu, Shennongjia, 31°28'N, 110°23'E, 1072 m, 8-IX-2012, coll. Jinwei Li, genitalia slide no. LJW12150; 1♀, Maoping, Wufeng, 30°08'N, 110°40'E, 1175 m, 12-IX-2012, coll. Lijun Yang, genitalia slide no. LJW12263; 6♂5♀, Shayuan, Hefeng, 1260 m, 15–18-VII-1999, coll. Houhun Li (NKUM); 1♂, Houhe, Wufeng, 1100 m, 11-VII-1999, coll. Houhun Li (NKUM); 5♂, Pingbaying, Xianfeng, 1280 m, 21–22-VII-1999, coll. Houhun Li (NKUM); 2♂, Maoba, Lichuan, 700 m, 30-VII-1999, coll. Houhun Li (NKUM); **Hunan:** 4♂3♀, Mt. Badagongshan, Sangzhi, 1250 m, 12-VIII-2001, coll. Houhun Li, Xinpu Wang (NKUM); 3♂, Zhangjiajie, 650 m, 7–11-VIII-2001, coll. Houhun Li, Xinpu Wang (NKUM); **Sichuan:** 1♂, Labahe, Tianquan, 30°09'N, 102°26'E, 1860 m, 8-VII-2012, coll. Jinwei Li, genitalia slide no. LJW12250; **Tibet:** 1♂, Dexing, Motuo, 29°20'N, 95°18'E, 835 m, 9-VII-2013, coll. Jinwei Li, genitalia slide no. LJW12209; 1♂, Pailong, Linzhi, 30°01'N, 95°00'E, 2010 m, 5-VII-2013, coll. Jinwei Li, genitalia slide no. LJW12212; **Yunnan:** 1♂1♀, Baihualing, Baoshan, 1520 m, 11–13-VIII-2007, coll. Dandan Zhang, genitalia slide no. LJW12160 (♂); 1♂, Haba, Diqing, 15-VII-2011, coll. Jinwei Li, genitalia slide no. LJW12153.

Distribution. China (Fujian, Guangxi, Guizhou, Hubei, Hunan, Sichuan, Tibet, Yunnan), Japan.

Udea stationalis Yamanaka, 1988, new record to China

Udea stationalis Yamanaka, 1988: 111. Type locality: Japan, Honshu.

Diagnosis. This species is similar to other species of *U. lugubralis*-complex. It can be distinguished from *U. lugubralis* by smaller size (wingspan 15–20 mm). Differs from both *U. lugubralis* and *U. exigualis* by somewhat straight harpe, by lacking granularly membranous interval zone between antrum and colliculum. Differs from *U. montensis* by the phallus apodeme lacking the small lateral tooth-like process, and by lacking granularly membranous interval zone between antrum and colliculum.

Material examined. China: Fujian: 1♀, Guadun, Mt. Wuyishan, 27°74'N, 117°64'E, 1220 m, 18-V-2012, coll. Jinwei Li, genitalia slide no. LJW12154.

Distribution. China (Fujian), Japan.

Udea curvata sp. n.

http://zoobank.org/0E665363-306D-4736-AB9B-47CF4B8E5869

Figs 1, 4

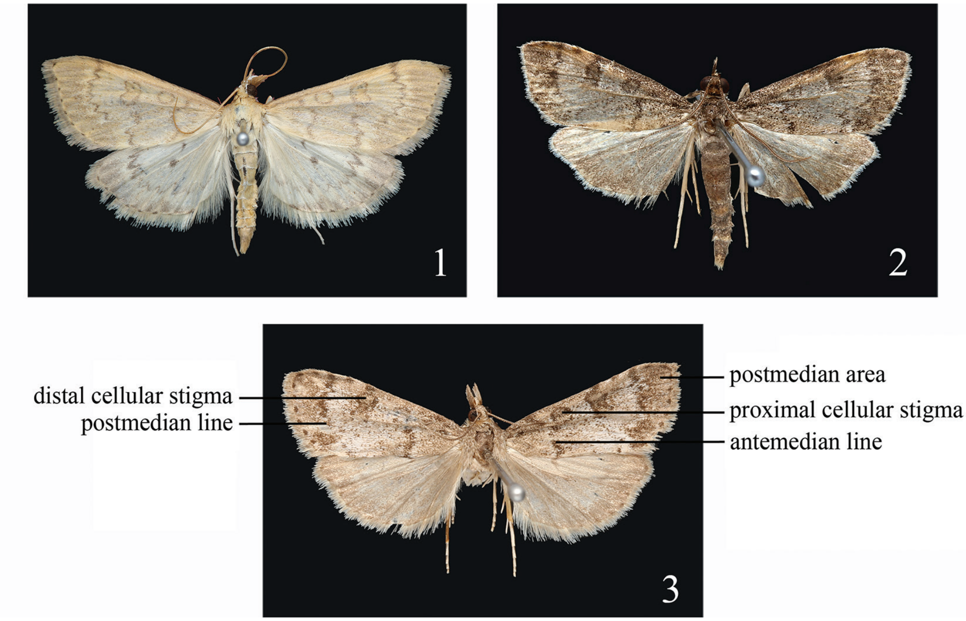
Type-locality. China, Tibet, Milin, Paizhen, 29°30'N, 94°51'E, 2961 m, 2-VII-2013, coll. Jinwei Li.

