

Revalidation of the spider genus *Citharoceps* Chamberlin, 1924 (Araneae, Segestriidae)

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Abstract

Citharoceps Chamberlin was diagnosed by the presence of a very distinctive stridulatory apparatus composed of two patches of ridges on the sides of the cephalic region, and a stridulatory thorn on the pro-lateral region of the femur I. Currently, this genus is a junior synonym of *Ariadna* Audouin, with the assumption that the stridulatory apparatus could constitute an exclusive feature of its unique known species, *Citharoceps fidicina* Chamberlin, currently senior synonym of *Citharoceps californica* Chamberlin & Ivie. In the present study, *Citharoceps* is revalidated and redescribed based on the occurrence of the stridulatory apparatus in *C. fidicina* and *Segestria cruzana* Chamberlin & Ivie, and also on the presence of distinguishable characters, such as the length of the labium-sternum junction, ventral median spine on male metatarsi I, and strong sclerotized interpulmonary fold in females, forming a conspicuous median flap. *Segestria cruzana* is transferred to *Citharoceps*, with *C. californica* removed from the synonym of *C. fidicina*, and proposed as a junior synonym of *C. cruzana*, due to the similarity between the additional material examined and the original description. Males of *C. fidicina* and *C. cruzana* are described for the first time.

Keywords

Taxonomy, Haplogynae, Synspermiata, Dysderoidea, California, stridulatory apparatus

Introduction

Segestriidae currently comprises 120 species distributed in three genera: *Segestria* Latreille, 1804, *Ariadna* Audouin, 1826 and *Gippsicola* Hogg, 1900 (World Spider Catalog 2015). *Ariadna* is the most diverse genus, with 99 taxonomically valid species and four generic junior synonyms: *Pylarus* Hentz, 1842, synonymized by Emerton (1890), *Macedonia* Hogg, 1900, synonymized by Rainbow (1911), and *Segestriella* Purcell, 1904 and *Citharoceps* Chamberlin, 1924, both synonymized by Beatty (1970).

The genus *Citharoceps* was described by Chamberlin (1924) to include only *Citharoceps fidicina*, described based on an immature holotype from Ensenada, Baja California, Mexico. He distinguished this genus from other segestriids by the presence of a stridulatory apparatus composed of two distinctive patches of grooves on both sides of the cephalic region and a stridulatory thorn located on the prolateral region of femur I. Later, Chamberlin and Ivie (1935) described a new species, *Citharoceps californica*, based on immatures from Laguna Beach, California, USA, distinguishing it from *C. fidicina* by the larger size and darker coloration.

Beatty (1970) examined the holotype of *C. fidicina* and paratypes of *C. californica*, and synonymized *C. californica* with *C. fidicina*, and *Citharoceps* with *Ariadna*. After the study was submitted to publication, Beatty (1970: 485) discovered a male specimen of *C. fidicina* with stridulatory patches like those found on the female. To the author, this characteristic, together with other structural features, confirms his assumptions on the synonymy of *Citharoceps* with *Ariadna*. This comment was included in the publication as an addendum.

In the present study, the revalidation of the genus *Citharoceps* is proposed, based on the presence of the stridulatory apparatus, together with distinctive characters, such as the labium-sternum length equal or smaller than the endite-sternum junction, a ventral median spine in the metatarsi I of males, and the internal female genitalia with a strong sclerotized interpulmonary fold, forming a conspicuous median flap. The genus is redescribed with more detailed information on the morphological characters, mainly with regard to male and female genitalia. The male of *C. fidicina* is described for the first time. *Citharoceps californica* is removed from the synonym of *C. fidicina* and proposed as a junior synonym of *Segestria cruzana* Chamberlin & Ivie, 1935, together with the transfer of this species to *Citharoceps*, and the first description of its male.

Materials and methods

The specimens examined are deposited in the American Museum of Natural History, New York (AMNH; L. Prendini), California Academy of Sciences, San Francisco (CAS; C. E. Griswold), Collection of the Cabrillo National Monument Park, San Diego (CNMP; K. Lombardo), Darrel Ubick collection, San Francisco (CDU),

Instituto Butantan, São Paulo (IBSP; A. D. Brescovit), and Queensland Museum, Brisbane (QM; R. Raven). The morphological examinations and descriptions follow Grismado (2008) and were made under Leica MZ6 and MZ12 stereomicroscope. Spine notation was modified from Grismado (2008) with the absence of the term “apical” (ap), and description of the leg IV spination. Measurements are in millimeters. The male genitalia was divided into bulb and embolus by the narrowing of the spermathecal duct, where it has a less sclerotized region (Figs 6A–B, 8A–C; see Lipke et al. 2014, fig. 10). The investigation of the internal female genitalia followed three steps: (I) dissection of the ventral anterior region of the abdomen; (II) digestion of the dissected material with Ultrazime® contact lenses cleaner enzyme in 1 tablet/5 ml distilled water for 24 hours; (III) posterior treatment with heated KOH for 20 minutes, according to Platnick et al. (1999). Spigot nomenclature followed Platnick et al. (1991) and Griswold et al. (2005). Illustrations were made under a Zeiss Axioscop 20, with a camera lucida attached. Photographs were taken with a Leica DFC 500 digital camera attached to a Leica MZ16A stereomicroscope. Extended focal range photos were composed with Leica Application Suite 3.3. For scanning electron microscopy (SEM) images, the body parts were dehydrated through a series of graded ethanol (80% to 100%), dried by critical-point drying method, mounted on metal stubs using adhesive copper tape and nail polish for fixation, and sputter coated with gold. SEM photographs were taken with a FEI Quanta 250 scanning electron microscope from the Laboratório de Biologia Celular of the Instituto Butantan, São Paulo. Abbreviations: AC–aciniform gland spigot; ALS–anterior lateral spinnerets; AR–anterior receptaculum; B–bulb; d–dorsal; DL–dorsal lobe; E–embolus; GD–glandular ducts plate; IF–interpupillary fold; LS–less sclerotized portion of the sperm duct; mAP–minor ampulate gland spigot; MAP–major ampulate gland spigot; p–prolateral; PI–piriform gland spigot; PLS–posterior lateral spinnerets; PMS–posterior median spinnerets; PR–posterior receptaculum; r–retrolateral; T–tracheal trunk; UE–uterus externus; v–ventral; VL–ventral lobe; vp–ventroprolateral; vr–ventroretrolateral. Geographical coordinates were obtained with Google Earth (Lat/Lon-WGS84).

Vouchers for comparative studies: *Segestria senoculata* (Linnaeus, 1758): DENMARK: *Zealand Island*: Tisvilde, Tisvildeleje (56°03'08"N; 12°05'05"W) (DMS), 1♂ 1♀ 3imm., 19–20.V.1991, C. Griswold & N. Scharff leg. (CAS 9032847). *Ariadna maxima* (Nicolet, 1849): CHILE: *Concepcion Province*: Estación Escuadrón [36°55'59"S; 73°09'00"W] (DMS), 2♂ 5♀ 3imm., 20.IX.1980, N. Cekalovic leg. (AMNH); *Santiago Province*: Santiago [33°26'16"S; 70°39'01"W] (DMS), 1♀, 20.X.2009, T. H. Kawamoto leg. (IBSP 166664). *Gippsicola* sp.: AUSTRALIA: *Queensland*: Massey Range, 4km W of Centre Bellender Ker, 1250m (17°16'S; 145°49'E) (DMS), 2♂, 9–11.X.1991, Monteith, Janetzi & Cook leg. (QM S91041); Bellender ker Range, Summit TV Station, 1560m [17°14'S; 145°52'E] (DMS), 1♀, 1–7.XI.1981, Earthwatch/Queensland Museum leg. (QM S30617).

Taxonomy

Segestriidae Simon, 1893

Citharoceps Chamberlin, 1924, gen. reval.

Citharoceps Chamberlin, 1924: 607.

Type species. *Citharoceps fidicina* Chamberlin, 1924

Diagnosis. The genus *Citharoceps* is distinguished from other segestriid genera by the presence in males, females and immatures of a conspicuous stridulatory apparatus composed of two patches of grooves on both sides of cephalic region (Figs 1A–C) and a stridulatory thorn located on the prolateral region of femur I (Figs 2A–B; 5C, H; 7C, H). *Citharoceps* has a labium with the distal region narrowed (Fig. 1F; 9C), differing from *Segestria* (Fig. 9D; Giroti and Brescovit 2011: fig. 8) and *Gippsicola* (Fig. 9B), which have a nearly parallel-sided labium. It is distinguished from *Ariadna* (Fig. 9A) by the presence of a labium-sternum junction with equal or smaller length than the endite-sternum junction (Fig. 9C); by a ventral spine on the median region of male metatarsi I (Figs 5E; 7E), and by the females with an interpulmonary fold strongly sclerotized, forming a conspicuous median flap (Figs 4D–E; 6C; 8D), which is absent in *Ariadna* (Fig. 10A).

Description. Medium-sized synspermiata spiders (see Michalik and Ramírez 2014). Total length 5.0–11.92, carapace 2.64–4.44 long, 1.76–2.76 wide. Carapace and chelicerae coloration ranging from orange to dark reddish orange. Eyes bounded by dark outlines (Figs 5A, F; 7A, F). Endites orange to reddish orange; labium dark orange to dark reddish orange. Sternum orange to reddish orange, with darker margins (Figs 5B, G; 7B, G). Legs orange to reddish orange with pair I–II darker. Femur, patella and tibia I–II distally marbled with darker pigment (Figs 5C–E, H–I; 7C–E, H–I). Abdomen greyish, with a dorsal pattern composed by dark chevrons, and irregularly distributed dark spots on the ventral region (Figs 5A–B, F–G; 7A–B, F–G). Carapace oblong, with cephalic region narrower than thoracic region, and sparsely distributed setae usually concentrated in the cephalic region. Posterior eyes positioned in a slightly recurved line (Figs 1A–B; 5A, F; 7A, F). Chelicerae: with prominent basal lateral ridge (Fig. 1D), and lateral proximal depression near the carapace (Fig. 1B); cheliceral teeth composed by three promarginal and one retromarginal, all with ridged cuticle (Figs 1E, G). Labium with 2/3 of the length of the endite, separated from the sternum by a partially membranous suture (Figs 1F, 9C; Labarque and Ramírez 2012: 6). Sternum longer than wide, with anterior region truncated and procurved anterior margin (Figs 5B, G; 7B, G). Male palp with a short and distally notched cymbium, piriform bulb and a hook-like embolus, with small tubercles (Fig. 4A–C). Female palps with one articulated claw, followed by scattered prolateral spines (Fig. 2C). Legs robust (Figs 5C–D, H–I; 7C–D, H–I). Tarsal organ exposed (following Labarque and Ramírez 2012) with edges, and usually three rimmed receptors (Fig. 2E; following Platnick et al. 2012).

Trichobothria on the dorsal subdistal region of metatarsi I–IV, dorsal subproximal and subdistal region of tibia I–IV, and dorsal region of the male and female palpal tibia; trichobothrial bases with a transverse ridge, curved inwards; trichobothrial shaft filiform (Fig. 2F). Legs with three tarsal claws, paired claws pectinated, and unpaired one with only a small tooth (Fig. 2D); chemosensory setae on the distal ventral region of tarsi I–II in males (Fig. 2D, G; according to Foelix and Chu-Wang 1973: figs 17a–b). Preening comb of metatarsi IV with 5–7 spines (Fig. 2H). Abdomen uniformly hairy, longer than wider (Figs 5A–B, F–G; 7A–B, F–G). Spinnerets: ALS with three segments, the basal segment crossed by a diagonal membranous stripe (Fig. 3A), and one MAP spigot with 8 PI (Fig. 3D); PMS with just one mAP spigot (Fig. 3C); PLS with 4 AC spigots (Fig. 3B). Colulus triangular and pilose (Fig. 3E). Internal female genitalia: anterior receptaculum bilobated with a hyaline external cuticle, a short dorsal lobe, and a small plate of glandular ducts restricted to the ventral and lateral region of the dorsal lobe; posterior receptaculum membranous, with pores (Figs 4D–G; 6C–D; 8C–D).

***Citharoceps fidicina* Chamberlin, 1924, comb. rest.**

Figs 1–3, 4A–F, 5–6

Citharoceps fidicina Chamberlin, 1924: 608 (Immature holotype from Ensenada [31°51'28"N; 116°36'21"W] (DMS), Baja California, Mexico, 4.VII.1921, Soiver leg., deposited in CAS 1392, examined).

Ariadna fidicina – Beatty, 1970: 478 (Syn.). – World Spider Catalog 2015.

Additional material examined. UNITED STATES OF AMERICA. California: *San Diego County:* San Diego, La Jolla [32°50'24"N; 117°16'37"W] (DMS), Eucalyptus grove, 1♀ 1imm., XII.1965, F. Ennik leg. (CAS 9039517); San Diego, Point Loma Peninsula [32°41'1.64"N; 117°14'52.07"W] (DMS), 2♂, 8–12.IX.2003, D. Chan & T. Duffield leg. (CNMP); **MEXICO. Baja California del Norte:** 2.5mi S. of the Halfway House on Mex. Highway #1 (RB-3) [30°33'N; 115°10'W] (DMS), 2♀ 1imm., 21.XI.1962, P. R. Craig & D. Dailey leg. (CAS 9039518; 9039526; 9039546).

Diagnosis. Males of *Citharoceps fidicina* differ from those of *C. cruzana* by the slightly shorter and thicker embolus (Fig. 6A–B) and by a straight metatarsus I (Fig. 5C–E). Females differ from *C. cruzana* by the anterior receptaculum with both dorsal and ventral lobes well delimited, the ventral lobe projected and laterally expanded (Figs 4D–F, 6C–D).

Description. Male (CNMP). Total length 5.2; carapace 2.64 long, 1.76 wide. Palps light brownish orange (Fig. 6A–B). Legs: robust, with short setae, and spines with different sizes (Fig. 5C–E). Leg formula: I/II–III–IV. Leg measurements: I, femur 2.36, patella 0.88, tibia 1.96, metatarsus 2.12, tarsus 0.88, total 8.2; II, 2.36, 0.88, 1.96, 2.12, 0.88, 8.2; III, 1.88, 0.68, 1.4, 1.48, 0.68, 6.12; IV, 2.16, 0.88, 1.68, 1.64, 0.68, 7.04. Spination: leg I, femur d0-0-0-1-0-0/1-0, p0-0-0-0-1/0-1-0; tibia p0-0-0-1-0-1-0, vp1-0-1-0-1-0-1, v1-0-1-0-1-0-0, vr2/1-0-1-0-1-0-1, r0-1-1-1-1-1-

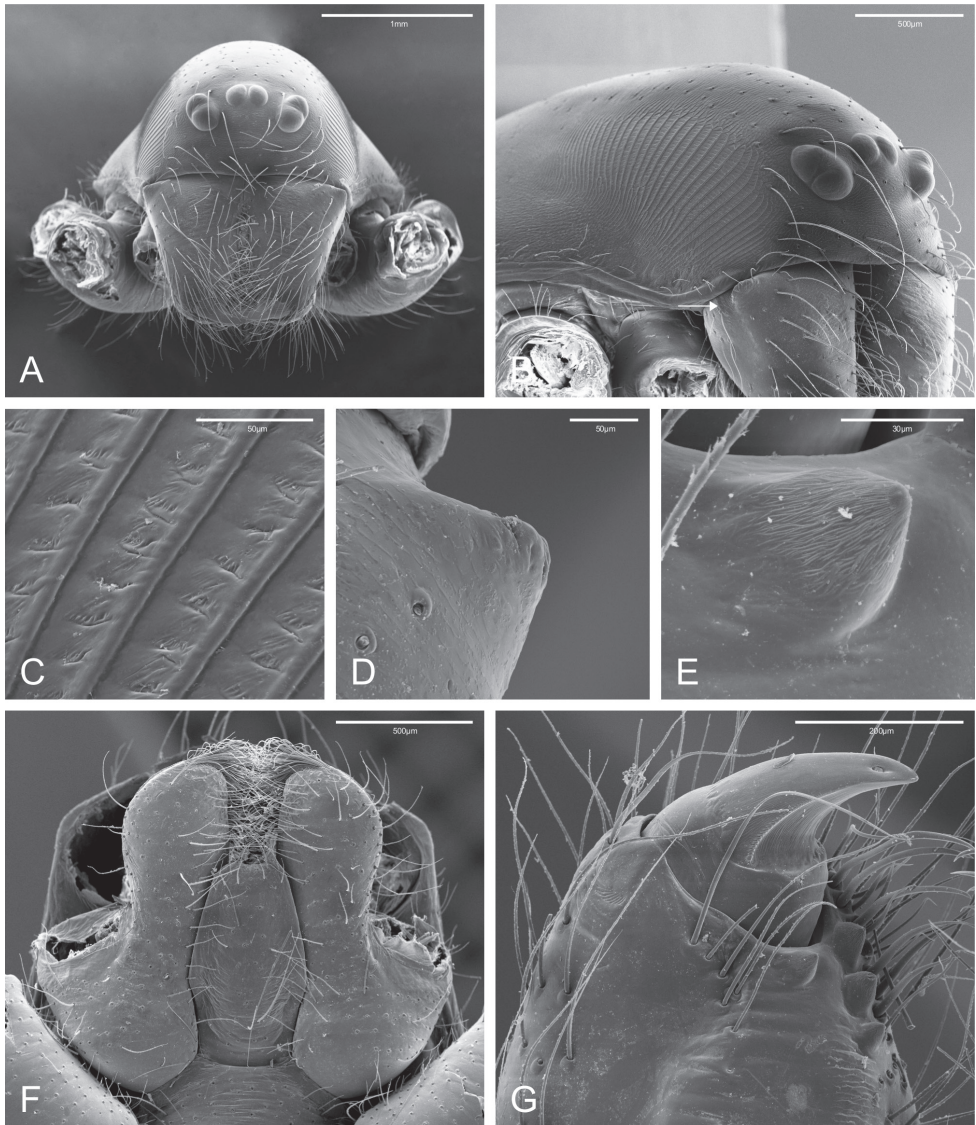


Figure 1. SEM images of *Citharoceps fidicina*, female from La Jolla, San Diego (CAS 9039517). **A** cephalothorax, frontal view **B** cephalothorax, frontal-lateral view, showing the right stridulatory patch, white arrow indicates the lateral proximal depression **C** stridulatory patch cuticle in detail **D** cheliceral lateral basal transverse ridge **E** cheliceral retromarginal tooth **F** endites and labium, ventral view **G** distal region of the right chelicerae, ventro-lateral view, showing the fang and the cheliceral teeth.

0; metatarsus p0, vp0-1-0-0-1-1-1, v0-0-1-0-0-0-2, vr0-1-0-0-1-1-1, r0-1-0-0-0-0-0 (Fig. 5C–E); leg II, femur d0-0-1-1-0-0/1-0, p0-0-0-0-0-1-0; tibia p0-1-0-1-0-1-0, vp0-0-0-0/1-0-1-1, v0-0-1-0-1-0-0, vr1-0-1-0-1-0-1, r1-0-0/1-0-1-0-0; metatarsus vp0-1-0-0-1-1-1, v0-0-1-0-0-0-2, vr0-1-1-1-0-0-1; leg IV femur d1-0-1-0-1-0-0-0;

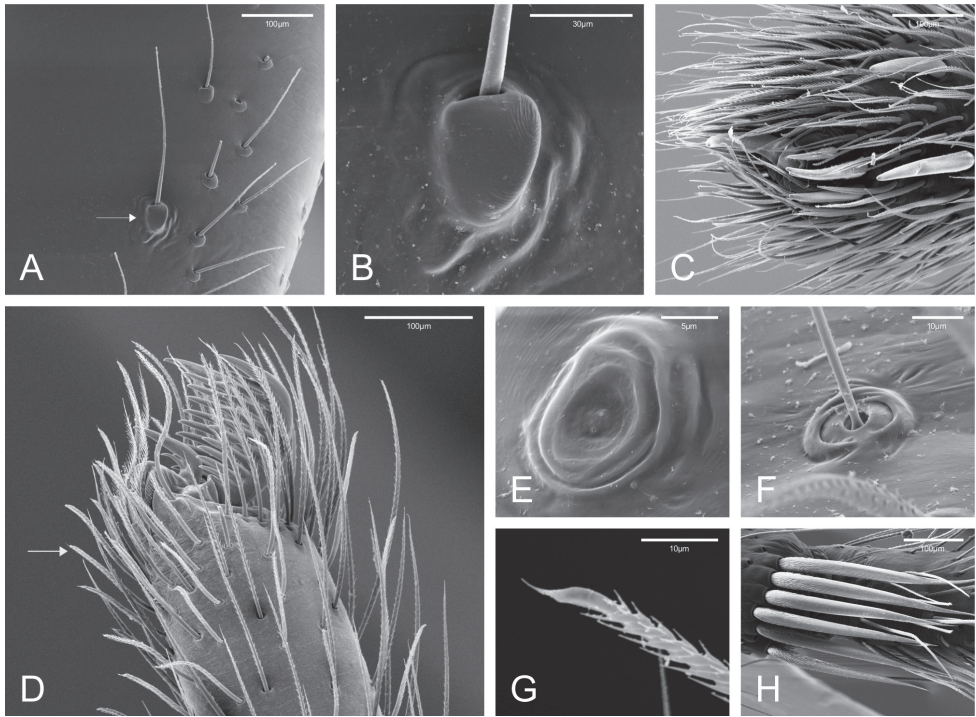


Figure 2. SEM images of *Citharoceps fidicina*, female from La Jolla, San Diego (CAS 9039517) (**A–C, E–F, H**) male from Cabrillo N. M., San Diego (CNMP) (**D, G**). **A** right femur I, median region, prolateral view, white arrow indicates the stridulatory thorn **B** stridulatory thorn, detail **C** right palp, ventro-prolateral view **D** left tarsus I, retrolateral view, white arrow indicates chemosensory setae **E** right tarsus II, tarsal organ **F** right tibia II, trichobothrial base **G** tarsal ventral chemosensory setae, detail **H** right metatarsus IV, distal preening comb, detail.