Type material. Male holotype, **China: Tibet:** Paizhen, Milin, 29°30'N, 94°51'E, 2961 m, 2-VII-2013, coll. Jinwei Li, genitalia slide no. LJW12172 (SYSBM); **Paratypes.** 3♂, **China: Tibet:** Paizhen, Milin, 29°30'N, 94°51'E, 2961 m, 2–3-VII-2013, coll. Jinwei Li, genitalia slides no. LJW12248, LJW12267 (SYSBM). **Additional material.** 1 abdomen missing, **China: Tibet:** Paizhen, Milin, 29°30'N, 94°51'E, 2961 m, 2-VII-2013, coll. Jinwei Li.

Diagnosis. This species is similar to *U. decrepitalis* and *U. elutalis* with zigzaggy serrated postmedian line and darker postmedian area of forewing, but can be distinguished in: fibula claw-shaped, bent, with point apex; phallus with a thumb-shaped cornutus. Differs from *U. decrepitalis* also by colouration of forewing stigmata identical with ground colour. *U. curvata* is similar to *U. conubialis* in male genitalia, but can be distinguished in: wingspan 25.5–28.5 mm, ground colour yellow, postmedian line zigzaggy, proximal cellular stigma distinct, fibula strongly bent. *U. curvata* similar to *U. lutealis* with yellow ground colour and colouration of forewing stigmata identical with ground colour, but can be distinguished by bent fibula extending ventro-distally, juxta bifid ventrally, phallus with a thumb-shaped cornutus, posterior phallus with granulated area not sclerotised, and lacking projecting denticulate ridge most posteriorly.

Description. Male (Fig. 1). Wingspan 25.5–28.5 mm. Frons yellowish-brown, with white lateral band not extending to anterior end, and a faint, short middle band. Vertex pale yellowish-brown. Labial palpus slightly upturned obliquely, third segment porrect; length about 2.5 times diameter of eye; yellowish-brown, contrastingly white at base ventrally. Maxillary palpus yellowish-brown, with a brush of scales. Basal scaling of proboscis white. Antenna with yellowish-brown scales dorsally. Thorax and abdomen yellow dorsally, dirty white ventrally. Legs creamy white, foreleg inner side dark yellowish.

Forewing yellow, scattered with brown scales, markings grey-brown; antemedian line from costal 1/4 sinuated to 1/3 posterior margin; proximal cellular stigma circular; distal cellular stigma kidney-shaped; postmedian line zigzaggy serrate, from costal 3/4,



Figures 1–3. Adults of *Udea* species. **1** *U. curvata* sp. n., male, paratype, Paizhen **2–3** *U. albostriata* sp. n. **2** paratype, male, Taomugeda **3** paratype, female, Taomugeda.

excurved around cell, and strongly inflexed below distal cellular stigma, then to 2/3 on posterior margin; postmedian area strongly dusted with grey and alternately formed grey and yellow streaks; vein ends on wing margin each with a small brown dot; fringe yellow, basal 1/4 grey. Hindwing pale yellow, a darker steak at anterior angle and a blackish dot at posterior angle of cell; postmedial line grey-brown, zigzaggy serrate, with anterior 1/4 most distinct; postmedian area similar to forewing, marginal line and fringe as forewing, paler at tornus area.

Male genitalia (Fig. 4). Uncus inverted T-shaped, with base expanded, apex bulbous and setose dorso-laterally. Pseudognathos slender and ribbon-like, semicircular produced medially. Triangular transtilla connected. Valva narrow and long, costa nearly straight, proximal half of costa twice as broad as distal half, ventral margin broadly sinuate basally, with a stout tip protruding proximal of the distal end of sacculus, nearly parallel to costa from middle to end; fibula claw-shaped, bent ventro-distally, with point apex. Saccus inflated, ventrally keeled. Juxta nearly circular, somewhat bifid ventrally, dorsal edge serrated. Phallus cylindrical, with a short coecum, with a thumb-shaped cornutus, posterior phallus with granulated vesica.

Female unknown.

Distribution. China (Tibet).

Etymology. The specific name is derived from the Latin *curvata* = curved, referring to the curved fibula.

Udea prunalis (Denis & Schiffermüller, 1775), new record to China

Pyralis prunalis Denis & Schiffermüller, 1775: 121. Type locality: Austria, Vienna environs.
Phalaena nivealis Fabricius, 1781: 274.
Phalaena Pyralis ferruginalis Villers, 1789: 451.
Pyralis leucophaealis Hübner, 1796: 27.
Pyralis nebulalis Haworth, 1811: 386.
Pionea prunalis (Denis & Schiffermüller): Hampson 1899: 243.
Udea prunalis (Denis & Schiffermüller): Hasenfuss 1960: 182.

Diagnosis. *U. prunalis* is similar to *U. cyanalis*, *U. inquinatalis* (Lienig & Zeller), *U. orbicentralis*-complex and *U. albostriata* sp. n. with greyish white ground colour of forewing variably dusted with dark brown, proximal cellular stigma, distal cellular stigma and postmedian area strongly and contrastingly dark browned, but can be distinguished from them in: cornuti composed of a row of linked short spines, a row of closely squeezed long spines and a single longer spine in male genitalia, the mid-folded ductus bursae with posterior half sclerotised and plate-shaped accessory signum in female genitalia.

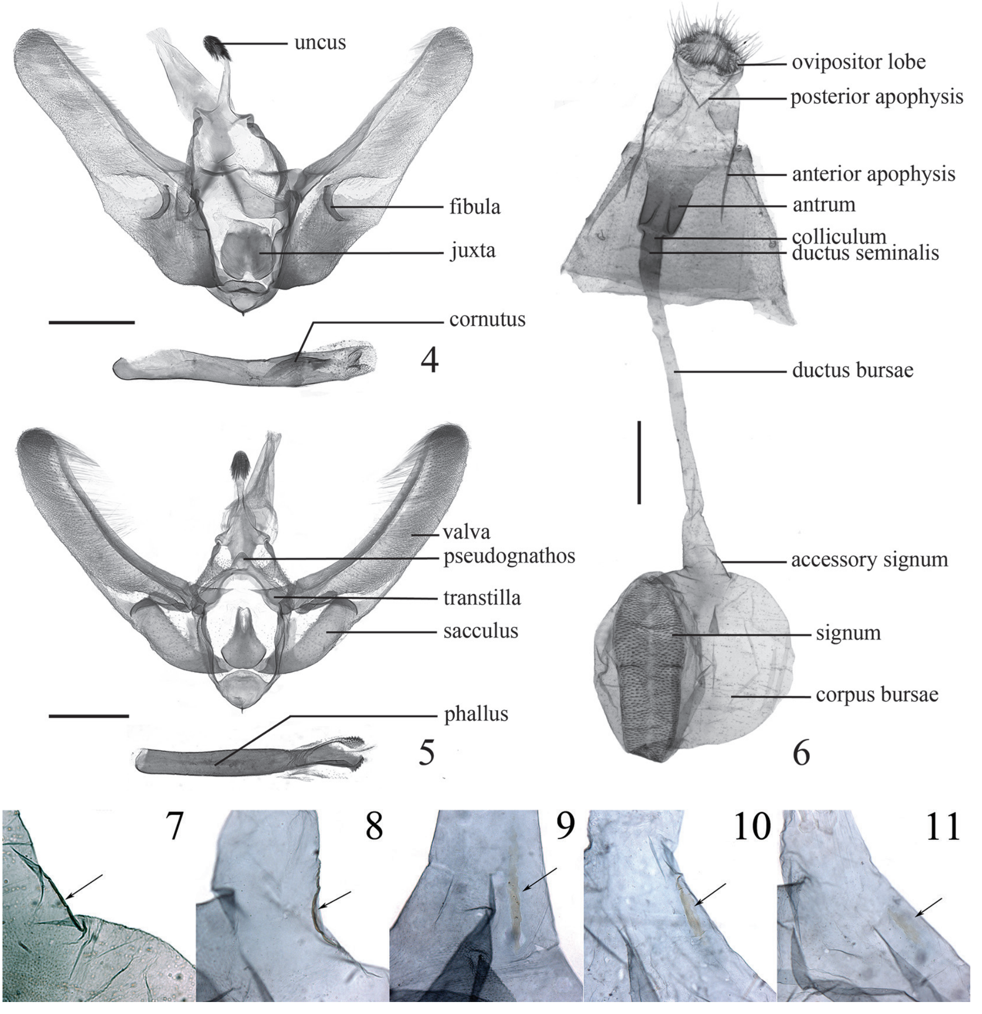
Material examined. China: Gansu: 5♂3♀, Mt. Xinglongshan, Yuzhong, 2120–2230 m, 29-VII–4-VIII-1993, coll. Houhun Li (NKUM); **Heilongjiang:** 1♂, Jiagedaqi, 14-VII-2012, coll. Dandan Zhang, Lijun Yang, genitalia slide no. LJW12157 (♂); **Ningxia:** 1♂, Xinmin Forestry Station, Jingyuan, 2100 m, 7-VIII-2000, coll. Houhun Li, Shuxia Wang (NKUM); **Shanxi:** 1♀, Xiachuan, Qinshui, 35°26'N, 112°00'E, 1555 m, 24-VII-2013, coll. Weicai Xie; **Sichuan:** 10♂6♀, Rize, Jiuzhaigou, 2700 m, 13-VIII-2002, coll. Shulian Hao (NKUM); 1♂, Shuzheng, Jiuzhaigou, 2300 m, 17-VIII-2002, coll. Shulian Hao (NKUM); 11♂3♀, Zhawa, Jiuzhaigou, 2400 m, 15-VIII-2002, coll. Shulian Hao (NKUM); **Xinjiang:** 1♂, Kuerdening, Gongliu, 2230 m, 28-VII-1994, coll. Houhun Li, Hongyan Qin (NKUM); 1♀, Kuerdening, Gongliu, 43°10'N, 82°52'E, 1483 m, 22-VII-2013, coll. Jinwei Li, genitalia slide no. LJW12254.