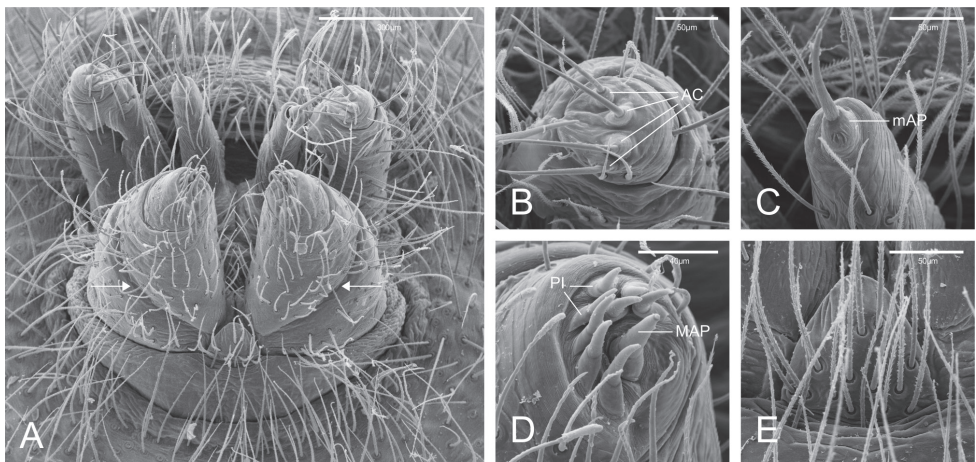


Figure 3. SEM images of *Citharoceps fidicina*, female from La Jolla, San Diego (CAS 9039517). **A** Spinnerets, ventro-posterior view, white arrows indicate the ALS basal segment transverse membrane **B** right PLS, posterior view **C** left PMS, posterior view **D** left ALS, posterior view **E** colulus in ventral view.

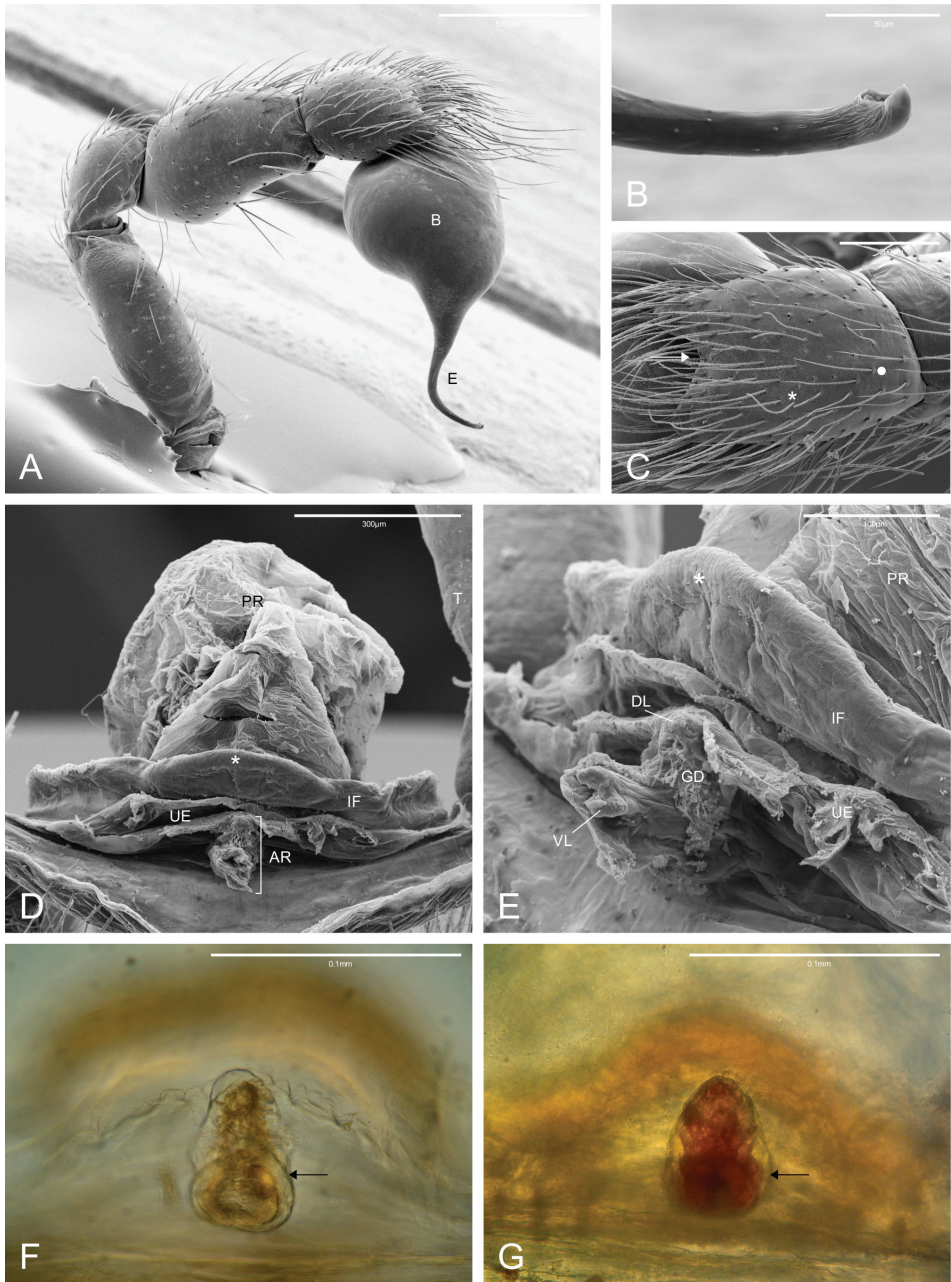


Figure 4. Male and female genitalia of *Citharoceps* species. *Citharoceps fdicina*, male from Cabrillo N. M., San Diego (CNMP) (**A–C**) female from La Jolla, San Diego (CAS 9039517) (**D–E**) and from Baja California, Mexico (CAS 9039518) (**F**) *Citharoceps cruzana*, female from Arroyo Seco, California (CDU) (**G**). **A** right palp, retrolateral view **B** embolus tip, prolateral view **C** cymbium, dorsal view, white arrow indicates distal notch, asterisk indicates a chemosensory setae and circle indicates a tactile setae **D** internal genitalia, apical view, and **E** lateral view, white asterisks indicates the median flap **F–G** anterior receptaculum, ventral view, black arrows indicate the hyaline cuticle.

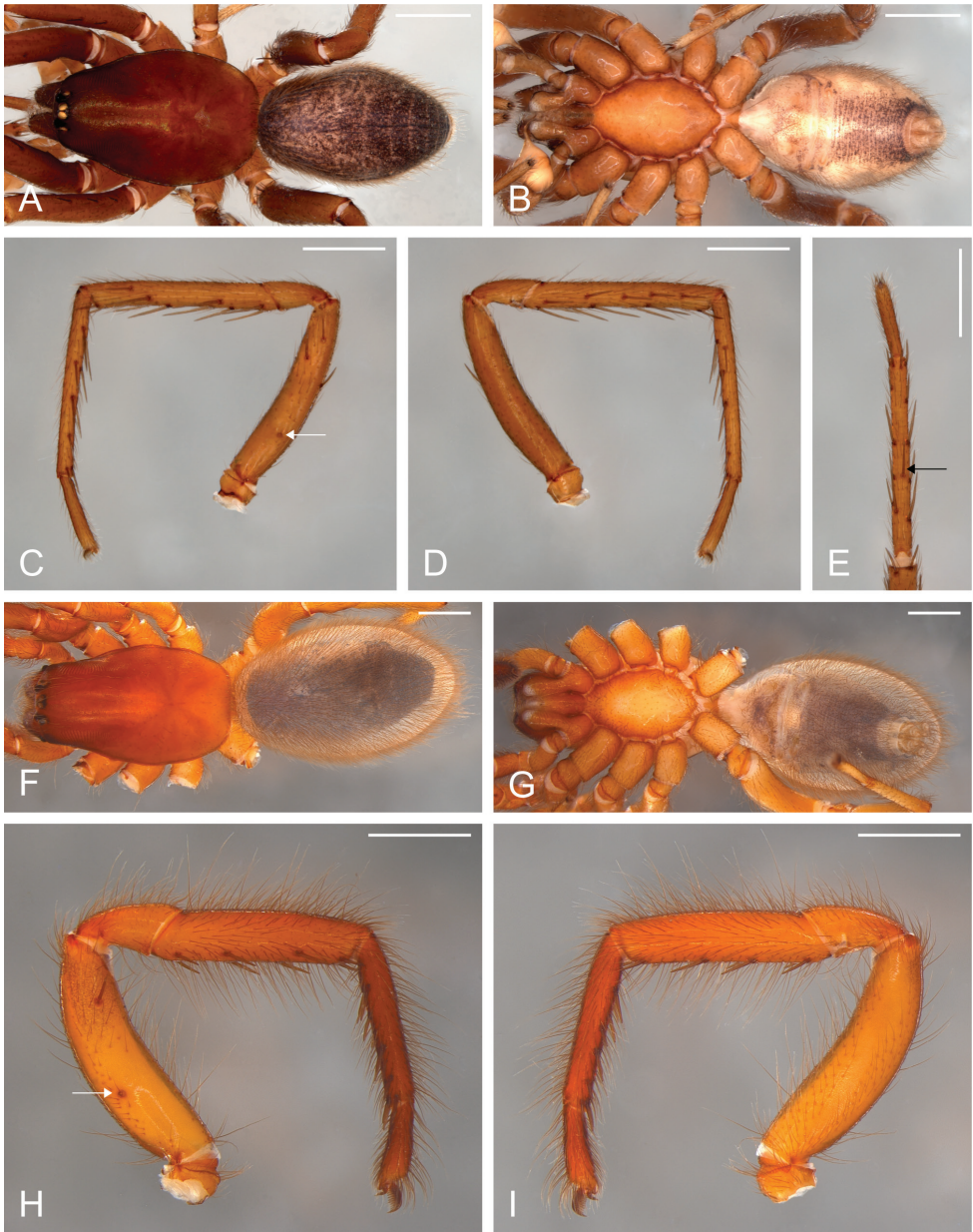


Figure 5. *Citharoceps fidicina*. Male from Cabrillo N. M., San Diego (CNMP) (**A–E**) female from La Jolla, San Diego (CAS 9039517) (**F–I**). **A, F** habitus, dorsal view **B, G** habitus, ventral view **C** right leg I, prolateral view **D** same, retrolateral view **E** right metatarsus and tarsus I, ventral view, black arrow indicates the ventral median spine **H** left leg I, prolateral view **I** same, retrolateral view; white arrows indicate the stridulatory thorn. Scale bars: 1 mm.

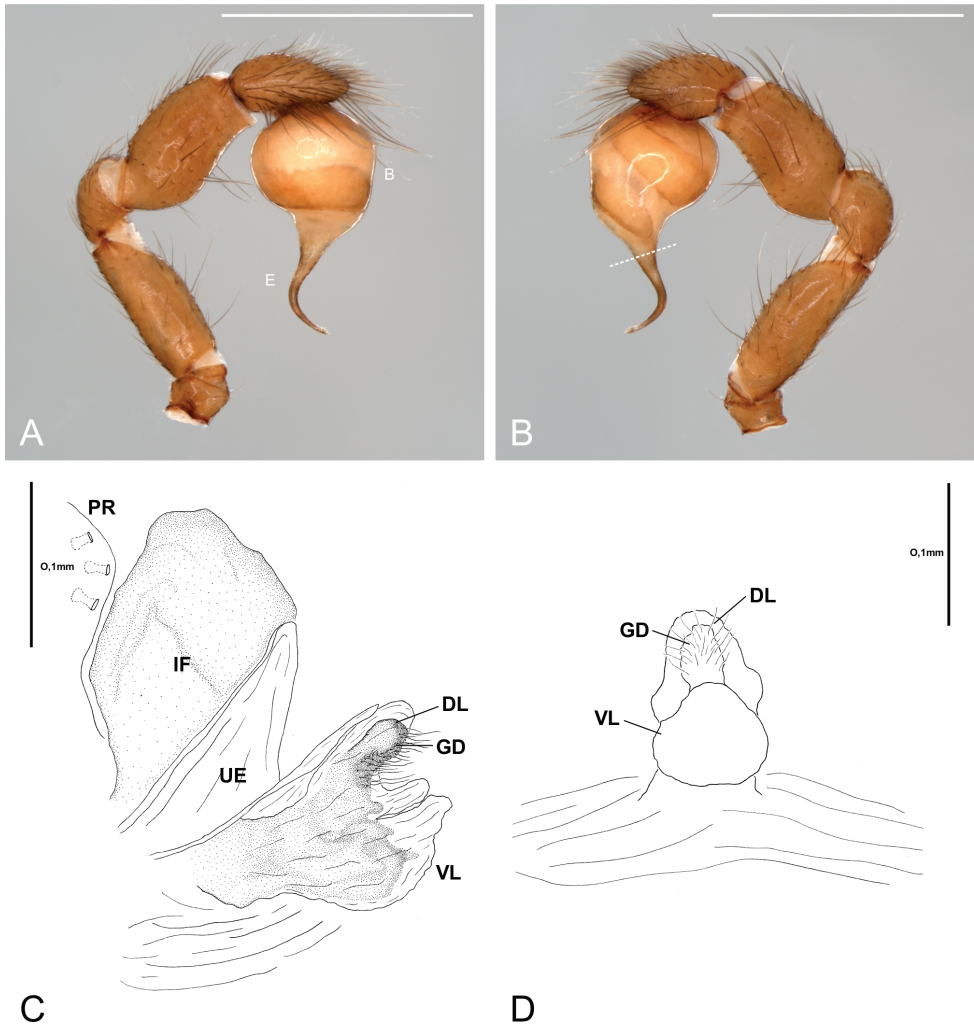


Figure 6. *Citharoceps fidicina*. Male from Cabrillo N. M., San Diego (CNMP) (**A–B**) female from Baja California, Mexico (CAS 9039518) (**C–D**). **A** left palp, prolateral view **B** same, retrolateral view, white dashed line indicates the narrowing of the sperm duct **C** internal female genitalia, lateral view, and **D** ventral view. White scale bars: 1 mm.

tibia v0-0-0/1-0-0-1-0, vr0-0-0-0-0-0-1; metatarsus vp0-0-1-0-0-0-1, vr metatarsal comb with 5 spines.

Female (CAS 9039517). Total length 8.0; carapace 3.72 long, 2.36 wide. Palps orange, gradually darkening distally. Legs: robust, with long setae, and with ventral tibial and metatarsal spines of similar size (Fig. 5H–I). Leg formula: I-II-IV-III. Leg measurements: I, femur 2.56, patella 1.08, tibia 1.88, metatarsus 1.72, tarsus 0.76, total 8.0; II, 2.36, 1.08, 1.84, 1.76, 0.76, 7.8; III, 1.92, 1.0, 1.28, 1.24, 0.68, 6.12; IV, 2.4, 1.24, 1.8, 1.52, 0.68, 7.64. Spination: I, femur p0-0-0-0-0-1-0; tibia vp1-

0-1-0-1-0-1, vr1-0-1-0-1-0-1; metatarsus vp0-1-0-1-1-1-1, v0-0-1-0-0-0-2, vr0-1-0-1-1-0-1-1-1 (Fig. 5H–I); II, tibia vr1-0-1-0-1-0-2/1; metatarsus vp0-1-0-1-1-1, v0-0-0/1-0-0-2, vr0-1-0-1-0-1; IV, vr metatarsal comb with 6-7 spines (Fig. 2H).

Variation. Male (n=2): Total length 5.0–5.2; carapace 2.64–2.72 long; femur I 2.36–2.44. Female (n=3): Total length 6.08–8.0; carapace 3.0–3.72 long, 1.84–2.36 wide; femur I 1.92–2.56.

Distribution. South of California, USA and Baja California, Mexico (Fig. 11).

Remarks. We feel that species attribution is unproblematic. The immature specimen collected in Baja California del Norte by Craig and Dailey in 1962, matches perfectly with the type material of *C. fidicina*. In addition, that immature was collected with two females that match perfectly with the females collected in San Diego.

***Citharoceps cruzana* (Chamberlin & Ivie, 1935), comb. n.**

Figs 4G, 7, 8, 9C

Segestria cruzana Chamberlin & Ivie, 1935: 7 (Immature holotype from Santa Cruz Island (34°00'N; 119°45'W) (DMS), Santa Barbara County, California, USA, III–IV.1913, R. V. Chamberlin leg., deposited in AMNH, examined). – World Spider Catalog, 2015.

Citharoceps californica Chamberlin & Ivie, 1935: 8, pl. 5, figs 32–33 (Immature holotype and four female paratypes from Laguna Beach (33°31'N; 117°46'W) (DMS), California, USA, following Beatty (1970: 478), should be deposited in AMNH, not located, according to E. Sorkin, in letter). – Beatty 1970: 478 – NEW SYNONYMY.

Additional material examined. UNITED STATES OF AMERICA. California:

Monterey County: Greenfield, Arroyo Seco Camping, talus area at The Lakes (36°14'N; 121°29'W) (DMS), 1♀, 22.II.2002, D. & S. Ubick leg. (CDU); Greenfield, Arroyo Seco Camping, Indians Road, el. 1126' (36°13.9'N; 121°29.5'W) (DMS), 1♂ 2imm., 18.VI – 24.X.2004, D. & S. Ubick leg. (CDU); Coast Ridge Trail [36°08'26.32"N; 121°33'10.03"W] (DMS), 0.8 mi SE Nacimiento Rd., el. 3000', 1♀ 2imm., 1.VI.1991, D. Ubick leg. (CDU); *San Luis Obispo County:* Cayucos [35°26'18"N; 120°53'37"W] (DMS), 300', 1♀, 15.XI.1937, O. Bryant leg. (CAS 9039527); *Santa Barbara County:* gully SW of U. C. Field Station, 80-90m, Santa Cruz Island [33°59'59"N; 119°45'42"W] (DMS), 1♂ 1imm., 22.IV.1994, D. H. Kavanaugh leg. (CAS 9055018; 9046542).

Diagnosis. Males of *Citharoceps cruzana* differ from those of *C. fidicina* by the presence of a relatively longer and slender embolus (Fig. 8A–B), and a slightly prolatally bent metatarsus I (Fig. 7C–E). Females differ from *C. fidicina* by the darker coloration, and anterior receptaculum with both dorsal and ventral lobes with similar length, the ventral lobe not expanded (Figs 4G, 8C–D).