Distribution. China (Gansu, Heilongjiang, Ningxia, Shanxi, Sichuan, Xinjiang), Europe (except some Mediterranean Islands).

Udea elutalis (Denis & Schiffermüller, 1775), new record to China

Pyralis elutalis Denis & Schiffermüller, 1775: 121. Type locality: Austria, Vienna environs.
Pyralis albidalis Hübner, 1796: fig. 118.
Udea elutalis (Denis & Schiffermüller): Hasenfuss 1960: 182.

Diagnosis. This species is similar to *U. lutealis* (Hübner), but can be distinguished by a wide, blade-shaped fibula with a minute, hook-like apex, by praephallus with cornuti a tight line of spines in male genitalia. *U. elutalis* with antrum narrower than colliculum in female genitalia but contrary in *U. lutealis*.



Figures 4–11. Genitalia of *Udea* species. **4** Male genitalia of *U. curvata* sp. n., genitalia slide no. LJW12267 **5–11** *U. albostriata* sp. n. **5** Male genitalia, genitalia slide no. LJW12288 **6** Female genitalia, genitalia slide no. LJW12296 **7–11** Variation of accessory signum, genitalia slides no. LJW12296, LJW12297, LJW12292, LJW12284, LJW12287. Scale bars: 0.5 mm.

Material examined. China: Hebei: 32♂13♀, Taomugeda, Laiyuan County, 39°37'N, 114°59'E, 1420 m, 3-VIII-2013, coll. Weicai Xie, Xiaolin Liu, genitalia slides no. LJW12174 (♂), LJW12203 (♀), LJW12243 (♂), LJW12244 (♀), LJW12268 (♂), LJW12289 (♀), LJW12290 (♂), LJW12291 (♀); **Xinjiang:** 1♂, Tianchi, Fukang, 43°52'N, 88°09'E, 2009 m, 18-VII-2013, coll. Jinwei Li, genitalia slide no. LJW12181; 4♀, Baiyanggou, Nanshan, 43°27'N, 87°11'E, 1947 m, 17-VII-2013, coll. Jinwei Li, genitalia slides no. LJW12202, LJW12294.

Remarks. There is considerable variation in size of wingspan, ground colour and genitalia. The specimens from Hebei have whitish or whitish-grey forewing, with small wingspan size (18–22 mm). The specimens from Hebei and Xinjiang exhibit a slightly curved and shorter row of spines in the posterior phallus compared to material from Europe and Russia (Bolshakov, 2002; Slamka, 2013). In the female genitalia, the accessory signum varies from crescent- or stick-shaped over gradual reduction to complete absence.

Distribution. China (Hebei, Xinjiang), Kazakhstan, West Europe, Central Europe, Romania, Balticstates, Finland, Russia (Siberia).

Udea cyanalis (La Harpe, 1855), new record to China

Botys cyanalis La Harpe, 1855: 30. Type locality: Europe.
Udea cyanalis (La Harpe): Hannemann 1964: 322.

Diagnosis. *U. cyanalis* is similar to *U. prunalis*, *U. inquinatalis*, *U. orbicentralis*-complex and *U. albostriata* sp. n. with similar ground colour and maculation as mentioned in diagnosis of *U. prunalis*, but can be distinguished from them by the semicircular produced process of pseudognathos with nipple-shaped end in male genitalia. In female genitalia, this species differs from *U. prunalis*, *U. inquinatalis* and *U. grisealis* Inoue, Yamanaka & Sasaki by ductus bursae approximately 1.8 times the length of the corpus bursae, the corpus bursae with narrowly crescent-shaped accessory signum, but lacking the lanceolate signum; differs from *U. nebulatalis* Inoue, Yamanaka & Sasaki by ductus bursae approximately 1.8 times the length of the corpus bursae and nearly round corpus bursae; differs from *U. proximalis* Inoue, Yamanaka & Sasaki and *U. intermedia* Inoue, Yamanaka & Sasaki by crescent-shaped accessory signum but lacking the lanceolate or pyriform signum; differs from *U. orbicentralis* and *U. albostriata* sp. n. by lacking the lanceolate signum.

Material examined. China: Hebei: 2♂, Taomugeda, Laiyuan County, 39°37'N, 114°59'E, 1420 m, 3-VIII-2013, coll. Xiaolin Liu, genitalia slides no. LJW12282, LJW12293.

Distribution. China (Hebei), Spain, France, Herzegovina, Romania, Germany, Central Urals, Russia (Caucasus).

Udea albostriata sp. n.

http://zoobank.org/B4A2764A-7681-411A-AEFA-BFD4686B8BBE
Figs 2, 3, 5–11

Type-locality. China, Hebei, Laiyuan County, Taomugeda, 39°37'N, 114°59'E, 1420 m, 3-VIII-2013, coll. Xiaolin Liu.

Type material. Male holotype, **China: Hebei:** Taomugeda, Laiyuan County, 39°37'N, 114°59'E, 1420 m, 3-VIII-2013, coll. Xiaolin Liu, genitalia slide no. LJW12204 (SYSBM); **Paratypes.** 14♂8♀, same data as holotype, genitalia slides no. LJW12173 (♂), LJW12178 (♂), LJW12245 (♂), LJW12283 (♂), LJW12284 (♀), LJW12286 (♀), LJW12287 (♀), LJW12288 (♂), LJW12292 (♀), LJW12296 (♀) (SYSBM); 2♀, **Hebei:** Jinhekou, Wei County, 39°57'N, 114°56'E, 1112 m, 5-VIII-2013, coll. Weicai Xie, Xiaolin Liu, genitalia slide no. LJW12297 (♀) (SYSBM). **Additional material. China: Hebei:** 1 abdomen missing, Taomugeda, Laiyuan County, 39°37'N, 114°59'E, 1420 m, 3-VIII-2013, coll. Xiaolin Liu; 1 abdomen missing, Jinhekou, Wei County, 39°57'N, 114°56'E, 1112 m, 5-VIII-2013, coll. Weicai Xie, Xiaolin Liu.

Diagnosis. *U. albostriata* is closely related to *U. cyanalis*, *U. prunalis*, *U. inquinatalis*, *U. orbicentralis*-complex with similar ground colour and maculation as mentioned in diagnosis of *U. prunalis*, but can be distinguished from *U. cyanalis*, *U. nebulatalis*, *U. proximalis* by corpus bursae with a lanceolate signum in female genitalia; differs from *U. prunalis*, *U. inquinatalis*, *U. grisealis* and *U. intermedia* by long ductus bursae about twice the length of the corpus bursae; differs from *U. orbicentralis* in: praephallus with a sclerotized, granulated area and a projecting ridge strongly denticulate, antrum much broader and shorter than in *U. orbicentralis*, and not bulged laterally.

Description. Wingspan 17–23 mm. Frons and vertex dark brown, dusted with light grey. Labial palpus slightly upturned obliquely, third segment porrect, dark brown, dusted with light grey, contrastingly white at base ventrally, length approximate three times the diameter of the eye. Maxillary palpus dark brown, dusted with light grey, with tip a brush of scales. Basal scaling of proboscis creamy white. Antenna with dark scales dorsally. Thorax dark greyish, dusted with light grey dorsally, greyish-white ventrally. Abdomen grey to dark greyish dorsally, greyish-white ventrally. Legs greyish-white, with scattered few dark scales, sometimes mid- and hind-tibiae, tarsus dark brown, dusted with white outwardly.

Forewing ground colour greyish white, dusted with dark brown, proximal and distal cellular stigmata and postmedian area strongly and contrastingly dark browned; antemedian line from 1/5 of costa oblique outwards to posterior margin of cell, then sinuating to 1/3 of posterior margin; proximal cellular stigma transversely oval, dark brown, rimmed with blackish; distal cellular stigma nearly 8-shaped, coloured like proximal cellular stigma; postmedian line sinuate, from costal 4/5 slightly arched to 3/5 of CuA_2, followed by a V-shaped curve, then to 2/3 of posterior margin, traced by a greyish-white line in postmedian area; marginal brown dots at vein ends on costa and termen; basal half of fringe pale grey, distal half dirty white. Hindwing grey, markings indistinct; a dark steak at anterior angle and a blackish dot at posterior angle of cell; postmedian line very indistinct, parallel with termen; fringe paler than in forewing.