Description. Male (CAS 9046542). Total length 8.4; carapace 4.0 long, 2.76 wide. Palps light orange (Fig. 8A–B). Legs: robust, with short setae, and spines with

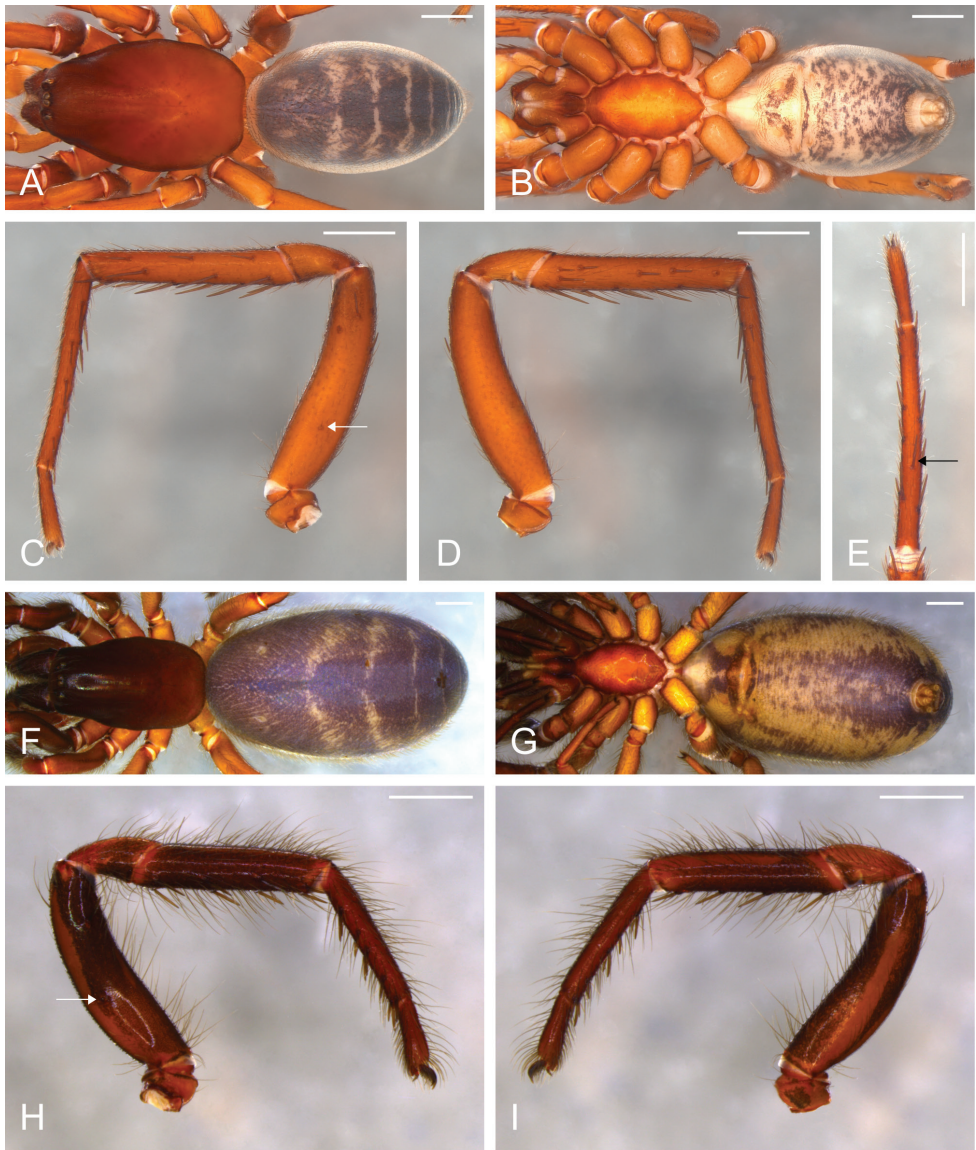


Figure 7. *Citharoceps cruzana*. Male from Santa Cruz Island, California (CAS 9046542) (**A–E**) female from Coast Ridge Trail, California (CDU) (**F–I**). **A, F** habitus, dorsal view **B, G** habitus, ventral view **C** right leg I, prolateral view **D** same, retrolateral view **E** right metatarsus and tarsus I, ventral view, black arrow indicates the ventral median spine **H** left leg I, prolateral view **I** same, retrolateral view; white arrows indicate the stridulatory thorn. Scale bars: 1 mm.

different sizes (Fig. 7C–E). Leg formula: II-I-III-IV. Leg measurements: I, femur 3.2, patella 1.28, tibia 2.68, metatarsus 3.04, tarsus 1.04, total 11.24; II, 3.2, 1.24, 2.96, 3.12, 1.04, 11.56; III, 2.72, 1.16, 2.12, 2.36, 0.88, 9.24; IV, 3.16, 1.32, 2.6, 2.6, 0.88, 10.56. Spination: I, femur d0-0-0-0-1-0/1-2-0, p0-0-0-0-2-0-0; tibia p0/1-

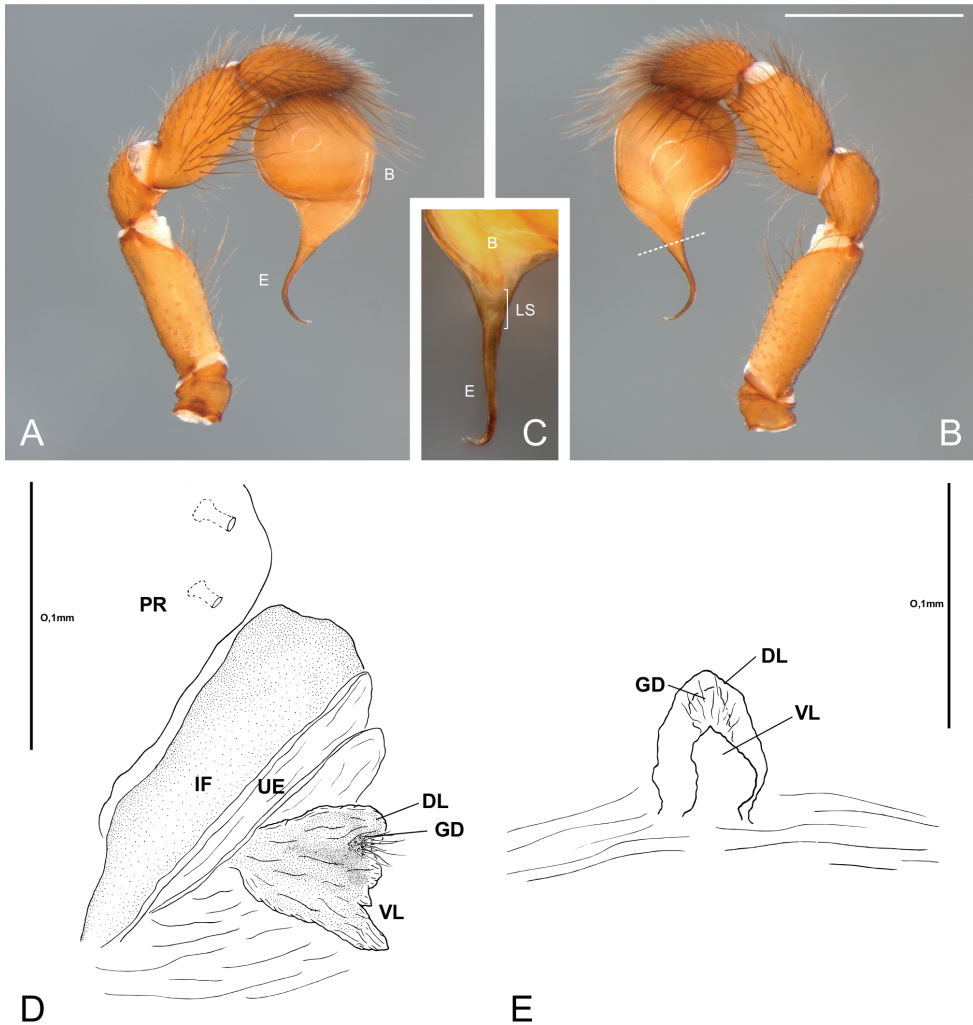


Figure 8. *Citharoceps cruzana*. Male from Santa Cruz Island, California (CAS 9046542) (**A–B**) male from Indians Road, Arroyo Seco Camping, California (CDU) (**C**) female from Arroyo Seco Camping, California (CDU) (**D–E**). **A** left palp, prolateral view **B** same, retrolateral view, white dashed line indicates the narrowing of the sperm duct **C** left palp, postero-retrolateral view, detail indicating the less sclerotized portion of the sperm duct **D** internal female genitalia, lateral view, and **E** ventral view. White scale bars: 1 mm.

1-0-1-0-1-0, vp1-0-1-0-1-0-1, v1-1-0-1-0-0-0, vr1-1-0-1-0-1-0-1, r2-1-0-1-1-0-1-0; metatarsus vp0-1-1-1-0/1-1-1, v0-0-1-0-0-0-0, vr0-1-0-1-1-0-1-2, r0-1-0-0-0-0-0 (Fig. 7C–E); II, femur d1-0-1-0-1-1-2-0, p0-0-0-0-0-0-1-0; tibia p0/1-1-0-1-0-1-0, vp0-1-0-1-0-1-0-1, v1/0-0-1-0-0-1-0-0, vr1-1-0-1-1-1-1, r1-1-0-1-1/0-1-1; metatarsus vp0-1-1-1-0-1-1, v0-1/0-1-0-0-0-0, vr0-1-1-0-1-0-1/0-2, r0-1-0-0-0-0-0-0; IV, femur d1-1-0-1-0-1-0-1-0-0, r0-0-0-0-0-0-0-0-1-0; tibia vp0/1-1-0-0-1-0-0, vr0-0-0-0-0-1/0-1; metatarsus vp0/0/1-1-0-0-1-0-1, metatarsal comb with 6 spines.



Figure 9. Endites and labium, ventral view. *Ariadna maxima*, male from Escuadrón, Concepción, Chile (AMNH) (**A**); *Gipsicola* sp., male from Massey Range, Queensland, Australia (QM S91041) (**B**); *Citharoceps cruzana*, male from Santa Cruz Island, California (CAS 9046542) (**C**); *Segestria senoculata*, male from Tisvildeleje, Zealand Island, Denmark (CAS 9032847) (**D**). Scale bars: 1 mm.

Female (Coast Ridge Trail, CDU). Total length: 11.92; carapace 4.44 long, 2.6 wide. Palps reddish orange, gradually darkening distally. Legs reddish orange, with pairs I-II darker. Femur, patella and tibia I-II darkly marbled mainly on the ventral, prolateral and retrolateral regions (Fig. 7H–I). Legs: robust, with long setae, and with ventral tibial and metatarsal spines of similar size (Fig. 7H–I). Leg formula: I-II-IV-III. Leg measurements: I, femur 2.88, patella 1.28, tibia 2.12, metatarsus 2.12, tarsus 0.88, total 9.28; II, 2.84, 1.28, 2.16, 2.12, 0.84, 9.24; III, 2.32, 1.08, 1.44, 1.6, 0.76, 7.2; IV, 2.84, 1.28, 2.08, 1.8, 0.8, 8.8. Spination: leg I, femur p0-0-0-0-0-2-0; tibia vp1-0-1-0-1-0-1, vr1-0-1-0-1-0-1; metatarsus vp 0-1-1-1-1-1-1, v0-0-0-0-0-0-2, vr0-1-1-1-0-1-1 (Fig. 7H–I); leg II, femur p0-0-0-0-0-1-0; tibia vp0-0-0-0-0-0-1, vr1-0-

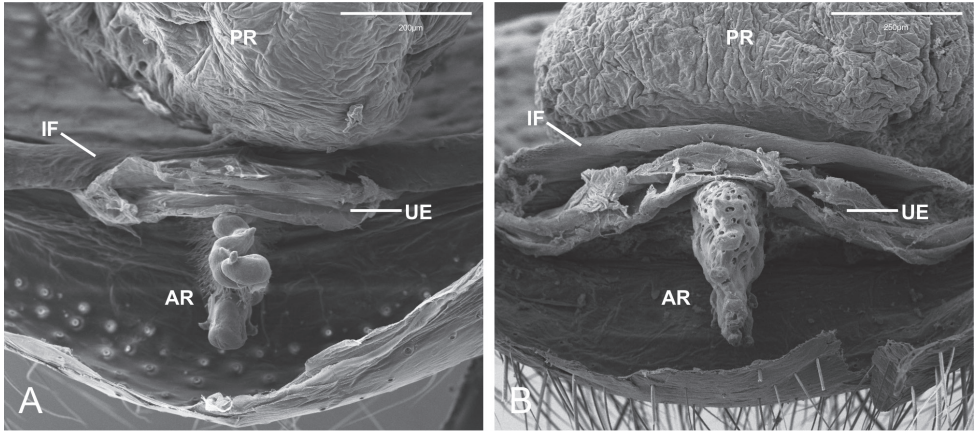


Figure 10. *Ariadna maxima*, female from Santiago, Chile (IBSP 166664) (A); *Gipsicola* sp., female from Bellender ker Range, Queensland, Australia (QM S30617) (B); SEM images of internal female genitalia, apical view, showing the absence of the median flap.

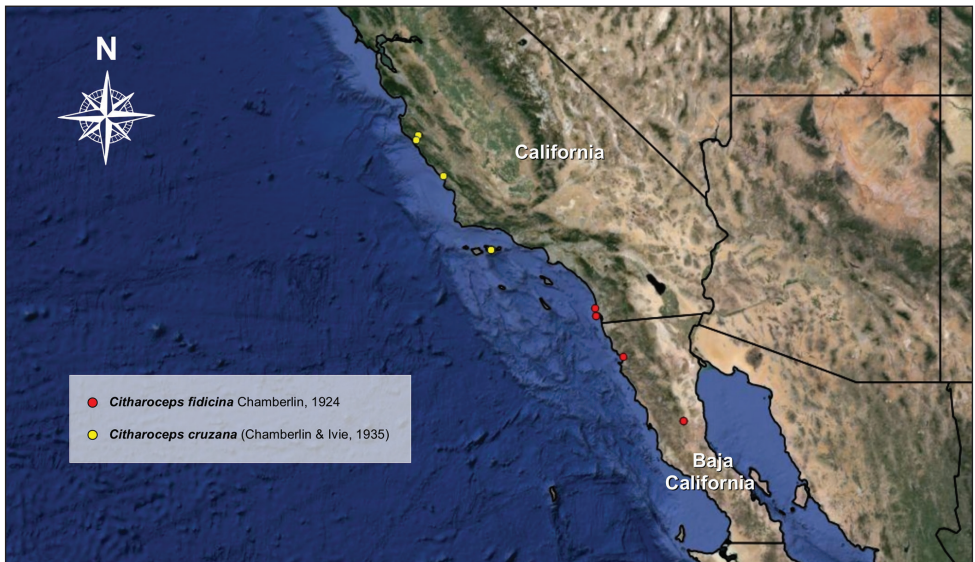


Figure 11. Locality of the specimens of *Citharoceps* examined in the present study.

1-0-1-0-1; metatarsus vp0-1-0-1-0-1-1, v0-0-0-0-0-0-2, vr0-1-0-1-0-1-1; leg IV, tibia vr0-0-0-0-0-0-1; metatarsus vp0-0-1/0-0-0-0-2/1, vr metatarsal comb with 5-6 spines.

Variation. Male (n=2): Total length 8.0–8.4; carapace 3.92–4.0 long, 2.4–2.76 wide; femur I 3.08–3.2. Female (n=3): Total length 9.32–11.92; carapace 4.24–4.44 long, 2.6–2.76 wide; femur I 2.72–2.92.

Distribution. Monterey County to Santa Barbara County, California, USA (Fig. 11).

Remarks. One male of *Citharoceps* was found from the type locality of *S. cruzana*. After the examination of the immature holotype of *S. cruzana*, it was detected that it

possessed the stridulatory apparatus exclusive for *Citharoceps*, not detected by Chamberlin and Ivie (1935), thus we transferred this species to this genus. In addition, in the additional material, females of *Citharoceps* were found from the middle coast of California that resemble those described by Chamberlin and Ivie (1935) as *C. californica*, together with a male, from the same region, that is similar to the one from Santa Cruz Island. Thus, *C. californica* is removed from its synonym with *C. fidicina*, due to its greater size and darker coloration, and placed as junior synonym of *C. cruzana*.

Discussion

The distribution of the genus *Citharoceps* Chamberlin, 1924 comprises only coastal regions of the state of California, USA, and Baja California, Mexico (Fig. 11). The Baja California peninsula has a tectonical origin and is well known to harbor a great diversity and endemic species of fauna and flora, mainly because of climate and topography divergences (Murphy 1983, Grismer 1994). Under this scenario, the diagnostic features presented by *Citharoceps* are rather distinct based on the other two segestriid genera occurring in this region e.g. *Ariadna* and *Segestria*. Although those characters are putative synapomorphies, the stridulatory apparatus, once thought by Beatty (1970) to be exclusive of *C. fidicina*, is also present in *C. cruzana*, contradicting his assumption. In addition, the labium-sternum junction length, the presence of a ventral median spine on metatarsi I of males, and the morphology of the interpulmonary fold are very distinctive characters from *Segestria* (Fig. 9D; Giroti and Brescovit 2011, figs 19–20, 23), *Ariadna* (Figs 9A, 10A; Grismado 2008, figs 1A, 4D, 6H) and *Gippsicola* (Figs 9B, 10B). Under these circumstances, it seems reasonable that *Citharoceps* is a different genus and must be treated as a valid taxon.

Notes on the stridulatory apparatus of *Citharoceps*

The occurrence of a stridulatory apparatus in spiders has been reported in at least 25 spider families (Legendre 1963, Rovner 1980, Uetz and Stratton 1982, Starck 1985, Maddison 1987, Wunderlich 1995, Ramírez et al. 2001, Jocqué 2005), and also phylogenetically tested in Haplogynae (Labarque and Ramírez 2012) and Entelegynae (Griswold et al. 2005, Ramírez 2014). Legendre (1963) was the first to classify these apparatus (types a–g), and Starck (1985) provided a complete list of known stridulatory apparatus in spiders, also discussing their structures and evolutionary context. The stridulatory apparatus found in *Citharoceps* can be classified as belonging to the “type I”, with ridges or grooves (*pars stridens*) in the carapace; and thorns (*plectron*) in the femur I. This type was also described by Maddison (1987) for seven salticid genera.

The function of the stridulatory apparatus in *Citharoceps* is unknown, but considering that it occurs in males, females and immatures, it seems unlikely that it has a courtship function. Maddison (1987) reported a personal comment of M. J. Moody

having heard a sub-adult male of *C. fidicina* making a loud buzzing sound while rubbing the carapace ridges. Considering this information, the function of the stridulatory apparatus in *Citharoceps* could involve defensive buzzing sounds, as described by Uetz and Stratton (1982) for *Micrathena gracilis* (Walckenaer, 1805), but future ethological studies are needed to corroborate this hypothesis.

Acknowledgments

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Two new species of benthopelagic *Stephos* (Copepoda, Calanoida, Stephidae) from Korea

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Abstract

Two new species of benthopelagic copepods of the genus *Stephos* T. Scott, 1892, belonging to the family Stephidae G.O. Sars, 1902, are described based on specimens collected in the stagnant water flooding the burrows excavated by ocyropodid crabs in two intertidal mud-flats, and from near-bottom shallow waters in Korea, respectively. They can be easily diagnosed based on the ornamentation of both the female genital double-somite and genital operculum; the morphology of the distal segment of the male right P5; the presence/absence of a tiny pointed process on the distomedial angle of second segment of female P5; and the condition (seta or spine) of the lateral armature element on the distal segment of female fifth legs, among other features. This is one of the few cases reported of calanoid copepods living as commensals of other invertebrates, and raises to six the number of members of the genus reported from Asia. This is also the first record of the family Stephidae in Korea.

Keywords

Stephos, new species, benthopelagic, intertidal mud-flat, commensal, Korea

Introduction

The benthopelagic calanoid family Stephidae G.O. Sars, 1902, consists of four valid genera: *Miostephos* Bowman, 1976, *Parastephos* G.O. Sars, 1902, *Speleohvarella* Kršinić, 2005, and *Stephos* T. Scott, 1892 (Boxshall and Halsey 2004; Kršinić 2005). The genus *Stephos* is the largest and more primitive, currently comprising 28 valid species found in anchialine and marine coastal near-bottom habitats from tropical to polar regions (Ohtsuka and Hiromi 1987; Bradford-Grieve 1999; Zagami et al. 2000; Boxshall and Halsey 2004; Jaume et al. 2008; Kršinić 2012). They are mostly benthopelagic and can be collected with dredges and sledges (Fosshagen 1970; Ohtsuka and Hiromi 1987; Bradford-Grieve 1999; Zagami et al. 2000). Most of them have so far been recorded from the North Atlantic and adjacent waters (Boxshall and Halsey 2004; Jaume et al. 2008; Kršinić 2012), and also from the Indo-Pacific region (Mori 1942; Chen and Zhang 1965; Andronov 1974; Bradford-Grieve 1999; Ohtsuka and Hiromi 1987).

In Korean waters, only three species of benthopelagic calanoids have so far been reported, namely: *Sarsarietellus orientalis* Soh et al., 2013 (Arietellidae), collected from the shallow water near-bottom of the Jeju Island, southern Korea (Soh et al. 2013), and *Paramisophria sinjinensis* Lim & Min, 2014 and *P. koreana* Lim & Min, 2014 (Arietellidae), both collected also from near-bottom shallow waters in southern Korea (Lim and Min 2014). The recent advances in the knowledge of species diversity of benthopelagic calanoids in the region is the result of intensive investigations using a diverse array of sampling methods.

During the general field surveys carried out recently to collect calanoid copepods from two inter-tidal mud flats and near-bottom shallow waters, two new species of the genus *Stephos* were recorded. This paper deals with their descriptions and presents the first record of the family in Korean waters.