Male genitalia (Fig. 5). Uncus with basal half nearly triangular, apex bulbous and setose dorso-laterally. Pseudognathos slender and ribbon-like, roundly triangular medially. Transtilla triangular. Valva narrow and elongate, costa slightly concave, slightly tapering in thickness towards apex, nearly parallel-sided with ventral valva edge; fibula extending ventrad, weakly sclerotised, blade-shaped, curved, with tip pointed; sacculus slightly inflated. Saccus ventrally keeled. Juxta broad ventrally, tapered dorsally, with dorsal 1/3 bifid. Phallus cylindrical, slightly curved, with posterior phallus apodeme divided into a sclerotised, granulated area and a projecting denticulate ridge most posteriorly.

Female genitalia (Figs 6–11)**.** Ovipositor lobes flat, crescent-shaped, densely setose. Anterior apophyses a little longer than posterior apophyses. Antrum sclerotised, nearly cylindrical, slightly tapering anteriorly, mesoventrally with two longitudinal ridges. Ductus bursae slender, about twice the length of the corpus bursae, slightly sclerotised posteriorly, colliculum short, ductus seminalis from ductus bursae close to colliculum. Corpus bursae nearly round, accessory signum (Figs 7–11) narrowly crescent-shaped, or weakly rod-shaped; signum lanceolate, ends rounded, with a mesally interrupted transverse ridge in the middle.

Distribution. China (Hebei).

Etymology. The specific name is derived from the Latin *albus* = white, *striatus* = striate, referring to forewing postmedian line traced by a greyish-white line in the postmedian area.

Discussion

Udea is one of the most species-rich genera of Spilomelinae. Until now, 31 *Udea*-species are recorded from China, but our knowledge about this fauna is still poor. For example, some of the species are only known by their original descriptions, based on type-localities in China.

Biogeographically, the northern part of China belongs to the Palaearctic region and the southern part to the Oriental region. The border is given by the Qinling Mountains and Huaihe River (Zheng and Zhang 1956). Accordingly, 15 of the Chinese *Udea*-species belong to the Palaearctic fauna, nine to the Oriental fauna and seven occur in both of these or even more regions. Most of the Oriental species occur in the mountains. Therefore, *Udea* could be called a group of temperate regions as well as of mountain regions at more southerly latitudes.

Remarkably, 15 of the *Udea* species recorded from China are so far only known from China. They are distributed in southwestern Yunnan and Sichuan, northwestern Qinghai, Tibet and Xinjiang as well as on Taiwan. Understanding this pattern will require further faunistic investigations throughout China, and a phylogeographic analysis including areas outside China.

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RESEARCH ARTICLE

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Newly discovered populations of the Ethiopian endemic and endangered *Afrixalus clarkei* Largen, implications for conservation

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Abstract

Knowledge of the Ethiopian amphibian fauna is limited and Southwest Ethiopia remains understudied. This part of Ethiopia, where most of the country's remaining natural forest is situated, is known to harbour the only populations of *Afrixalus clarkei* (Largen), an endemic banana frog, worldwide. This species is under great threat of extinction and is therefore classified as endangered on the IUCN red list. We surveyed different potential habitats for this species outside its known range and found several new populations extending its known habitat preference, and the geographical and altitudinal range of the species. We here show that *Afrixalus clarkei* is more common than previously thought.

Keywords

Amphibians, Distribution, Forest, IUCN, Survey, Southwest Ethiopia

Introduction

The highlands of Ethiopia are characterized by a high endemism of fauna and flora (Evangelista et al. 2008; Freilich et al. 2014), and acknowledged as one of the prime biodiversity hotspots globally (Mittermeier et al. 2011). Despite a recent surge in amphibian studies (Weinsheimer et al. 2010; Mengistu 2012), including several expeditions to the undulating highlands (Gower et al. 2012; Freilich et al. 2014), substantial knowledge gaps on the Ethiopian amphibian fauna remain. Based on Amphibiaweb (2015), 66 species of amphibians are currently recorded from Ethiopia (see also Largen 2001), of which 41% are endemic (Evangelista et al. 2008; AmphibiaWeb 2015) and 38 species are known to occur in Southwest Ethiopia (Largen and Spawls 2010). Still, the Southwest of Ethiopia remains poorly documented with data from only two herpetological expeditions (Largen 1974; Gower et al. 2013) together with some sporadic observations (summarized in Largen 2001). Although the Southwest of Ethiopia is known to harbour the last large tracts of natural forest, forest cover has declined dramatically to less than 3% nationwide (Dessie and Christiansson 2008). Therefore, accurate information on species conservation and distribution is an essential first step to facilitate the delivery of conservation updates, recognize biodiversity hotspots and encourage habitat protection and restoration (De Beenhouwer et al. 2015a; Rovero et al. 2014).