Material and methods

Copepods were collected from the stagnant water retained in the burrows excavated by ocypodid crabs in two intertidal mud-flats using a hand net (0.2 mm mesh size) and also from near-bottom shallow waters using a light trap and a plankton net (0.2 mm mesh size) at high tide at dusk hours in eastern and southern Korea. For morphological examination, samples were fixed in 5% natural formalin-seawater solution. Specimens were later cleared in 70% lactic acid for 1 to 2 hours before dissecting under the dissection microscope (Nikon) in a drop of lactophenol on a wooden slide (Humes and Gooding 1964). The removed body parts and appendages were examined under a Olympus BX51 phase contrast microscope up to $\times 1,000$. Drawings were made with the aid of a drawing tube attached to the microscope.

Body sizes of individuals were measured using a stage micrometer from the head to the tip of the caudal rami excluding caudal setae. The morphological terminology

follows Huys and Boxshall (1991). Abbreviations used in the text and figures are as follows: ae, aesthetasc; P1-P5, first to fifth swimming legs. Specimens are deposited at the National Institute of Biological Resources (NIBR), Incheon, Korea.

Results

Order Calanoida G.O. Sars, 1903

Family Stephidae G.O. Sars, 1902

Genus *Stephos* T. Scott, 1892

***Stephos geojinensis* sp. n.**

<http://zoobank.org/57A20501-74CF-4E13-874D-4FC21A3C7ECE>

Figs 1–4

Material examined. Female holotype (NIBRIV0000304586) and male allotype (NIBRIV0000304587) undissected and preserved in 70% ethanol; female paratype (NIBRIV0000304738) and male paratype (NIBRIV0000304739) dissected on two glass slides; one female paratype and seven male paratypes (NIBRIV0000304293, 1 vial) preserved in 70% ethanol. All specimens were collected from the near-bottom using a light trap at high tide at dusk, on 28 August 2010 by the senior author (S. Y. Moon). The description below is based on the paratypes.

Type locality. Geojin fishery port, Gosung-gun, Gangwon-do (approximately 38°26'58"N 128°27'46"E), Korea.

Female. Body (Fig. 1A, B) robust, length 883 μm . Prosome 5-segmented; cephalosome and first pedigerous somites completely separated; fourth and fifth pedigerous somites completely fused, posterior corners of prosome symmetrical. Rostrum represented by rounded knob. Prosome-urosome ratio 2.42:1. Urosome (Fig. 1C, D) 4-segmented, comprising genital double-somite, two free abdominal somites and anal somite; length ratio of urosome somites as 48.7: 17.0: 19.8: 14.5 = 100. Genital double-somite (Fig. 1C, D) symmetrical with proximolateral margins produced in dorsal aspect (Fig. 1C), asymmetrical in ventral aspect with smooth evenly rounded operculum displaced to the right; double-somite with row of spinules anteriorly on ventral surface and patch of spinules at each side as figured. First and second free abdominal somites with transverse hyaline frill both dorsally and ventrally. Anal somite (Fig. 1C, D) shortest. Caudal rami (Fig. 1C, D), with 6 setae, symmetrical, about 1.35 times longer than wide ($43 \times 31 \mu\text{m}$), with several rows of spinules on dorsal and ventral surface; caudal seta I absent; seta II reduced; seta VII displaced to medial margin.

Antennules (Fig. 1E) symmetrical, extending beyond distal margin of second urosomite; 24-segmented, with ancestral segments I-II, III-IV, X-XI, and XXVII-XXVIII fused. Segmentation and setation pattern as follows (ancestral segment number-setae+aesthetasc): I-II-3s; III-IV-4s + 1ae, V-2s, VI-2s, VII-2s + 1ae, VIII-2s, IX-2s, X-XI-4s + 1ae, XII-1s, XIII-1s, XIV-2s + 1ae, XV-1s, XVI-2s + 1ae, XVII-1s, XVIII-

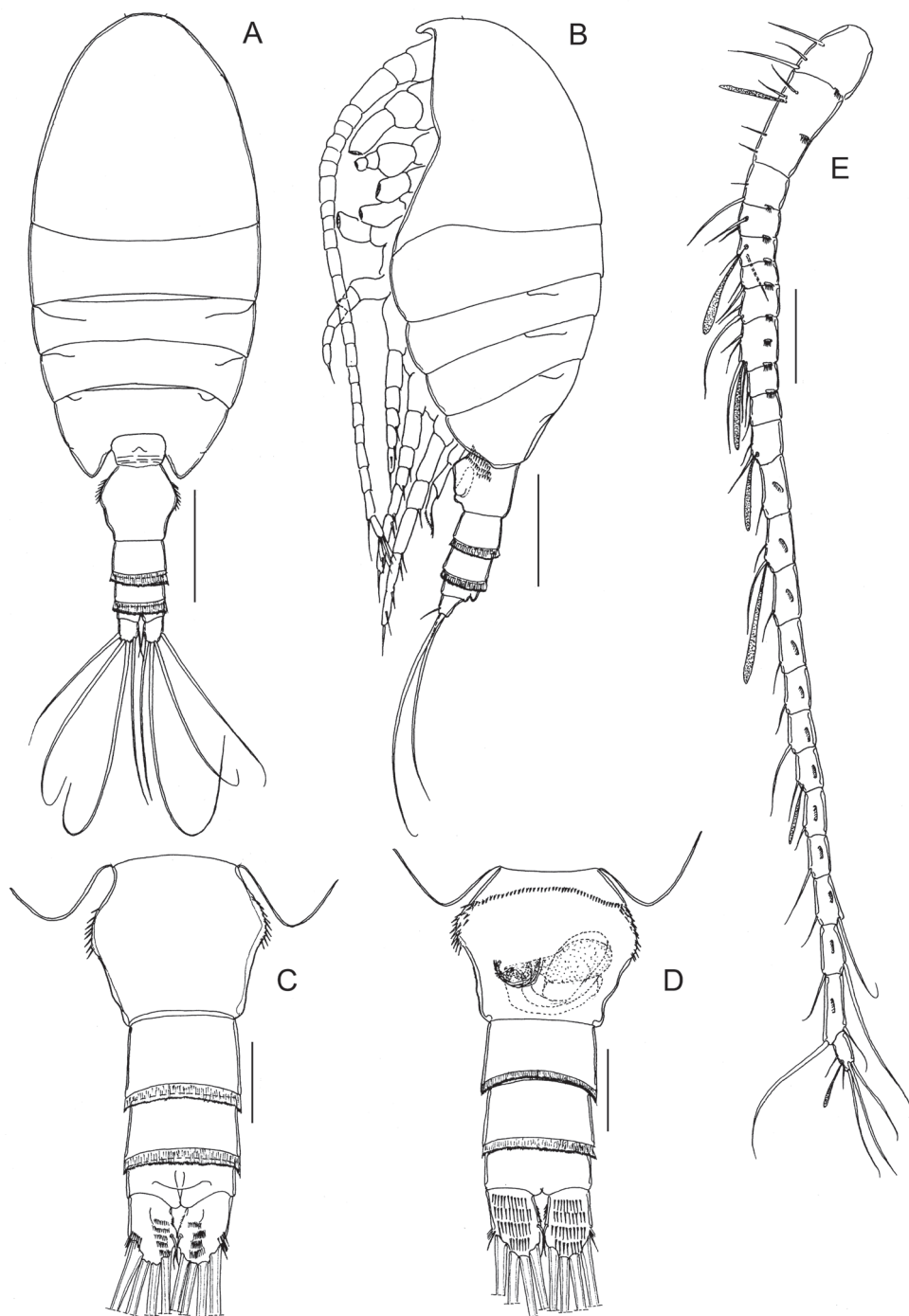


Figure 1. *Stephos geojinensis* sp. n., female paratype. **A** habitus, dorsal view **B** habitus, lateral view **C** urosome, dorsal view **D** urosome and genital double-somite, ventral view **E** antennule. Scale bars: **A, B** = 200 μ m; **C–E** = 50 μ m.

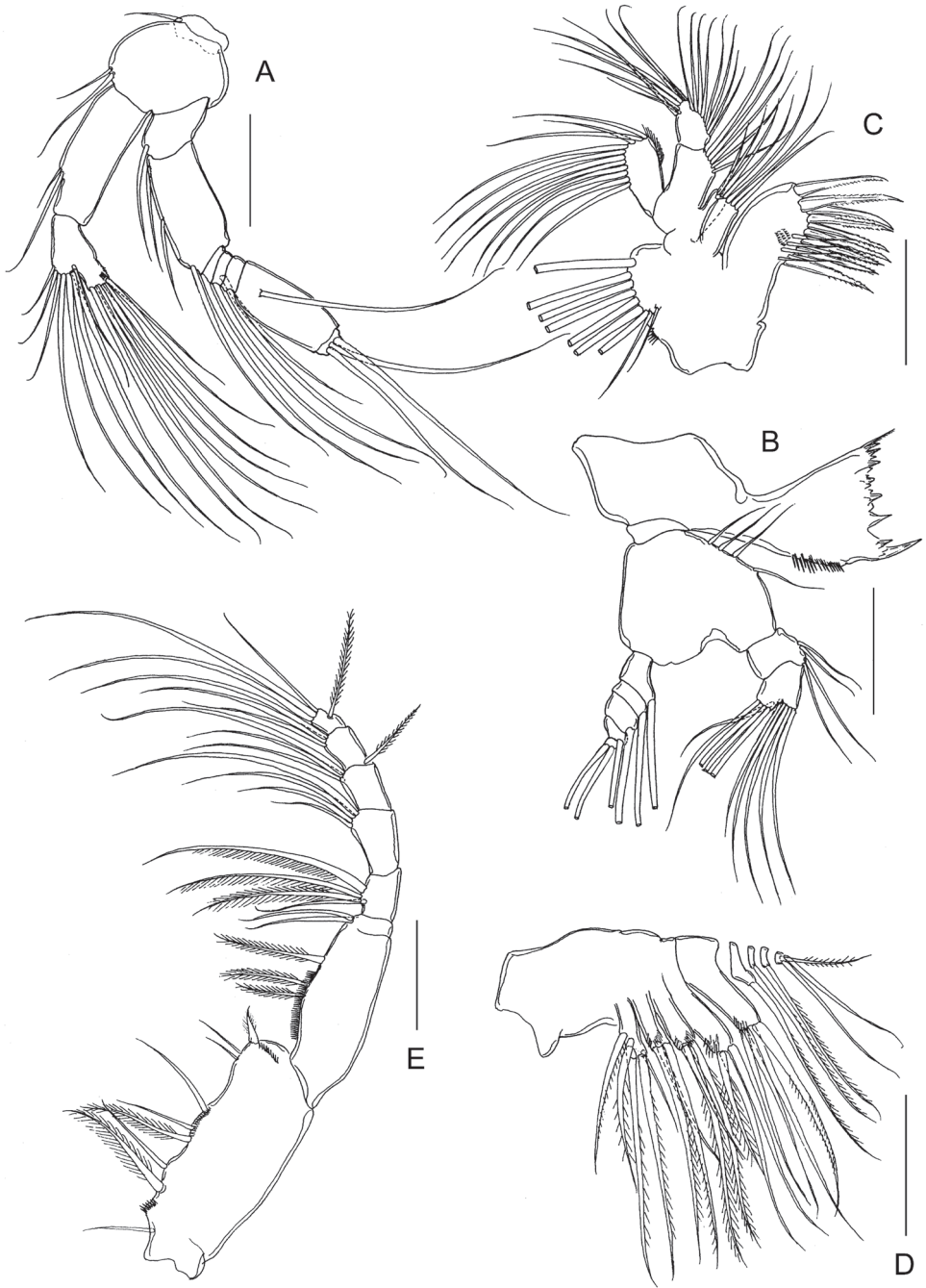


Figure 2. *Stephos geojinensis* sp. n., female paratype. **A** antenna **B** mandible **C** maxillule **D** maxilla **E** maxilliped. Scale bars = 50 μ m.

1s, XIX-1s, XX-1s, XXI-1s + 1ae, XXII-1s, XXIII-1s, XXIV-1s + 1s, XXV-1s + 1s, XXVI-1s + 1s, XXVII-XXVIII-5s + 1ae. Ancestral segments II, III, V-XII, and XV-XXVI each with row of spinules on posterior surface.

Antenna (Fig. 2A) biramous; coxa and basis separate, bearing 1 and 2 setae on distomedial angle, respectively; endopod 2-segmented, proximal segment with 2 setae, compound distal segment bilobed with 8 and 7 setae, respectively, outer margin with small serrated process subdistally and tiny spinule adjacent to serrated process; exopod 7-segmented, setal formula 1, 3, 1, 2, 1, 1, 3.

Mandible (Fig. 2B) with well developed coxal gnathobase, cutting edge with isolated unicuspid tooth and 7 heterogeneous teeth plus dorsal spinulose seta. Mandibular palp biramous; basis with 4 setae on inner margin. Exopod 5-segmented, setal formula 1, 1, 1, 1, 2; endopod 2-segmented, proximal segment with 4 setae, distal segment with 10 setae.

Maxillule (Fig. 2C) praecoxa and coxa incompletely fused; praecoxal arthrite with 9 marginal spines plus 4 stiff setae on posterior surface; several rows of tiny spinules on posterior surface as figured. Coxal epipodite with 9 setae; coxal endite with 3 stiff setae. Proximal basal endite with 4 setae; distal basal endite indistinct, with 5 setae; no trace of basal exite. Exopod with 11 marginal setae; row of setules along distal portion of medial margin. Endopod apparently unsegmented with 4, 4, 7 setae.

Maxilla (Fig. 2D), indistinctly 6-segmented. Armature of praecoxal and coxal endites as 5, 3, 3, 3, respectively. Basal endite with 4 setae, 1 stouter than rest. Endopod 4-segmented, setal formula 1, 1, 1, 3. Praecoxal, coxal and basal endites with cluster of long spinules subdistally on lateral surface.

Maxilliped (Fig. 2E) syncoxa robust, with setal formula 1, 2, 3, 3 and several oblique rows of tiny spinules as figured; basis with 3 setae and row of setules on medial margin; endopod 6-segmented with proximal segment partially incorporated into basis, setal formula 2, 4, 4, 3, 3+1, 4.

P1 to P4 (Fig. 3A–D) progressively larger towards posterior, each comprising coxa, basis and 3-segmented exopod; endopod of P1 (Fig. 3A) 1-segmented, that of P2 (Fig. 4B) 2-segmented; endopods of P3 (Fig. 3C) and P4 (Fig. 3D) 3-segmented. Endopod of P2–P4 with transverse row of spinules distally on terminal segment. Exopod of P2–P4 with row of spinules on anterior surface of terminal segment. Armature formula of P1–P4 as follows (Roman numerals indicate spines, Arabic numeral indicate setae):

Legs	Coxa	Basis	Exopod	Endopod
P1	0-0	0-1	0-0; I-1; 1,2,2	0,2,3
P2	0-1	0-0	I-1; I-1; III,I,4	0-1; 1,2,2
P3	0-1	0-0	I-1; I-1; III,I,4	0-1; 0-1; 1,2,2
P4	0-1	0-0	I-1; I-1; III,I,4	0-1; 0-1; 1,2,2

Fifth legs (Fig. 3E) symmetrical, uniramous, 3-segmented with proximal segment fused to intercoxal sclerite; second segment elongated, 2.62 times longer than wide (42 × 16 μm), with distomedial angle produced into tiny pointed process. Distal seg-

ment elongated, tapering with short spine implanted mid-laterally and coarsely serrated spine incorporated (i.e. non-articulating) to segment distally.

Male. Body (Fig. 4A, B) robust, length 819 μm (mean 821 ± 0.06 , $n=4$). Prosome 5-segmented; cephalosome and first pedigerous somite almost completely separated; fourth and fifth pedigerous somites completely fused; fifth pedigerous somite symmetrical, with lateral lobe at each side. Rostrum as in female. Prosome-urosome ratio 2.12:1. Urosome 5-segmented, comprising genital somite, three free abdominal somites and anal somite; length ratio of urosomites as 28.3: 20.5: 18.6: 17.0: 15.7 = 100. Genital somite asymmetrical, with lobe protruding anterolaterally on left side. First to third abdominal somites with transverse hyaline frill both dorsally and ventrally. Anal somite shortest. Caudal rami similar to those of the female.

Antennules (Fig. 4C) extending beyond distal margin of second urosomite, non-geniculate, 24-segmented with failure to express articulations between ancestral segments I-IV (although vestige of articulation between segments II and III expressed dorsally), X-XI and XXVII-XXVIII. Segmentation and setation pattern as follows (ancestral segment number-setae+aesthetasc): I-II – 3s + 2ae, III-IV – 4s + 3ae, V – 2s + 1ae, VI – 2s + 1ae, VII – 2s + 1ae, VIII – 2s + 1ae, IX – 2s + 1ae, X-XI – 4s + 1ae, XII – 1s, XIII – 1s, XIV – 2s + 1ae, XV – 1s, XVI – 2s + 1ae, XVII – 1s, XVIII – 1s, XIX – 1s, XX – 1s + 1ae, XXI – 1s + 1ae, XXII – 1s, XXIII – 1s + 1ae, XXIV – 1s + 1s + 1ae, XXV – 1s + 1s, XXVI – 1s + 1s, XXVII-XXVIII – 5s + 1ae. Ancestral segments V-IX, XI and XV-XXVI each with row of spinules on posterior surface.

Antenna, mandible, maxillule, maxilla, maxilliped and P1-P4 similar to those of female. Fifth legs (Fig. 4D) strongly asymmetrical, uniramous and filiform. Left leg 5-segmented, shorter than right counterpart; second segment with blunt prominence medially; third and fourth segments elongated, about equal in length; distal segment reduced, with row of seven unequal long and 13 short hyaline lamellae disposed as figured. Right leg 4-segmented; third segment very elongated with short, curved proximolateral spur-like process; distal segment elongated and curved, bifid with short inner branch.

Etymology. The specific name *geojinensis* is taken after the type locality Geojin Port, Gosung-gun, Gangwon-do, Korea.

Remarks. *Stephos geojinensis* sp. n. is easily recognizable by the display of the following five diagnostic features: (1) female genital double-somite with protruding proximolateral margins in dorsal aspect; (2) genital double-somite with row of spinules anteriorly on ventral surface and patch of spinules at each side; (3) basis and distal segment of P5 elongated in female; (4) distal segment tapering with short spine implanted mid-laterally and coarsely serrated spine incorporated to segment distally in female P5; and (5) male right P5 distal segment elongated and curved, bifid with short inner branch.

Bradford-Grieve (1999) divided the species of *Stephos* in four groups based on the morphology of the male fifth legs. *Stephos geojinensis* falls within a “group IV” characterized by a 4-segmented male right P5 combined with a left leg with a narrow fourth segment. This group includes eight species from the western Pacific and the Atlantic: *S. angulatus* Bradford-Grieve, 1999, *S. marsalensis* Costanzo, Campolmi & Zagami,

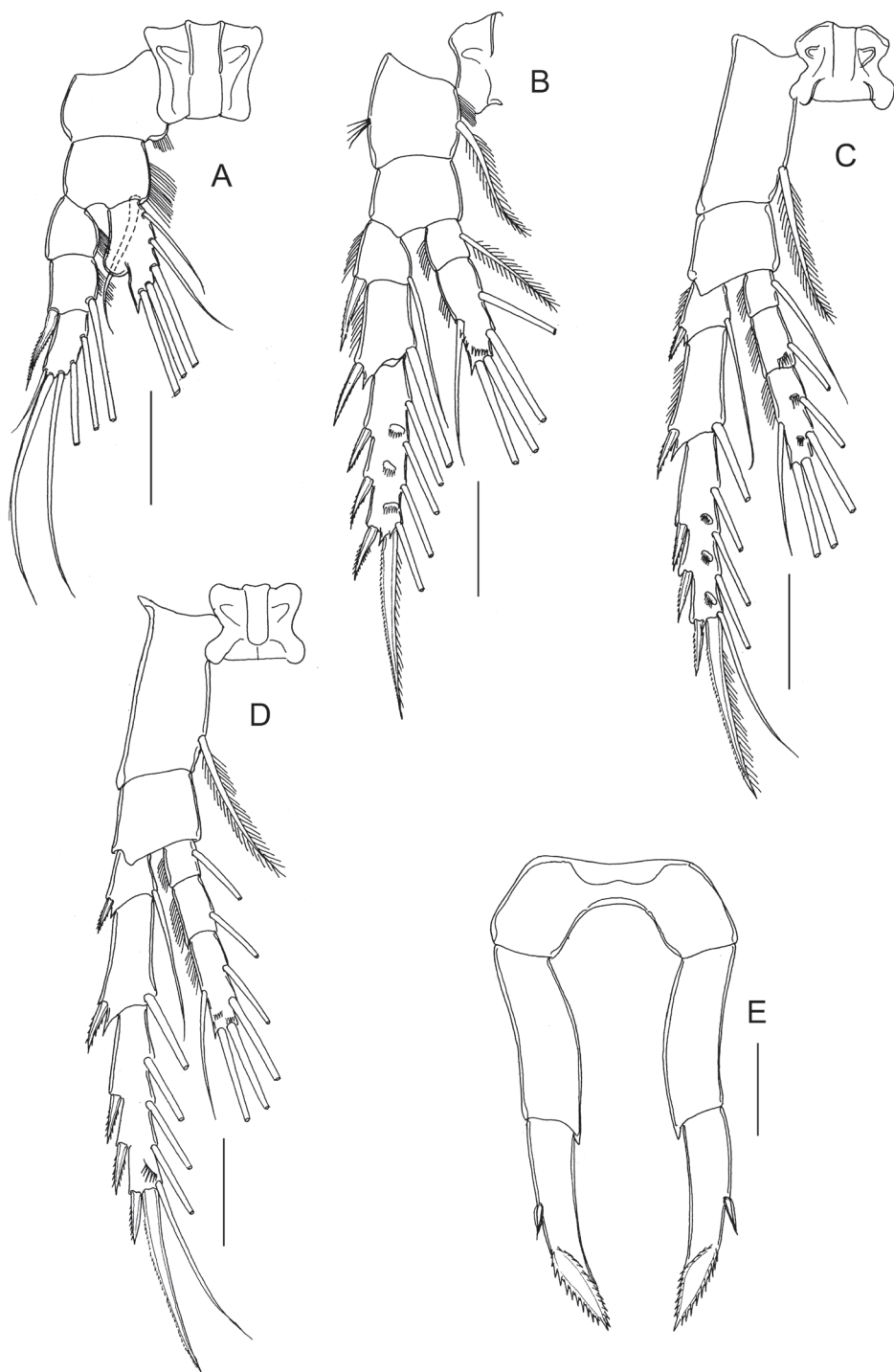


Figure 3. *Stephos geojinensis* sp. n., female paratype. **A** P1 **B** P2 **C** P3 **D** P4 **E** fifth legs. Scale bars = 50 μm.