Materials and methods

The authors conducted fieldwork in the Jimma zone, Oromia region, in Southwest Ethiopia. Within the Jimma zone, the Belete-Gera forest is an evergreen montane forest that ranges up to 3000 m a.s.l. and has considerable cover of moist evergreen montane forest. In August 2014, the middle of the rainy season, we completed an assessment of the amphibian fauna in one of the largest remaining natural forest tracts in the area around Afalo (7°38.02'N; 36°13.17'E) between 1600 and 2200 m a.s.l. (De Beenhouwer et al. 2015b). We used both visual encounter survey methods and pitfall trapping to assess the amphibian diversity in the forest (Rödel and Ernst 2004). Identification was based on morphology (Largen 2001, amongst others).

Results and discussion

Amphibians were searched for by the team members on ten evenings in August 2014, resulting in 111 search hours across seven different locations. In total, 13 amphibian taxa were identified from our surveys (Table 1). The most common species were *Hyperolius viridiflavus* (Dumeril & Bibron, 1841) and *Phrynobatrachus minutus* (Boulenger, 1895), accounting for approximately 48% of the species surveyed. Thirty-eight percent of the identified species were endemic to Ethiopia (Table 1). *Hyperolius kivuensis* (Ahl, 1931) was observed in two locations around Afalo on the 21st and 22nd of August. This

Table 1. List of amphibian species found in the Belete-Gera forest during the August 2014 survey. The asterisk (*) indicates the species that are new for the area, Ethiopian endemic speies are followed by (E). #ind. = minimum number of individuals encountered. IUCN-status EN = Endangered, LC = Least concern.

Species	#ind.	IUCN-status (2014)
*Afrixalus clarkei** (E)	100	EN
Amietophrynus asmarae / regularis	20	LC
Conraua beccarii Boulenger	20	LC
Hemisus microscaphus Laurent (E)	20	LC
Hoplobatrachus occipitalis Günther	5	LC
*Hyperolius kivuensis**	10	LC
Hyperolius viridiflavus	100	LC
Leptopelis vannutellii Boulenger (E)	50	LC
Paracassina obscura Boulenger (E)	100	LC
Phrynobatrachus minutus (E)	100	LC
Phrynobatrachus natalensis Smith	50	LC
Ptychadena spp.	100	
Xenopus clivii Peracca	20	LC

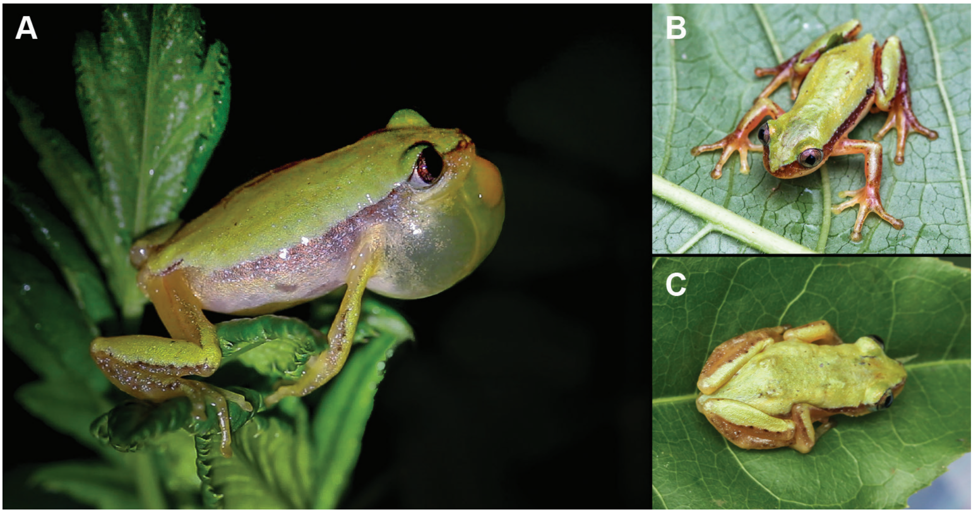

Figure 1. *Afrixalus clarkei*; calling male (**A**), frontal view of male (**B**), dorsal view of female (**C**). Pictures: J. Mertens.

species, listed as 'Least Concern' (IUCN 2015.2), is shown here to extend its range with approximately 150 km to the East of the country (IUCN 2013b). All species identified are listed as 'Least Concern' on the IUCN red list, except for *Afrixalus clarkei* (Largen, 1974), which is considered 'Endangered' (B1 ab(iii); IUCN 2012.2).