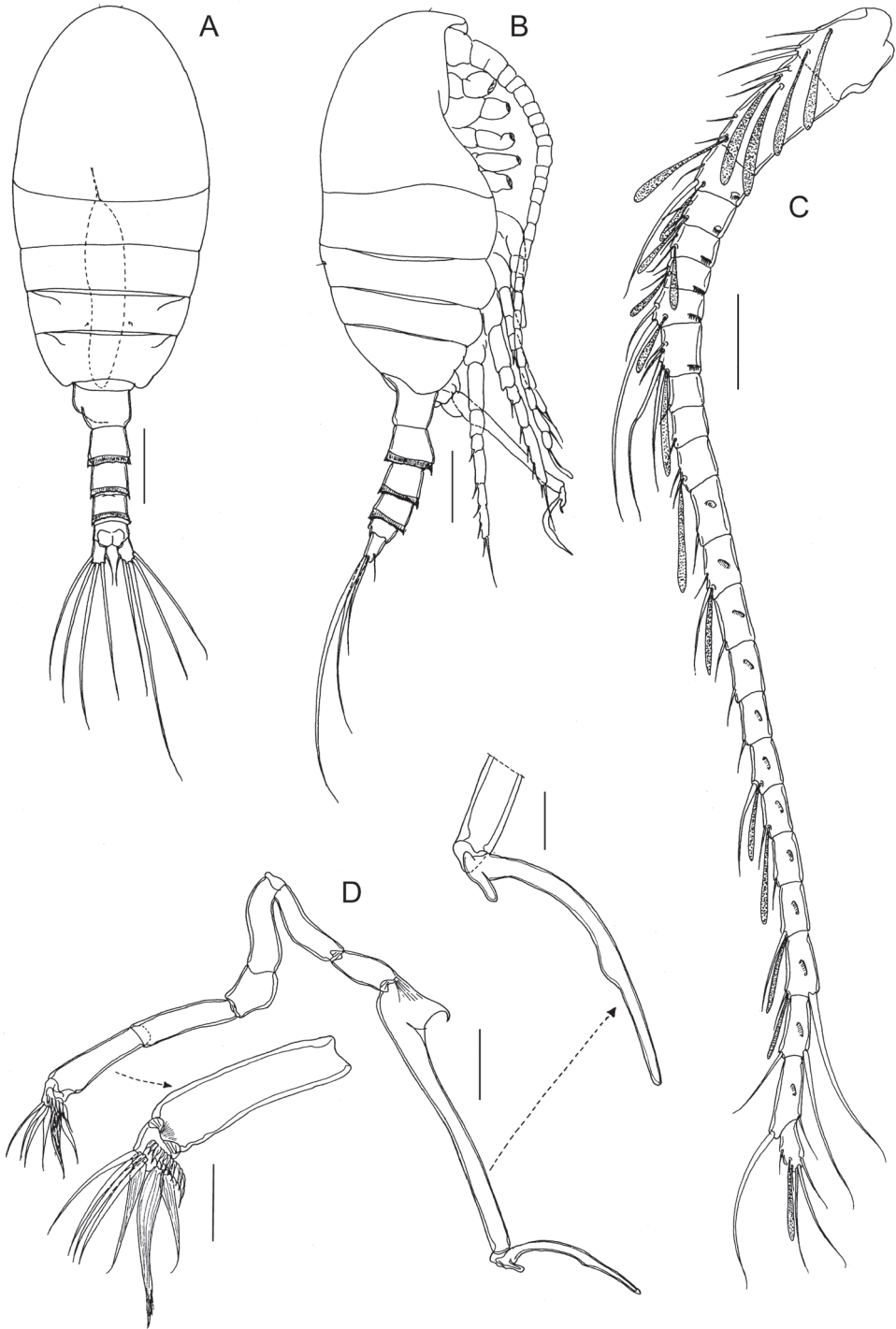


Figure 4. *Stephos geojinensis* sp. n., male paratype. **A** habitus, dorsal view **B** habitus, lateral view **C** antennule **D** fifth legs. Scale bars: **A, B** = 200 μ m; **C, D** = 50 μ m.

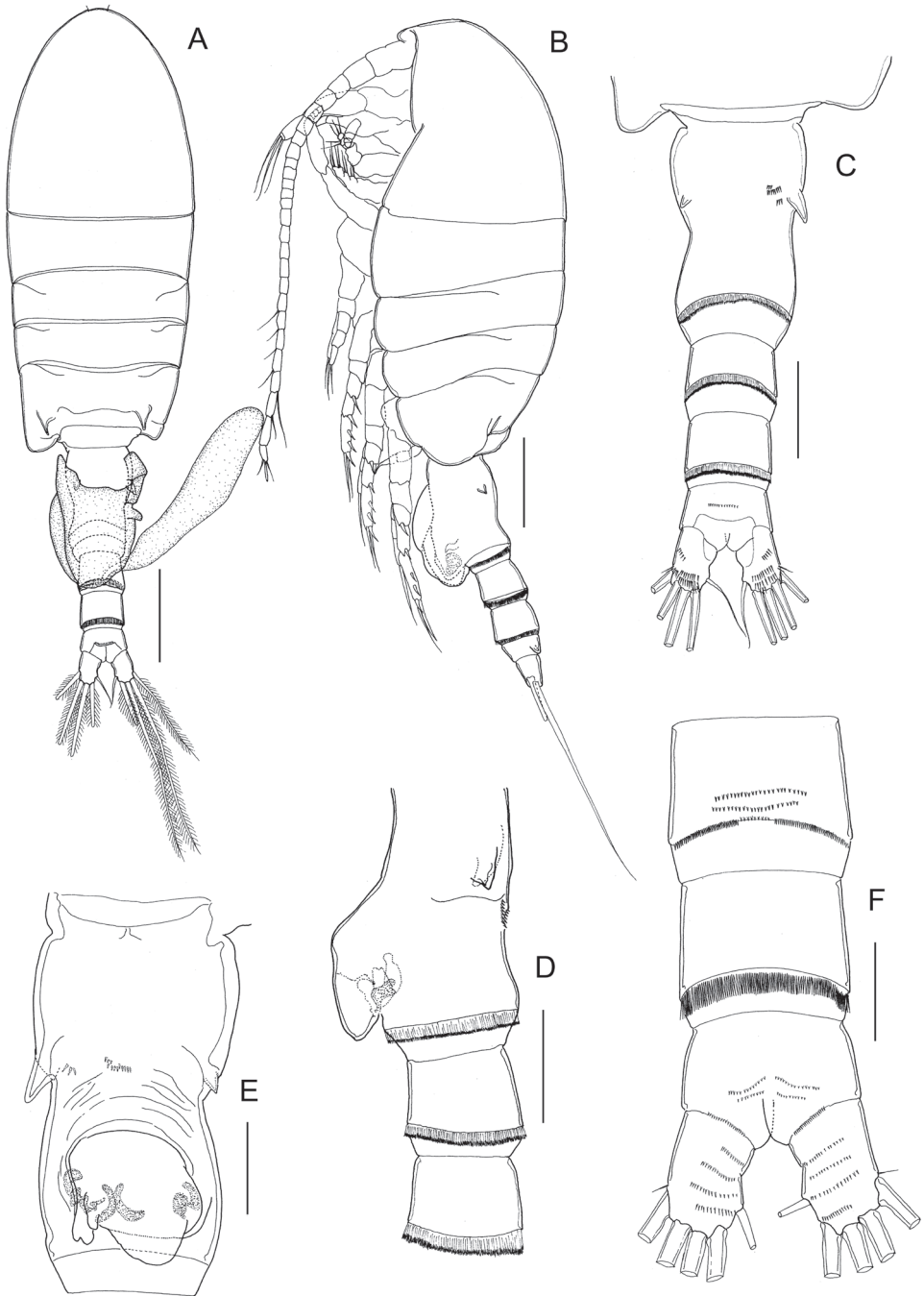


Figure 5. *Stephos projectus* sp. n., female paratype. **A** habitus, dorsal view **B** habitus, lateral view **C** fifth pedigerous somite and urosome, dorsal view **D** urosome, lateral view **E** genital double-somite, ventral view **F** second urosomal somite to caudal rami, ventral view. Scale bars: **A**, **B** = 200 μ m; **C**, **D** = 100 μ m; **E**, **F** = 50 μ m.

2000, *S. morii* Greenwood, 1978, *S. pacificus* Ohtsuka & Hiromi, 1987, *S. pentacanthos* Chen & Zhang, 1965, *S. rustadi* Strömberg, 1969, *S. tsuyazakiensis* Tanaka, 1967, and *S. vivesi* Jaume, Boxshall & Gràcia, 2008 (see Table 1 in Bradford-Grieve 1999; Costanzo et al. 2000; Jaume et al. 2008).

The male fifth legs are diagnostic to distinguish *Stephos goejinensis* from other congeners in this group. Thus, *S. angulatus* is easily differentiated from the new species by the more developed inner branch of the bifid distal segment of the right P5, and by the distal segment of the left male P5 with only three elongate hyaline lamellae and a rounded cluster of short spinules (see Bradford-Grieve 1999). In *S. marsalensis*, the distal segment of right male P5 is not bifid whereas there are only 5 lamellate hyaline processes on the distal segment of left male P5 (see Costanzo et al. 2000).

Stephos morii differs from the new species in having the right P5 pseudochelate with a large inner branch on the distal segment, and the left leg carrying about 5 lamellate processes on the distal segment, which is produced into a long spinous process about 1.6 times longer than the segment (see Greenwood 1978 as *S. tropicus*). In *S. pacificus*, the distal segment of the right leg is not bifid and is bordered by a narrow lamella, whereas the left leg carries three terminal and two subterminal lamellate processes on the distal segment (see Ohtsuka and Hiromi 1987).

Stephos rustadi is easily separated from the new species by having the segment 3 of the right leg slightly shorter than segment 4, which terminates in a finely serrated claw-like structure, whereas the left leg carries two strong hook-like processes on the terminal segment, the larger one bifid (see Strömberg 1969).

Stephos pentacanthos and *S. tsuyazakiensis* share with the new species the same ornamentation on the male P5, but the new species has 7 unequal long and 13 short hyaline lamellae on the distal segment of left leg and a bifid distal segment with a short inner branch on right leg (Chen and Zhang 1965; Tanaka 1966).

Finally, *Stephos vivesi* can be differentiated from *S. goejinensis* based on the male right fifth leg distal segment, which is spatulate and displays two rounded outgrowths proximally on the anterior surface (vs. segment not spatulate, slender and bifid in *S. goejinensis*) (see Jaume et al. 2008).

***Stephos projectus* sp. n.**

<http://zoobank.org/9B90D397-EE66-4873-89C2-18D5AA6EC35F>

Figs 5–8

Material examined. Female holotype (NIBRIV0000304294) and male allotype (NIBRIV0000304297) undissected and preserved in 70% ethanol; 20 female paratypes (NIBRIV0000304295), and four male paratypes (NIBRIV0000304296) preserved in 70% ethanol. Dissected paratypes of both sexes are retained in the collection of the senior author. All specimens were collected at the type locality using a hand net on 28 February 2013 by the senior author (S. Y. Moon). The description below is based on the paratypes.

Additional material. Female (NIBRIV0000304584) undissected, preserved in ethanol, female (NIBRIV0000304585) dissected on 1 glass slide, Daeyari, Wando Island, Wando-gun, Jeollanam-do, Korea, 19 July 2010.

Type locality. Stagnant water in burrows of ocypodid crabs in intertidal mud flat, Bongyoungri, Naro Island, Goheung-gun, Jeollanam-do (approximately 34°29'13"N, 127°29'12"E), Korea.

Etymology. The specific name, *projectus*, is derived from the dorsolateral spiniform projections present on the female genital double-somite.

Female. Body (Fig. 5A, B) robust, length 1.51 mm (mean 1.54 ± 0.07 , $n = 5$). Prosome 5-segmented; cephalosome and first pedigerous somite completely separated; fourth and fifth pedigerous somites incompletely fused, posterior corners of fifth pedigerous somite slightly asymmetrical. Rostrum represented by rounded knob. Prosome-urosome ratio 1.83:1. Urosome 4-segmented (Fig. 5C, D), comprising genital double-somite, two free abdominal somites and anal somite; length ratio of urosomites as $51.1: 18.9: 17.3: 12.7 = 100$. Genital double-somite (Fig. 5E) elongated, asymmetrical, with pointed process at each side on dorsal surface; that on right side larger than left counterpart and with patch of spinules placed nearby; genital operculum bumpy with two outgrowths, one of them bifid on right side. First and second free abdominal somites (Fig. 5C, D) with transverse hyaline frill both dorsally and ventrally. Anal somite shortest (Fig. 5F). Caudal rami (Fig. 5C, F), with 6 setae, symmetrical, about 1.63 times longer than wide ($72 \times 44 \mu\text{m}$), with 4 transverse rows of spinules on ventral surface; caudal seta I lacking; seta II reduced; seta VII displaced to medial margin.

Antennules (Fig. 6A) similar to preceding species except for not extending beyond distal margin of fifth pedigerous somite.

Antenna (Fig. 6B) similar to preceding species except for presence of two transverse rows of spinules (instead of tiny serrated process plus spinule) on lateral margin of distal segment of endopod.

Mandible (Fig. 6C) similar to preceding species except for: (1) coxal gnathobase with straight row of moderately incised teeth; (2) outer margin of proximal segment of exopod with row of setules; and (3) distal segment of endopod with transverse row of spinules.

Maxillule (Fig. 6D) and maxilla (Fig. 6E) similar to preceding species except for presence of one additional seta on basal endite of maxilla.

Maxilliped (Fig. 6F) differing from *S. geojinensis* in presence of additional rows of tiny spinules on syncoxa.

P1 to P4 (Fig. 7A–D) with armature formula as in preceding species but with outer spine on second exopodal segment of P1 transformed into seta.

Fifth legs (Fig. 7E) symmetrical, uniramous, 3-segmented with proximal segment fused to intercoxal sclerite; second segment similar to *S. geojinensis* but shorter (1.72 times longer than wide; $31 \times 18 \mu\text{m}$); distal segment with a seta instead of spine on lateral margin, and with spinulation on terminal spine not so coarse.

Male. Body (Fig. 8A, B) robust, length 0.93 mm (mean 0.91 ± 0.05 , $n=4$) and similar to female in all major features except for last pedigerous somite, urosomal

segmentation, armature of antennules and morphology of fifth legs. Fourth and fifth pedigerous somites, incompletely fused, latter asymmetrical with lateral lobe on left margin. Rostrum as in female. Prosome-urosome ratio 1.87:1. Urosome 5-segmented, comprising genital somite, three abdominal somites and anal somite; length ratio of urosomites as 23.7: 25.6: 22.6: 18.6: 9.5 = 100. Genital somite asymmetrical, with protruding lobe on left side and patch of tiny spinules proximally at each side. Abdominal somites with transverse hyaline frill both dorsally and ventrally. Anal somite shortest. Caudal rami similar to those of female.

Antennules (Fig. 8C) similar to preceding species except for not extending beyond distal margin of fifth pedigerous somite and for failure to express an aesthetasc on ancestral segments VI, VIII, composite X-XI, XX and XIII. In addition, the composite segment I-II displays 4 setae (vs. 3 in *S. geojinensis*).

Antenna, mandible, maxillule, maxilla, maxilliped and P1 to P4 similar to female.

Fifth legs (Fig. 8D, E) strongly asymmetrical, uniramous and filiform. Left leg 5-segmented; segments 3 and 4 each with rounded outgrowth on medial margin, outgrowth on segment 3 more slender and crowned with hyaline frill, that on segment 4 with ridged plate terminally; fourth segment with additional short conical outgrowth and longitudinal row of spinules; distal segment short, rounded, with 4 long hyaline lamellae on distal margin and patch of short spinules on posterior surface. Right leg 4-segmented; segment 3 elongate, straight and slender except for blunt triangular process proximally on lateral margin; fourth segment sickle-shaped with rounded tip; 4 rounded outgrowths along inner margin and single outgrowth subterminally on outer margin of segment.

Remarks. *Stephos projectus* sp. n. falls within a group of species characterized by a 4-segmented right male P5 combined with a left leg in which the fourth segment is swollen (group III of Bradford-Grieve 1999). This group comprises 14 species from the Atlantic and the Indo-Pacific regions, namely: *S. boettgerschnackae* Kršinić, 2012, *S. canariensis* Boxshall, Stock & Sanchez, 1990, *S. cryptospinosus* Zagami, Campolimi & Costanzo, 2000, *S. deichmannae* Fleminger, 1957, *S. fultoni* T. Scott, 1898, *S. hastatus* Bradford-Grieve, 1999, *S. kurilensis* Kos, 1973, *S. lamellatus* G.O. Sars, 1902, *S. lucayensis* Fosshagen, 1970, *S. maculosus* Andronov, 1974, *S. minor* T. Scott, 1892, *S. robustus* Ohtsuka & Hiromi, 1987, *S. scotti* G.O. Sars, 1902, and *S. tropicus* Mori, 1942 (see Table 1 in Bradford-Grieve 1999; Zagami et al. 2000; Kršinić 2012). Only two of them, *S. hastatus* and *S. robustus*, share with the new species an asymmetrical female genital double-somite.

Stephos projectus sp. n. differs from *S. hastatus* in the following features: (1) presence of dorsolateral process at each side on the female genital double-somite (vs. processes absent, in *S. hastatus*); (2) fourth segment of male left P5 without strong spine (vs. strong spine present in *S. hastatus*); (3) fifth segment of male left P5 with 4 unequal long hyaline lamellae on distal margin (vs. two hyaline lamellae in *S. hastatus*); and (4) distal segment of male right P5 sickle-shaped (vs. segment bifid in *S. hastatus*). The new species can be easily differentiated from *S. robustus* based on the following features: (1) the presence of a dorsolateral pointed process at each side of the genital double-somite in female (vs. presence of a small mid-dorsal rounded process and not dorsolateral

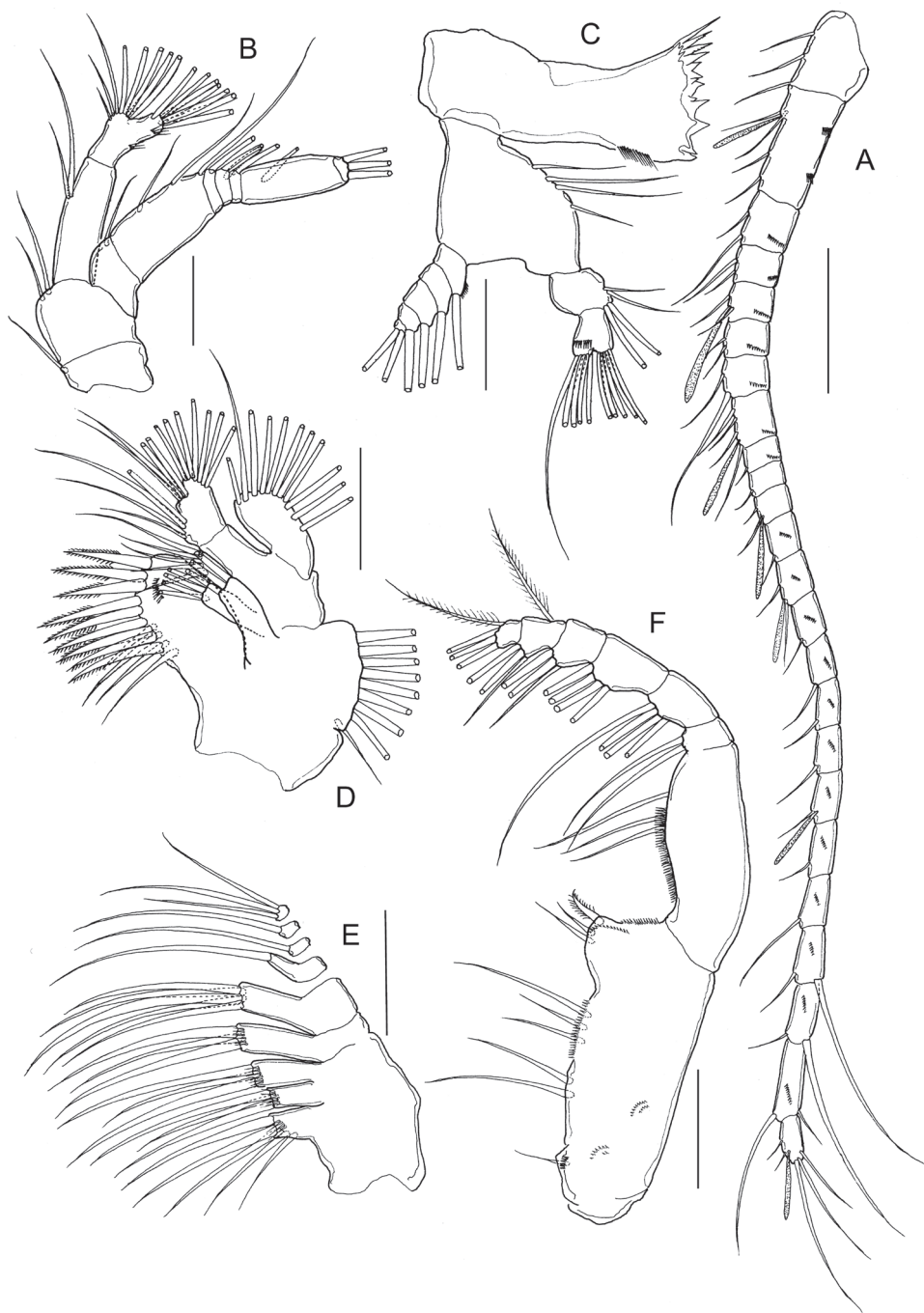


Figure 6. *Stephos projectus* sp. n., female paratype. **A** antennule **B** antenna **C** mandible **D** maxillule **E** maxilla **F** maxilliped. Scale bars = 50 μm.

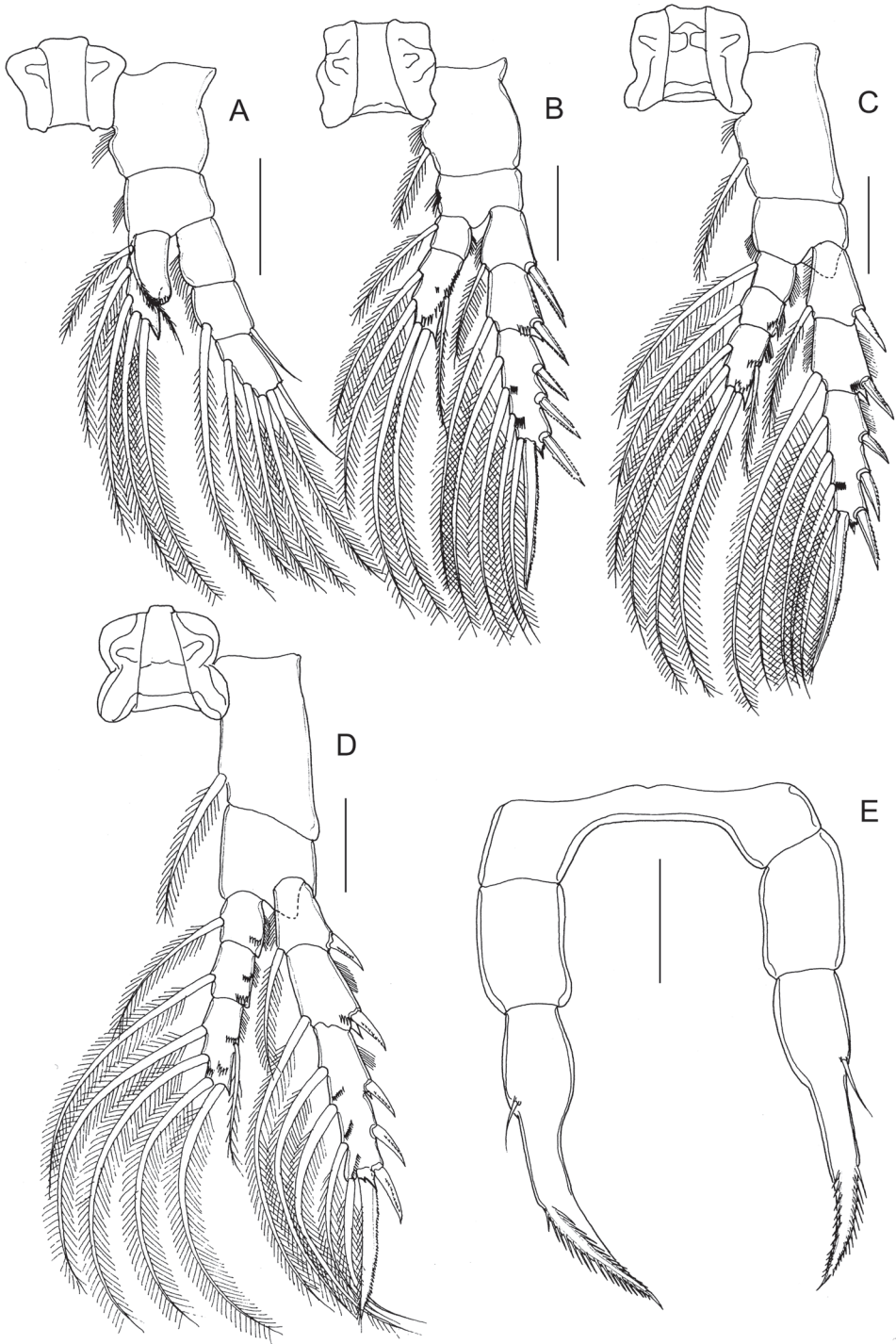


Figure 7. *Stephos projectus* sp. n., female paratype. **A** P1 **B** P2 **C** P3 **D** P4 **E** fifth legs. Scale bars = 50 μ m.

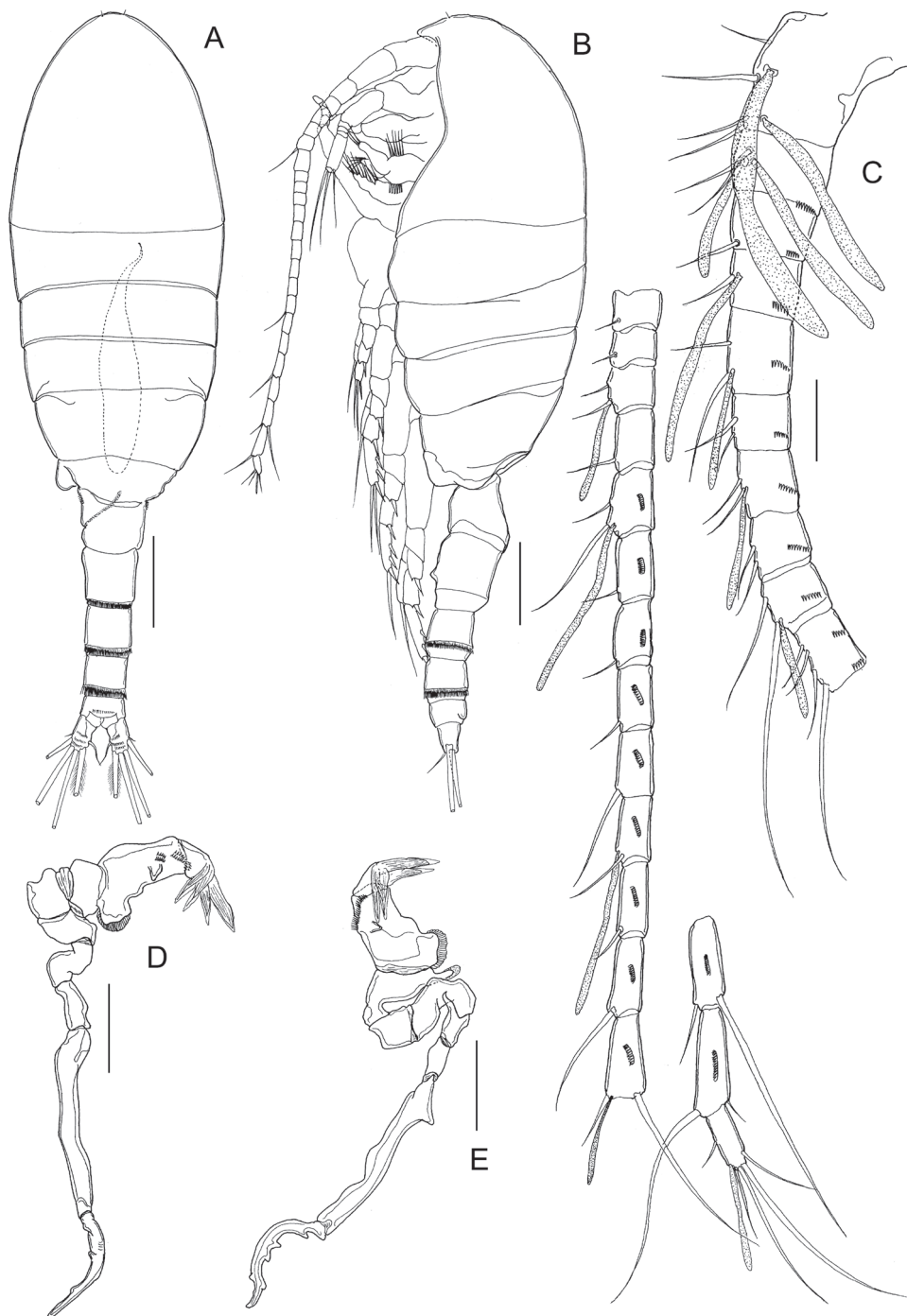


Figure 8. *Stephos projectus* sp. n., male paratype. **A** habitus, dorsal view **B** habitus, lateral view **C** antennule **D, E** fifth legs. Scale bars: **A, B** = 200 μ m; **C–E** = 50 μ m.

processes in *S. robustus*); (2) fifth segment of male left P5 with 4 long hyaline lamellae on distal margin (vs. 5 large spines of unequal length in *S. robustus*); and (3) fourth segment of male right leg sickle-shaped (vs. bifid in *S. robustus*).

The two new stephids described herein, *Stephos geojinensis* sp. n. and *S. projectus* sp. n., are easily differentiated based on the ornamentation of both the female genital double-somite and genital operculum; the morphology of the distal segment of the male right fifth leg; the presence/absence of a tiny pointed process on the distomedial angle of second segment of female P5; and the condition (seta or spine) of the lateral armature element on distal segment of female P5, among other features.

Discussion

The genus *Stephos* shows many similarities in its morphological characteristics with its congener genera *Miostephos*, *Parastephos*, and *Speleohvarella*; however well, differs in the following characteristics: (1) the basal exite of the maxillule is present in *Stephos* and *Miostephos* (vs. absent in *Parastephos* and *Speleohvarella*), (2) the right P5 is 4-segmented in *Stephos* (vs. 5-segmented in *Parastephos* and 3-segmented in *Miostephos* and *Speleohvarella*); and (3) male right P5 is ending in unarmed claw and/or mitten-like segment (vs. claw is armed with spines along concave margin in *Parastephos* and reduced in *Miostephos* and *Speleohvarella*) (Boxshall and Halsey 2004; Kršinić 2005).

As an update we report that *Stephos* has 30 nominal species including the two described herein: *S. angulatus*, *S. antarcticum* Wolfenden, 1908, *S. articus* G.O. Sars, 1909, *S. boettgerschnackae*, *S. canariensis*, *S. cryptospinosus*, *S. deichmannae*, *S. geojinensis* sp. n., *S. exumensis* Fosshagen, 1970, *S. fultoni*, *S. gyrans* (Giesbrecht, 1893), *S. hastatus*, *S. kurilensis*, *S. lamellatus*, *S. longipes* Giesbrecht, 1902, *S. lucayensis*, *S. maculosus*, *S. margalefi* Riera, Vives & Gill, 1991, *S. marsalensis*, *S. minor*, *S. morii*, *S. pacificus*, *S. pentacanthos*, *S. projectus* sp. n., *S. robustus*, *S. rustadi*, *S. scotti*, *S. tropicus*, *S. tsuyazakiensis*, and *S. vivesi*. Six species of *Stephos* have so far been reported in Asian waters in particular East Asia: *S. pentacanthos* from China (Chen and Zhang 1965), *S. pacificus*, *S. robustus*, and *S. tsuyazakiensis* from Japan (Tanaka 1966; Ohtsuka and Hiromi 1987), and *S. geojinensis* sp. n. and *S. projectus* sp. n. from Korea (present study).

Members of *Stephos* are frequent in hyper- or epibenthic habitats of tropical to polar regions (Razouls et al. 2005–2014), and are occasionally recorded in caves (Boxshall et al. 1990; Riera et al. 1991; Jaume et al. 2008; Kršinić 2012). *Stephos geojinensis* sp. n. was collected at night using a plankton net and a light trap in near bottom shallow waters. Other stephids have also appeared in plankton samples collected at night in coastal waters (Kos 1972; Ohtsuka and Hiromi 1987; Costanzo et al. 2000; Zagami et al. 2000). We suggest that benthopelagic calanoids could undertake daily vertical migrations (Zagami et al. 2000) since many calanoids have a diel feeding rhythm with a maximum at night (Alldredge and King 1980; Head et al. 1985). The upward migratory behavior is a complex phenomenon related to factors such as feeding, reproduction, moulting, dispersal, and niche diversification (Alldredge and King 1980).

The second new species, *S. projectus* sp. n. was collected in the stagnant water flooding the burrows excavated by cyclopoid crabs in two intertidal mud flats. Cases of calanoid copepods associated with invertebrates have rarely been reported (Fosshagen 1970; Humes and Smith 1974; Moon and Soh 2014), whereas two epibenthic calanoid genera, *Placocalanus* Fosshagen, 1970 and *Boholina* Fosshagen, 1989, are known to burrow into the sediment temporally (Fosshagen 1970; Ohtsuka et al. 1996; Moon and Soh 2014).

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***Chaerilus pseudoconchiformus* sp. n. and an updated key of the chaerilid scorpions from China (Scorpiones, Chaerilidae)**

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Abstract

A new species, *C. pseudoconchiformus* sp. n., is described from Xizang, China. The new species is distinguished from its congeners by a body length of 32–40 mm, carapace with the anterior margin straight, chela with length/width ratio average of 3.3 in males (3.2–3.4, two adults), and 2.5 in females (2.3–2.6, nine adults), eight or nine (eight usually) rows of denticles on fixed and movable fingers of pedipalp chela, five pectinal teeth in males and three or four in females. To date, the chaerilid species fauna of China consists of nine species. An updated identification key to *Chaerilus* from China is presented.

Keywords

Chaerilidae, *Chaerilus*, new species, Xizang, China

Introduction

The small monotypic family, Chaerilidae, has been reported containing one genus with 39 species (1/2015, <http://www.ntnu.no/ub/scorpion-files/>). The only genus is *Chaerilus*, which is found in southern and southeast Asia. In Xizang (Tibet), the chaerilid scorpions live under stones and fallen trees in humid habitats.

Chaerilid scorpions have a unique type B trichobothrial arrangement (Vachon 1974; Sologlad and Fet 2001). Kovařík (2000) reported 18 species in this genus in his review. Kovařík (2012) published an identification key for the genus. Recently, new species were described (Kovařík et al. 2014; Lourenço and Pham 2014).

Kovařík (2000) reported an old species and erected a new species of chaerilid from Xizang in his revision: *C. pictus* (Pocock, 1890) and *C. tryznai* Kovařík, 2000. In fact, one locality of *C. tricosatus* Pocock, 1899, Upper Rotung (Abor District), is also a territory belonging to Xizang (China). Therefore, Kovařík's revision recorded three species for China (Di et al. 2009). Zhu et al. (2004) recorded one chaerilid species (*C. pictus*) found in China. Qi et al. (2005) described one new species (*C. tessellatus* Qi, Zhu & Lourenço, 2005) and redescribed *C. pictus* (misidentification). Bastawade (2006) reported a new species from southeast Xizang: *C. dibangvalleycus* Bastawade, 2006. Zhu et al. (2008) redescribed *C. tessellatus* and *C. tryznai*, and pointed out that *C. pictus* as redescribed by Qi et al. (2005) was misidentified and erected it as a new species: *C. conchiformis* Zhu, Han & Lourenço, 2008. Zhu et al. (2008) also suggested that distribution of *C. pictus* in China was doubtful. Di and Zhu (2009) reported one new species: *C. mainlingensis* Di & Zhu, 2009. Di et al. (2009) reviewed the genus *Chaerilus* in China, registered seven species, and described the female of *C. tricosatus* for the first time. Kovařík (2012) described a new species from Xizang: *C. wrzecionkoi* Kovařík, 2012. Di et al. (2014) reviewed the research history of the order Scorpiones from China, and recorded eight chaerilid species. To date, the chaerilid fauna of China consists of nine species including the new species described in this paper, *C. pseudoconchiformis* sp. n.

Material and methods

Illustrations and measurements were made using a Motic K700 stereomicroscope with an Abbe drawing tube and an ocular micrometer. The photos were taken with a Canon (650D) camera. Measurements follow Sissom (1990) and are given in mm. Trichobothrial notations follow Vachon (1974) and morphological terminology mostly follows Hjelle (1990). Research materials have been deposited in the Specimen Room of University of Science and Technology of China, Hefei, China (USTC).

Taxonomy

Family Chaerilidae Pocock, 1893

Genus *Chaerilus* Simon, 1877

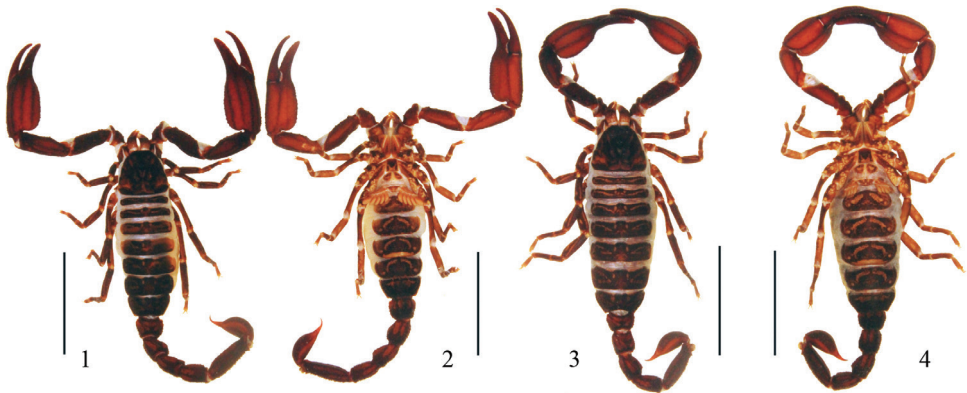
Chaerilus pseudoconchiformus sp. n.

<http://zoobank.org/569B23FC-86FB-4E16-8487-047B100BF9DC>

Figs 1–35, Tables 1–2

Type material. Holotype, male, China: Xizang, Nyingchi County (Linzhi County), VIII/2014, Zhiyong Di and Tao Li leg. (Ar.-USTC-XZLZ1401); paratypes: 1 adult male, 9 adult females, same data as holotype (Ar.-USTC-XZLZ1402–11) (kept in USTC).