A. clarkei, an Ethiopian endemic frog (Fig. 1), was recorded from the banks of the Kito river South of Jimma (10 August 2014, 7°40.08'N; 36°49.12'E, 1722 m a.s.l.), in a swamp in the floodplain of a river South of Chira (14 August 2014, 7°40.08'N; 36°14.56'E, 2030 m a.s.l.), and in the moist montane evergreen forest around Afalo

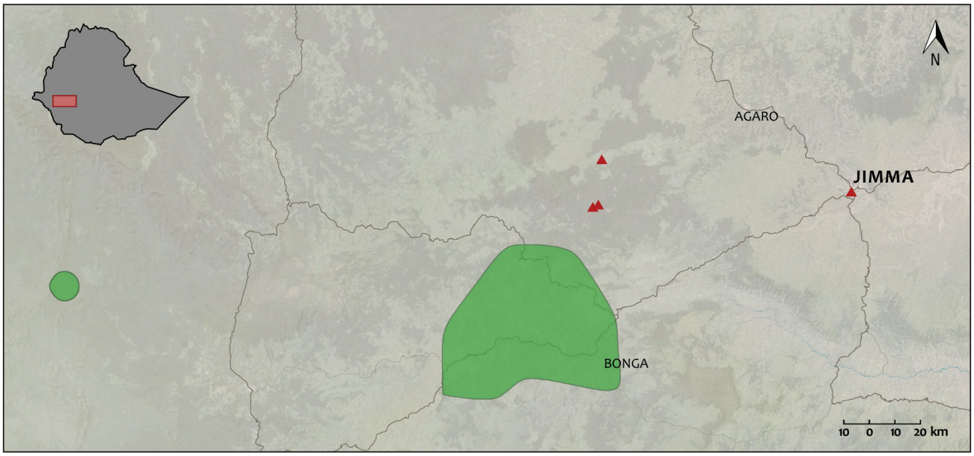

Figure 2. Distribution map of *Afrixalus clarkei*. Green polygons represent previously known distribution. Red triangles represent new records.

(16 August 2014, 7°38.01'N; 36°13.16'E, 1829 m a.s.l. and 20 August 2014, 7°37.09'N; 36°13.48'E, 1784 m a.s.l.). Most specimen had a plain green dorsum and brown dorsolateral lines fading towards the back (Fig. 1; Largen and Spawls 2010), one male in Afalo had an overall turquoise dorsum. Adult males in our sampling reached a maximum snout vent length (SVL) of 23 mm (avg. length 20.3 mm, avg. weight 0.52 g), the largest female reached 24.3 mm SVL (avg. length 23.2 mm, avg. weight 0.71 g).

A. clarkei was previously only known from two populations in Southwest Ethiopia between 820 and 1800 m a.s.l. in moist tropical forest near Bonga (Largen and Spawls 2010; Gower et al. 2012). Our findings extend the distribution of *A. clarkei* by roughly 40 km towards the North (Chira) and 70 km to the East (Jimma) (Fig. 2; IUCN 2013a). It also extends the altitudinal range to a maximum of 2030 m a.s.l. (Chira). Our observations of *A. clarkei* outside forest habitats, in marshes and riverine floodplains in open disturbed landscapes, suggest a higher degree of tolerance against forest degradation than previously expected. The populations found in floodplains along the Kito River in Jimma and the Naso River in Chira suggest that the species still has a larger distribution than currently documented. These observations illustrate the limited knowledge on amphibian distribution and conservation in this part of Ethiopia.

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It came to our attention after our manuscript was published that the caption of Table 1 was incomplete. We provide below the missing information, which is essential to the correct interpretation of the referred table.

[a] Species names and authors are as specified in the original text.
[b] Setation formulae of the first (P1), second (P2) and fourth (P4) swimming legs are summarized as follows: Re (inner setae; outer setae)/Ri (inner setae; outer setae), where Re: exopod, Ri: endopod. F: adult female; M: adult male; TL: total length (mm); Ur1 to Ur5: urosome segments; Fu: furca; CR: caudal rami. nd: no data.

* Character not explicitly stated in the original but taken from accompanying drawings for comparison purposes.

§ Most likely Crisafi (1959) described a late juvenile C5 as an adult male. In addition to the non-geniculated antennule, the urosome is 4-segmented with the last two segments fused (Fig. 3, p. 51 in Crisafi, 1959).