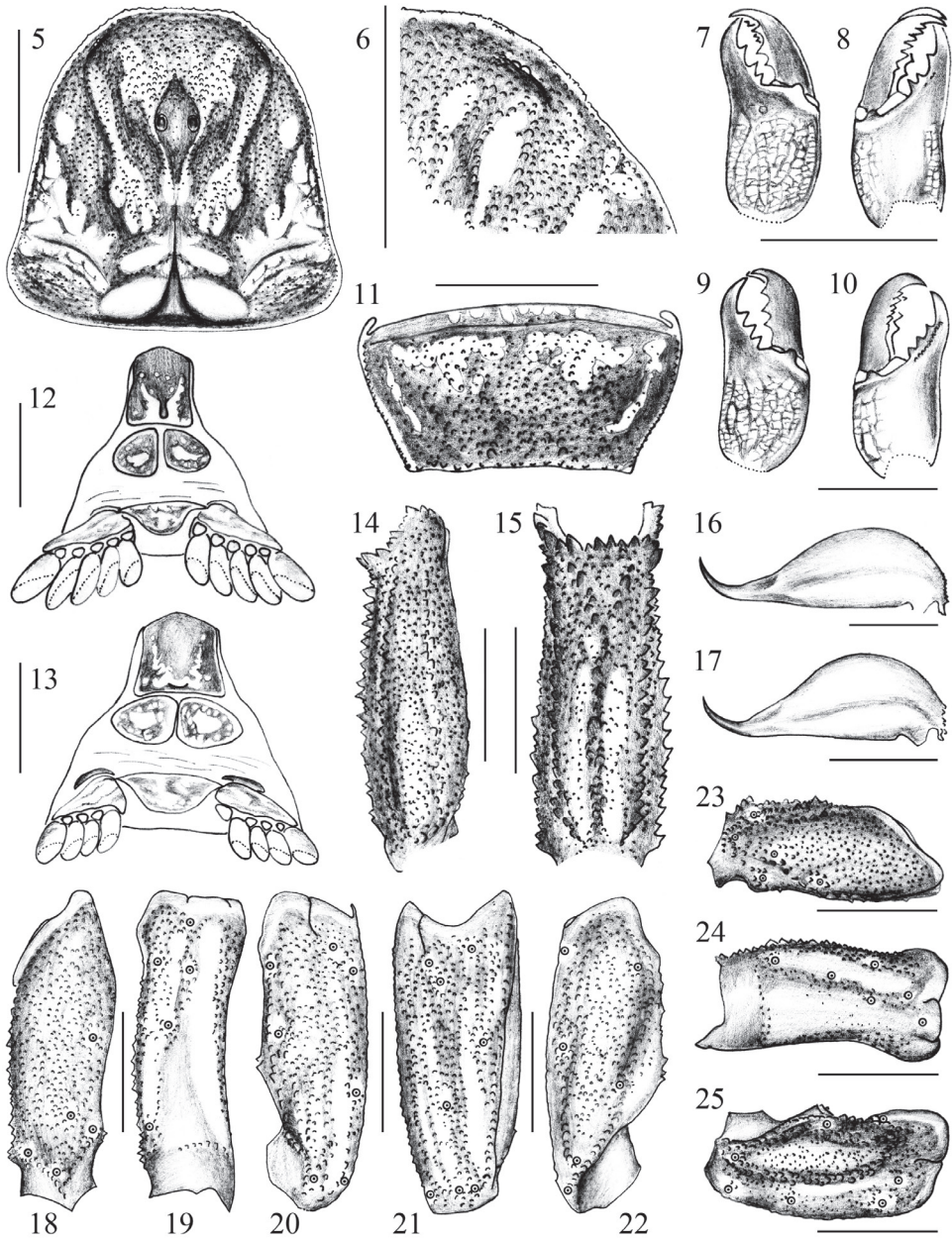
Diagnosis. The new species differs from other congeners by the following features: approximately 30–40 mm in total length (Table 2); carapace with the anterior margin straight; chela with length/width ratio: average of 3.3 in males, and 2.5 in females (Table 2); eight or nine (usually eight) rows of denticles on fixed and movable fingers of pedipalp chelae; five pectinal teeth in males and three or four in females. *Chaerilus pseudoconchiformus* sp. n. can be distinguished from the geographically and morphologically closely related species (Tables 2–3, and key). Morphologically closest are *C. conchiformus* and *C. wrzecionkoi*. Both these species have similar body lengths, as well as similar numbers of denticle rows on fixed and movable fingers of the pedipalp chelae. They can be distinguished by the length/width ratio of the pedipalp chela: manus of pedipalp in male narrow and long, chela length/width ratio in male higher than 3 (average of 3.3 in two males, and 2.5 in nine females) in *C. pseudoconchiformus* sp. n.; manus of pedipalp in male robust (Kovářík 2012: Fig. 68), chela length/width ratio in both sex adults lower than 2.6 in *C. wrzecionkoi* (Kovářík, 2012: 2); manus of pedipalp in both sex adults robust (Zhu et al. (2008): Figs 3, 17), chela length/width ratio in one male adult is 2.4 (paratype: Ar.–MHU–XZ0102), in two females (including the holotype) lower than 2.0 in *C. conchiformus*.



Figures 1–4. *C. pseudoconchiformus* sp. n., dorsal and ventral habitus: **1–2** Male holotype (Ar.-USTC-XZLZ1401) **3–4** Female paratype (Ar.-USTC-XZLZ1402). Scale bar = 10 mm.

Table 1. Measurements (mm) of *C. pseudoconchiformus* sp. n., male holotype (Ar.-USTC-XZLZ1401) and female paratype (Ar.-USTC-XZLZ1402). The information of *C. wrzecionkoi* from Kovařík (2012).

	<i>C. pseudoconchiformus</i> sp. n.		<i>C. wrzecionkoi</i>	
	Male holotype	Female paratype	Male holotype	Female paratype
Total length	37.4	37.1	37.0	39.0
Carapace:				
-Length	4.5	4.4	4.3	4.5
-Anterior width	2.4	2.7	4.4	5.1
-Posterior width	5.0	5.3		
Mesosomal segments:				
-Length	11.3	13.5		
Metasomal segment I:				
-Length	2.0	1.8	2.0	1.8
-Width	2.9	2.8	2.4	2.7
-Depth	2.1	2.1		
Metasomal segment II:				
-Length	2.6	2.2	2.4	2.2
-Width	2.4	2.4	2.0	2.2
-Depth	1.9	1.8		
Metasomal segment III :				
-Length	2.9	2.5	2.4	2.2
-Width	2.3	2.2	2.0	2.0
-Depth	1.7	1.8		
Metasomal segment IV:				
-Length	3.3	3.0	2.7	2.7
-Width	2.1	2.0	1.9	1.8
-Depth	1.6	1.6		
Metasomal segment V:				
-Length	5.4	4.9	4.7	4.4
-Width	1.9	1.8	1.8	1.6
-Depth	1.5	1.5		
Telson:				
-Length	5.5	4.8	4.9	4.9
-Width	2.1	2.0		
-Depth	1.7	1.7		
Pedipalp femur:				
-Length	5.4	4.1	4.5	3.7
-Width	1.8	1.7	1.6	1.7
-Depth	1.9	1.9		
Pedipalp patella:				
-Length	5.3	4.1	4.8	4.0
-Width	1.9	2.0	1.7	2.2
-Depth	2.1	2.4		
Chela:				
-Length	10.2	9.0	9.0	8.3
-Width (manus)	3.2	3.6	3.5	3.5
-Depth (manus)	3.1	3.1		
Movable finger:				
-Length	5.2	5.2	5.0	4.5
Pectinal teeth (left/right)	5/5	4/4	4/5	?



Figures 5–25. *C. pseudoconchiformis* sp. n. Male holotype: **5** Carapace, dorsal aspect **6** Lateral eyes area **7–8** Chelicera, dorsal and ventral aspects **11** Tegument of the seventh sternite; **12** Sternum, genital operculum and pectines **14–15** Metasomal segment V, lateral and ventral aspects **16** Telson **18–19** Femur, dorsal and external aspects **20–22** Patella, dorsal, external and ventral aspects. Female paratype (Ar.-USTC-XZLZ1402): **9–10** Chelicera, dorsal and ventral aspects **17** Telson **23–24** Femur, dorsal and external aspects **25** Patella, dorsal aspect. Scale bars = 2 mm.

Table 2. Feature datasets of body length (BL, mm; segment by segment was measured and added in type specimens, while others were measured for overall length only), chela with length/width ratio (CR), number of granule rows of movable finger of pedipalp (RN), and number of pectinal teeth (PT) of *C. conchiformus* (CO, Ar.-USTC-XZLZ1412), *C. pseudoconchiformus* sp. n., and *C. tryznai* (TY, Ar.-USTC-XZBM1401–02).

	Sex	BL	CR	RN	PT
XZLZ1401	♂	37.4	3.2	8/8	5/5
XZLZ1402	♀	37.1	2.5	8/8	4/4
XZLZ1403	♂	32.0	3.4	8/8	5/5
XZLZ1404	♀	36.0	2.5	8/8	4/4
XZLZ1405	♀	39.0	2.6	9/9	4/4
XZLZ1406	♀	32.5	2.4	8/8	3/3
XZLZ1407	♀	38.0	2.6	8/8	4/3
XZLZ1408	♀	37.0	2.3	8/8	3/3
XZLZ1409	♀	38.0	2.3	8/8	3/3
XZLZ1410	♀	37.0	2.5	8/8	4/3
XZLZ1411	♀	35.5	2.5	8/8	4/3
XZLZ1412(CO)	♀	32.0	1.9	7/7	4/4
XZBM1401(TY)	♀	44.0	2.8	8/8	3/3
XZBM1402(TY)	♀	39.0	2.6	8/8	3/3

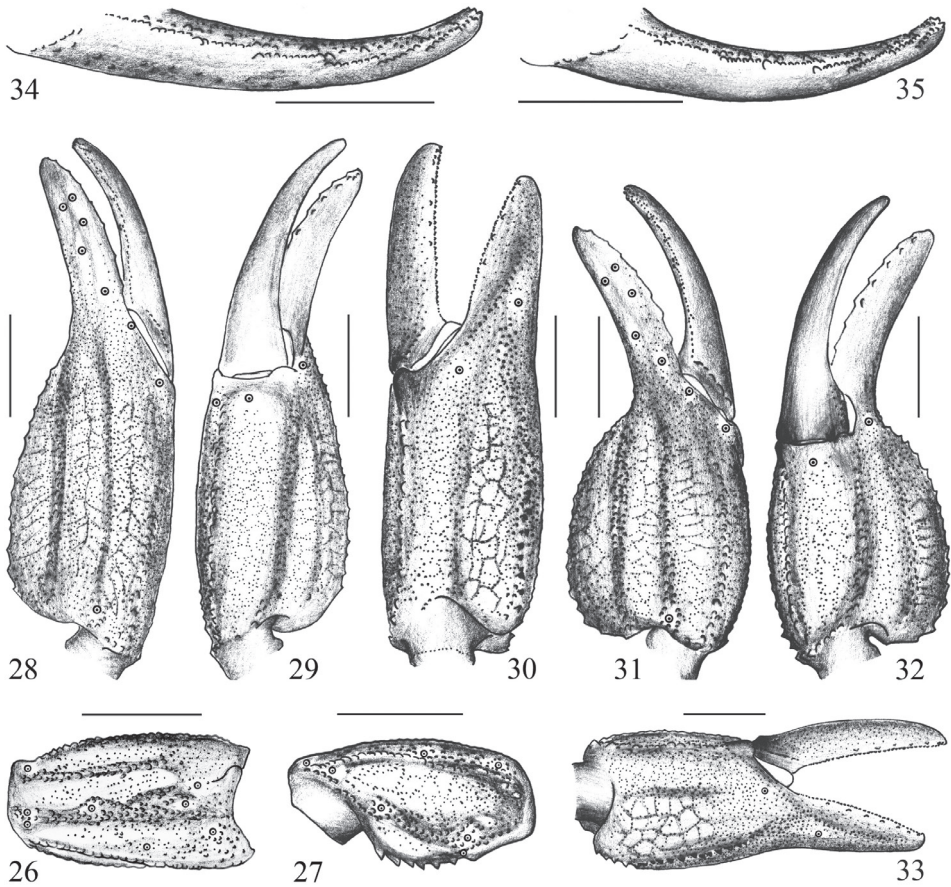
mus. Furthermore, *C. pseudoconchiformus* sp. n. has more slender pedipalps than *C. wrzecionkoi* (Table 1; Kovařík 2012: 13), in other words, the length ratio of pedipalp (LRP) is distinctly larger than the length ratio of total length (LRT) of *C. pseudoconchiformus* sp. n. and *C. wrzecionkoi*: 1.14 (LRP), 1.01 (LRT) in male holotypes; 1.08 (LRP), 0.95 (LRT) in female allotypes of *C. pseudoconchiformus* sp. n. and *C. wrzecionkoi* (Table 1).

Etymology. The specific name refers to the geographically and morphologically most closely related species *C. conchiformus*, adding the Greek prefix “pseudo-” as “pseudoc-onchiformus”, because the habitus of both sexes is very similar to that of *C. conchiformus*.

Description. Based on male holotype and female paratype.

Coloration (Figs 1–4). Basically reddish brown. Carapace dark red-brown with black parts and yellowish stripes. Mesosomal tergites dark red-brown with yellowish stripes. Metasoma: all segments dark red-brown. Telson dark red-brown with reddish brown part; aculeus light red-brown. Chelicerae reddish brown with dark reticular pattern on dorsal surface. Pedipalps: femur, patella and chela dark red-brown with dark carinae. Legs dark red-brown and red-brown on distal segments. Sternum, genital operculum and sternites red-brown with some light parts. Pectines light yellow.

Morphology. Carapace carinated, with the anterior margin straight; with dense granules of nearly equal size; lateral furrow moderately deep; large granules form two longitudinal lateral carinae (Fig. 5). Median ocular tubercle with granules. Lateral ocular tubercle small with a pair of lateral eyes and some granules (Fig. 6). Lateral eyes distinctly smaller than median eyes (Fig. 5).



Figures 26–35. *C. pseudoconchiformus* sp. n. Male holotype: **28–30** Chela, dorsoexternal, ventral, and internal aspects **34** Movable finger of pedipalp. Female paratype (Ar.-USTC-XZLZ1402): **26–27** Patella, external and ventral aspects **31–33** Chela, dorsoexternal, ventral, and internal aspects **35** Movable finger of pedipalp. Scale bars = 2 mm.

Mesosoma: Tergites uniform distributing with granules of larger and unequal size; tergites I to II without carinae, each of tergites III to VI bearing a pairs of obsolete granular carinae on posterior margin, tergite VII bearing two pairs of obsolete granular lateral carinae, but middle pair is represented only by ridges without expressed carinae; sternum pentagonal; genital operculum triangular; pectinal teeth count 5/5 in males and 3–4 in females, with fulcra well developed (Figs 12–13); sternites III to VI are smooth, sternite VII granular without carinae (Fig. 11).

Metasoma: Length about 4.8 times as long as carapace in males and 4.4 in females; segment I always wider than long; segments I to V with 10-8-8-8-7 granular carinae; the ventromedian and ventrolateral carinae of segment V composed of strong, den- tated granules, ventromedian carina posteriorly bifurcated as “Y” (Figs 14–15); all

Table 3. The differences between of chaerilids from China: *C. conchiformis*, *C. dibangvalleyicus*, *C. mainlingensis*, *C. pictus*, *C. pseudoconchiformis* sp. n., *C. urzecionkoi*, *C. tessellatus*, *C. tricastatus*, and *C. tryznai*; body length (BL, mm); carapace with the anterior margin (straight or curving, CA); chela with length/width ratio respectively in females and males (CR(F), CR(M)), dorsal secondary carinae of the chela (DS); rows number of denticles on fixed and movable fingers of chelae (RF); the tegument of the seventh sternite (SVII); holotype (H), paratype (P), new material (N).

	<i>conchiformis</i> (H&N)	<i>dibangvalleyicus</i> (H&P)	<i>mainlingensis</i> (H&P)	<i>pictus</i> (H&P)	<i>pseudoconchiformis</i> sp. n. (H&P)	<i>urzecionkoi</i> (H&P)	<i>tessellatus</i> (H&P)	<i>tricastatus</i> (N)	<i>tryznai</i> (H, P&N)
BL	32–44	36–42	40–41	38–66	32–39	33–41	35–52	48–60	30–44
CA	straight	slightly curving	slightly depressed	slightly curving	straight	straight	straight	straight	straight
CR(F)	1.8–1.9	?	2.4–2.8	2.4	2.3–2.6	2.4	2.2	2.2–2.4	2.6–2.9
CR(M)	?	?	?	2.5	3.2–3.4	2.6	?	3.7	>3
DS	present	absent	absent	present	present	present	present	absent	present
RF	8	7 or 8 ^{*1}	7	13 or 14	8 or 9	8(9?) ^{*2}	11	11 or 12	8
SVII	weakly granular; with carinae	granular; with carinae	weakly granular; with carinae	?	granular; without carinae	granular; without carinae	with carinae	granular; with carinae	granular; without carinae

^{*1} Nine rows of denticles on fixed and movable fingers of pedipalp chelae in the holotype (Bastawade 2006: Fig. 5). But the author thought that there are seven or eight rows in *C. dibangvalleyicus* and 10–11 in *C. tricastatus* (Bastawade 2006: 454).

^{*2} Nine rows of denticles on movable fingers of pedipalp chelae in the holotype (Kovářík 2012: Fig. 64), but the author described eight rows in *C. urzecionkoi* (Kovářík 2012: 11).

segments with sparse small granules. Vesicle is almost smooth; aculeus slightly curved (Figs 16–17).

Chelicerae: Tibia surfaces smooth; thickly covered with numerous short, silky hairs, extending to ventral aspect of chelicerae and dorsal aspect of fixed fingers; ventral inner edges of movable finger with some minute teeth (2–3 obsolete teeth in two males and 3–9 well developed and obsolete teeth in nine females) (Figs 7–10).

Pedipalp: Tegument granular. The femur has four carinae and the patella has five granular carinae (Figs 18–27). Chela with length/width ratio average of 3.3 in males (two adults) and 2.5 in females (nine adults), has seven granulated dorsointernal, except internal carina obsolete; entire tegument of chela manus densely covered with coarse granules, forming some indistinct reticular pattern (Figs 28–33); fingers straight, the cutting edge of movable finger with 8 or 9 (mainly 8) rows of denticles (Figs 34–35). Trichobothriotaxy of type B; orthobothriotaxic (Vachon 1974) (Figs 18–33).

Legs: Tibia without tibial spur. Basitarsus with two pedal spurs strongly developed. Tarsi with two rows of spiniform setae.

Variation. Coloration and morphology in holotype and paratypes are very similar (feature datasets please see Table 2).

Habitat. Found under the stones in mixed forest.

Distribution. China (Xizang).

Update key to species of the genus *Chaerilus* in China

- 1 Movable finger of pedipalp with 7–9 rows of granules 2
- Movable finger of pedipalp with 10–14 rows of granules 7
- 2 Chela length to width ratio in female adults 1.6–1.9 ***C. conchiformus***
- Chela length to width ratio in female adults higher than 2.0 3
- 3 Ventral side of seventh mesosomal segment with 2 pairs of granular carinae; carapace with anterior margin straight with a median notch 4
- Ventral side of seventh mesosomal segment with many granules but without carinae; carapace with anterior margin straight without median notch 5
- 4 Pedipalp femur shorter than carapace; 8–9 minute teeth on inner ventral margins of movable and immovable fingers respectively (Bastawade 2006: 451, fig. 5) ***C. dibangvalleycus***
- Pedipalp femur longer than carapace, 7–8 minute teeth on inner ventral margins of movable and immovable fingers respectively (Di and Zhu 2009: 101, fig. 11) ***C. mainlingensis***
- 5 Manus of pedipalp narrower and longer with the ventral margin not round in females (Zhu et al. 2008: fig. 47); chela length/width ratio in females is 2.6–2.9 (Kovářík 2000: table 1) ***C. tryznai***
- Manus of pedipalp robust in females with the ventral margin very round in females; chela length/width ratio in females is 2.3–2.6 6

- 6 Chela length/width ratio in males average of 3.3 (3.2–3.4), and 2.5 in females (2.3–2.6), chelae of male and female with sexual dimorphism *C. pseudoconchiformus* sp. n.
- Chela length/width ratio about 2.6 in male, and about 2.4 in female, chelae of male and female without sexual dimorphism (Kovářík 2012: 13, figs 62, 76) *C. wrzecionkoi*
- 7 Movable finger of pedipalp with 13–14 rows of granules; telson of male rather long and about 4.7 times longer than wide, with an obvious sexual dimorphism in both sexes..... *C. pictus*
- Movable finger of pedipalp with 11–12 rows of granules; telsons of male and female without sexual dimorphism **8**
- 8 Carapace and tergites nearly smooth in adults (Zhu et al. 2008: 44, 47) *C. tessellatus*
- Carapace and tergites with many big granules in adults (Di et al. 2009: 133, 136)..... *C. tricastatus*

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***Scorpiops ingens* sp. n. and an updated key to the *Scorpiops* from China (Scorpiones, Euscorpiidae, Scorpiopinae)**

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Abstract

A new species, *Scorpiops ingens* **sp. n.**, from Xizang, is described and illustrated. *Scorpiops ingens* **sp. n.** is characterized by yellow-brown color, large size (length of adults above 70.0 mm), small and dense granules on tegument, a pair of small median eyes, 17 external trichobothria (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 4 *et*), and 7 or 8 (usually 7) ventral trichobothria in the pedipalp patella, chela with a length/width ratio average of 2.2 in males and females, pedipalp chela fingers on adult females and males scalloped, pectinal teeth count 6–8, pectinal fulcra absent. With the description of this new species, the number of known species of *Scorpiops* from China is raised to 12. An updated identification key to *Scorpiops* from China is presented.

Keywords

China, Euscorpiidae, scorpion, *Scorpiops*, Xizang

Introduction

Recently, the diversity of *Scorpiops* species from China was highlighted (Qi et al. 2005; Di and Zhu 2009; Di et al. 2011, 2014). Kovařík and Ahmed (2009) referred to an unre-

solved, widespread *S. hardwickii* “complex” (12 species) which, in their opinion, included five species known from China (*S. atomatus*, *S. hardwickii*, *S. langxian*, *S. pococki*, and *S. tibetanus*). Di et al. (2011) suggested that *S. atomatus* and *S. tibetanus* should be excluded from *S. hardwickii* “complex” by morphological analysis results, and provided unifying features of *S. hardwickii* “complex” base on the species from China: (1) color red-brown to dark brown; (2) total length approximately 45–80 mm in adults; (3) fingers of pedipalps very strongly flexed (curved) in males, slightly flexed (undulated) in females; (4) ventral trichobothria on patella number 6–8; (5) pectinal teeth number 4–9; (6) length/width ratio of chela about 1.8–2.1; (7) fulcra absent; (8) patella with two small spinoid granules on the internal aspect. There are three species from China belonging to *S. hardwickii* “complex” after the revision provided by Di et al. (2011): *S. hardwickii*, *S. langxian*, and *S. pococki*. In fact, Qi et al. (2005: 29) pointed out the differences among *S. hardwickii*, *S. langxian*, and *S. pococki*: pedipalp chela manus almost as long as wide in *S. hardwickii*, while the pedipalp chela manus usually longer than its width in *S. langxian* and *S. pococki*; distance between median eyes much more than their diameter in *S. langxian*, while the distance between median eyes only slightly more than their diameter in *S. pococki*. Di et al. (2014) recorded 11 species in the updated checklist of scorpions from China based mainly on the literature: *S. atomatus* (Xizang), *S. hardwickii* (Xizang), *S. jendeki* (Yunnan), *S. langxian* (Xizang), *S. leptochirus* (Xizang), *S. lhasa* (Xizang), *S. luridus* (Xizang), *S. margerisonae* (Xizang), *S. petersii* (Xizang), *S. pococki* (Xizang), and *S. tibetanus* (Xizang).

Material and methods

Identification and measurements were made using a Motic K700 stereomicroscope with an ocular micrometer. The photos were taken with a Canon (650D) camera. Measurements follow Sissom et al. (1990) and are given in mm. Trichobothrial notations follow Vachon (1974) and morphological terminology mostly follows Hjelle (1990). Research materials have been deposited in the Specimen Room of University of Science and Technology of China, Hefei, China (USTC).

Taxonomy

Family Euscorpiidae Laurie, 1896

Subfamily Scorpiopinae Kraepelin, 1905

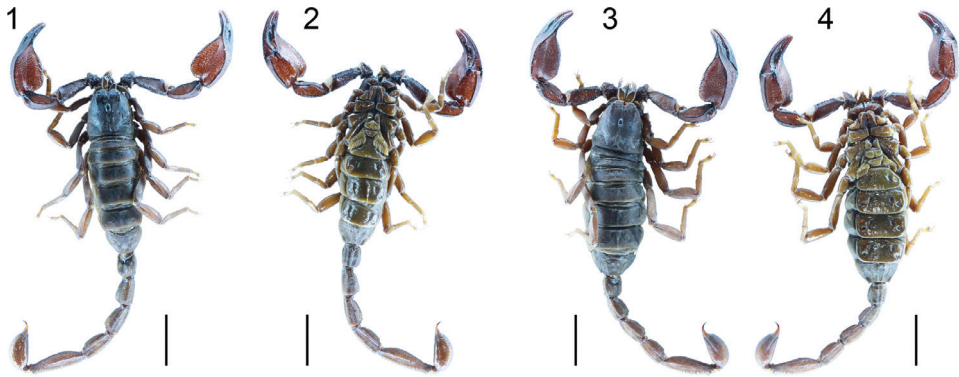
Genus *Scorpiops* Peters, 1861

***Scorpiops ingens* sp. n.**

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Figs 1–18

Type material. Holotype male (USTC), China: Xizang, Lhasa banlieue, 26/VII/2014, Zhiyong Di leg. (Ar.-USTC-XZLS1401); paratypes: 1 adult female, 1 immature fe-



Figures 1–4. Habitus of *Scorpiops ingens* sp. n. Dorsal and ventral habitus: **1–2** Male holotype (Ar.-USTC-XZLS1401) **3–4** Female paratype (Ar.-USTC-XZLS1402). Scale bar = 10.0 mm.

male, and 1 juvenile male, same data as holotype (Ar.-USTC-XZLS1402–1404) (kept in USTC).

Diagnosis. In accordance with the grouping of species proposed by Kovařík (2000) for the genus *Scorpiops*, the new species, which has 7 (rarely 8) trichobothria on the ventral surface of the patella, has to be placed in the *S. hardwickii* “complex” group. The new species differs from other members of the group in having yellow-brown color, larger size (length of adults above 70.0 mm), small and dense granules on the tegument, a pair of small median eyes and a lofty median ocular tubercle.

Comments. There are four close relatives from China distributed near to *S. ingens* sp. n.: *S. hardwickii*, *S. langxian*, *S. petersii*, and *S. pococki*. But *S. hardwickii*, *S. langxian*, and *S. pococki* with red-brown to black-brown color, body length no longer than 65 mm. Although *S. petersii* also above 75.0 mm, its carapace is not densely granulated, granules on its mesosoma are widely spaced, with the distance between them far greater than their size (Kovařík 2000: 193), while the granules are dense on the carapace and mesosoma of *S. ingens* sp. n.

Etymology. The specific name refers to the size of the morphology of the new species.

Description. Based on male holotype and female paratype.

Coloration. Mostly yellow to yellow-brown (Figs 1–4). Carapace yellow-brown with un conspicuous dark stripe (Figs 5, 7), median and lateral ocular tubercles black. Tergites and metasoma segments yellow-brown. Vesicle yellow-brown with a dark brown aculeus. Chelicerae yellow-brown, with fingers black-brown and gradually lighter toward the tip. Pedipalp yellow-brown, with the carinae black-brown. Legs yellow-brown. Claws yellow-brown with brown tips. Sternum and sternites yellow-brown (Figs 6, 8). Genital operculum, basil piece and pectines yellow (Figs 6, 8).

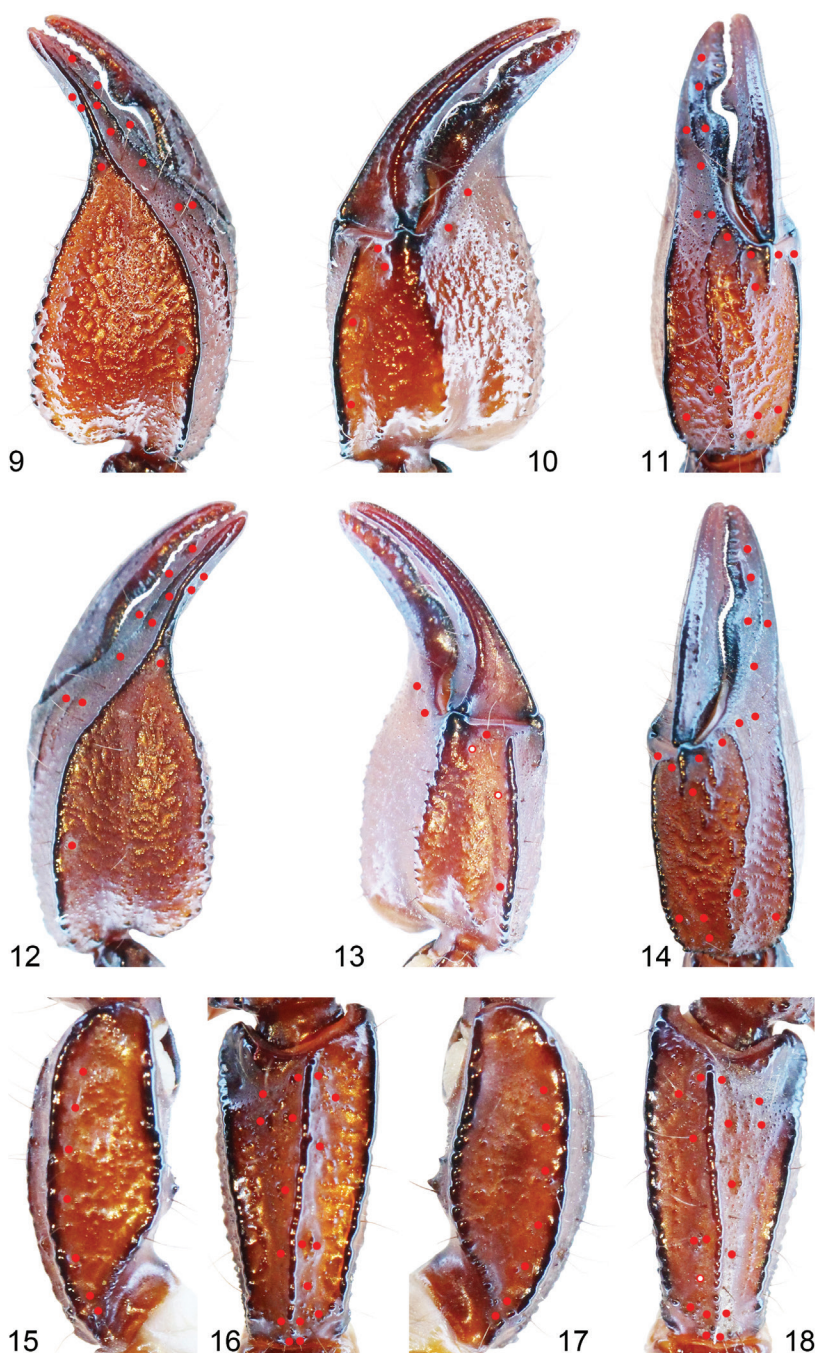
Morphology. Prosoma: Carapace coarse, with sparse and large granules in the area of the front of the eye region, with dense and minute granules in the area of the behind of the eye region; lateral furrow broad and flat; anterior median furrow broad and deep; posterior median furrow deep; anterior margin nearly smooth; posterior and lateral mar-



Figures 5–8. *Scorpiops ingens* sp. n. Male holotype: **5, 6.** **5** Carapace and tergite I– II. **6** Ventral aspect of prosoma. Female paratype (Ar-USTC-XZLS1402): **7, 8.** **7** Carapace and tergite I **8** Ventral aspect of prosoma.

gins and other parts with dense, minute granules (Figs 5, 7). Median eyes small and same as the first lateral eye, situated anterior to the center of the carapace; three pairs of lateral eyes, the third smallest. Median ocular tubercle high and smooth, with a median furrow, which having some granules. Lateral ocular tubercle with some big smooth granules.

Mesosoma: Tergites are almost completely densely covered with equal minute granules in male holotype, posterior part with some bigger granules in female paratypes;



Figures 9–18. *Scorpiops ingens* sp. n. Male holotype: 9–11, 15–16. 9–11 Chela (right) dorsal and external, ventral and internal, and external aspects. 15–16 Patella (right) ventral and external aspects. Female paratype (Ar-USTC-XZLS1402): 12–14, 17–18. 12–14 Chela (left) dorsal and external, ventral and internal, and external aspects. 17–18 Patella (left) ventral and external aspects. The red dots and rings denote trichobothrial patterns of pedipalps, the red ring meaning vestigial.

Table 1. Measurements (in mm) of holotype (male, Ar.-USTC-XZLS1401) and paratype (female, Ar.-USTC-XZLS1402) of *Scorpiops ingens* sp. n.

	<i>Scorpiops ingens</i> sp. n.	
	Holotype	Paratype
Total length:	74.6	75.9
Carapace:		
-Length	8.7	9.6
-Anterior width	4.9	5.3
-Posterior width	8.9	9.8
Mesosomal segments:		
-Length	22.3	24.7
Metasomal segment I:		
-Length	4.6	4.5
-Width	4.0	4.1
-Depth	3.1	3.2
Metasomal segment II:		
-Length	5.1	5.2
-Width	3.6	3.7
-Depth	3.0	2.9
Metasomal segment III :		
-Length	6.3	5.5
-Width	3.3	3.5
-Depth	3.0	3.0
Metasomal segment IV:		
-Length	6.8	6.2
-Width	3.0	3.3
-Depth	3.0	3.0
Metasomal segment V:		
-Length	10.8	10.6
-Width	3.0	3.0
-Depth	3.0	3.2
Telson:		
-Length	10.0	9.6
-Width	3.8	3.6
-Depth	3.7	3.6
Pedipalp femur:		
-Length	7.0	8.1
-Width	3.1	3.3
-Depth	2.6	2.9
Pedipalp patella:		
-Length	7.0	7.6
-Width	3.1	3.5
-Depth	3.3	3.6
Chela:		
-Length	14.3	14.8
-Width (manus)	6.3	6.4
-Depth (manus)	4.8	5.0
Movable finger:		
-Length	9.0	9.4
Pectinal teeth (left/right)	7/7	6/6

from tergite II to VI the trace of a median carina first appears and gradually becomes distinct; on tergite VII with a distinct apophysis and two pairs of lateral carinae. Sternum pentagonal (Figs 6, 8). Pectinal teeth count 6–8 (rarely 8), fulcra absent (Figs 6, 8). Genital opercula subtriangular (Figs 6, 8). Sternites smooth and shiny (Figs 2, 4); segment VII ventrally with four weak carinae.

Metasoma: Tegument coarse. Segments I to V are longer than wide; segments I to V have 10-8-8-8-7 carinae, segments II–IV with a pair of vestigial lateral carinae; all carinae granular; on segment V, ventral carinae with larger serration. Vesicle smooth, with some granules and few setae.

Chelicerae: Tibiae smooth. Movable finger with 4 denticles on dorsal edge and 6 denticles on ventral edge (smaller in female). Fixed finger with 3 denticles on dorsal edge.

Pedipalps: Tegument of femur and patella coarse, tegument of chelae and ventral aspects of femur and patella smooth. Femur with dorsointernal, dorsoexternal, external, ventroexternal, ventrointernal carinae granulated, and internal carinae crenulated. Patella with dorsoexternal, dorsointernal, external, ventrointernal, ventroexternal carinae with large, smooth granules; two small spinoid granules present on the internal aspect. Trichobothrial pattern C, neobothriotaxic; patella with 17 external trichobothria (5 eb, 2 esb, 2 em, 4 est, 4 et) and 7 or 8 (usually 7) ventral trichobothria (Figs 15–18). Chela with 4 ventral trichobothria, with dorsal marginal, external secondary, and ventral internal carinae, all smooth; internal carina vestigial only with few large granules (Figs 9–14). Male pedipalp chela fingers stronger curved than females.

Legs: Tegument coarse except coxa and trochanter. Trochanter with few granules and setae. Femur dorsal surface densely granular and ventrally smooth, internally with 2 granular carinae. Patella dorsal surface densely granular and ventrally smooth, with dorsoexternal, dorsal and ventroexternal granular carinae. Tibiae with few setae, without spurs. Basitarsus with more setae, and two lateral pedal spurs. Tarsus ventrally with row of spinules. Ungues falcate.

Variation. Female and male: coloration and morphology are very similar. Number (left/right) of ventral trichobothria on the pedipalp patellae: two females with 8/7 and 7/7, two males with 7/7. Number of pectinal teeth: two females with 6/6, two males with 7/7 and 7/8. Measurements in Table 1.

Habitat. Under stones on a hillside with ruderal vegetation.

Distribution. China (Xizang).

Updated key to species of *Scorpiops* from China

- 1 Fingers of pedipalps are straight or only slightly curved in both sexes2
- Fingers of pedipalps are curved in both sexes3
- 2 Ventral trichobothria on patella number 6 (7 rarely), total length 30.0–42.1 mm, pectinal teeth number 4–5, chela length to width ratio about 2.2.
..... *S. jendeki*

- Ventral trichobothria on patella number 7, total length 40.0–58.0 mm, pectinal teeth number 7–9, chela length to width ratio about 3.3–3.5 *S. leptochirus*
- 3 Manus length to width ratio visibly higher than 1 4
- Manus with similar length and width 9
- 4 Total length more than 65.0 mm 5
- Total length less than 65.0 mm 6
- 5 Ventral patella of pedipalps with 9 trichobothria *S. luridus*
- Ventral patella of pedipalps with 7 (rarely 6 or 8) trichobothria *S. petersii*
- 6 Dorsally flat manus of pedipalps and chela of both sexes, with length/width ratio: 2.1–2.2 (about 2.1 in males and 2.2 in females), total length 40.0–50.0 mm in adults *S. margerisonae*
- Dorsally round manus of pedipalps or at least the chela of one sex, with length to width ratio higher than 2.2 or total length higher than 50.0 mm 7
- 7 Total length less than 40.0 mm 8
- Total length 45.0–61.0 mm *S. tibetanus*
- 8 Chela of pedipalp length to width ratio about 2.6–3.0, dorsal surface of chela of pedipalp coarse *S. lhasa*
- Chela of pedipalp length to width ratio lower than 2.5, dorsal surface of chela of pedipalp smooth with luster *S. atomatus*
- 9 Yellow-brown color, length of adults above 70.0 mm *S. ingens* sp. n.
- Red-brown color, length of adults under 65.0 mm 10
- 10 Pedipalp chela manus almost as long as wide *S. hardwickii*
- Pedipalp chela manus usually longer than its width 11
- 11 Distance between median eyes much more than their diameter ... *S. langxian*
- Distance between median eyes only slightly more than their diameter *S. pococki*

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A revision of the genus *Hemistrochostoma* (Hemiptera, Heteroptera, Plataspidae)

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Abstract

The genus *Hemistrochostoma* Bergroth, 1913 (Hemiptera, Heteroptera, Plataspidae) is redescribed and reviewed. Two species are recognized: the type species *H. altilabris* Bergroth, 1913 (Malaysia: Sarawak), and *H. rutabulum* **sp. n.** (Malaysia: Perak). The following new subjective synonymies are proposed: *Hemistrochostoma* Bergroth, 1913 = *Inflatilabrum* Tomokuni, 2012, **syn. n.**; *H. altilabris* Bergroth, 1913 = *I. lambirensis* Tomokuni, 2012, **syn. n.**

Keywords

Taxonomy, Heteroptera, Plataspidae, *Hemistrochostoma*, Oriental Region

Introduction

The genus *Hemistrochostoma* Bergroth, 1913 (Hemiptera, Heteroptera, Plataspidae) has remained monotypic so far; the single included species, *H. altilabris* Bergroth, 1913 was described from Borneo, Malaysia. Except for a paper briefly discussing the peculiar morphology of *H. altilabris* (Rédei & Bu, 2013) we could not trace any literature mentioning the genus or species. *Hemistrochostoma* and its included species are redescribed, an additional new species is described, and new genus and species-level synonymies are proposed in the present paper.

Material and methods

External structures were examined using a stereoscopic microscope (Zeiss Discovery V8). Drawings were made with the aid of a camera lucida. Genitalia were dissected after careful maceration in KOH, stained with Chlorazol Black E if necessary, and examined using stereoscopic (Zeiss Discovery V8) and optical (Olympus CX21) microscopes. Digital photographs were taken with a Nikon D90 camera equipped with an AF-S Micro Nikkor 60mm f/2.8G ED lens.

Measurements were taken with calibrated micrometer eyepiece. Since the apical portion of the mandibular plates are strongly curved upwards, the length of the head was measured to the apex of the anteclypeus in dorsal position of the frontoclypeus, and to the apex of the mandibular plates in the most exposed (anterodorsal) position of the head.

The two species of this genus are highly similar in their colour, integument, vestiture, and external morphology. Therefore in order to avoid repetitions a rather detailed description of the genus is provided; the species descriptions are kept short and focus on the diagnostic characters of the two species. Morphological terminology mostly follows Tsai et al. (2011).

Abbreviations for depositories: HNHM, Hungarian Natural History Museum, Budapest, Hungary; NSMT, National Museum of Nature and Science (formerly National Science Museum), Tokyo, Japan; ZJCP, Zdeněk Jindra's private collection, currently deposited at the Department of Plant Protection, Czech University of Agriculture, Prague, Czech Republic.

Taxonomy

Genus *Hemitrochostoma* Bergroth, 1913

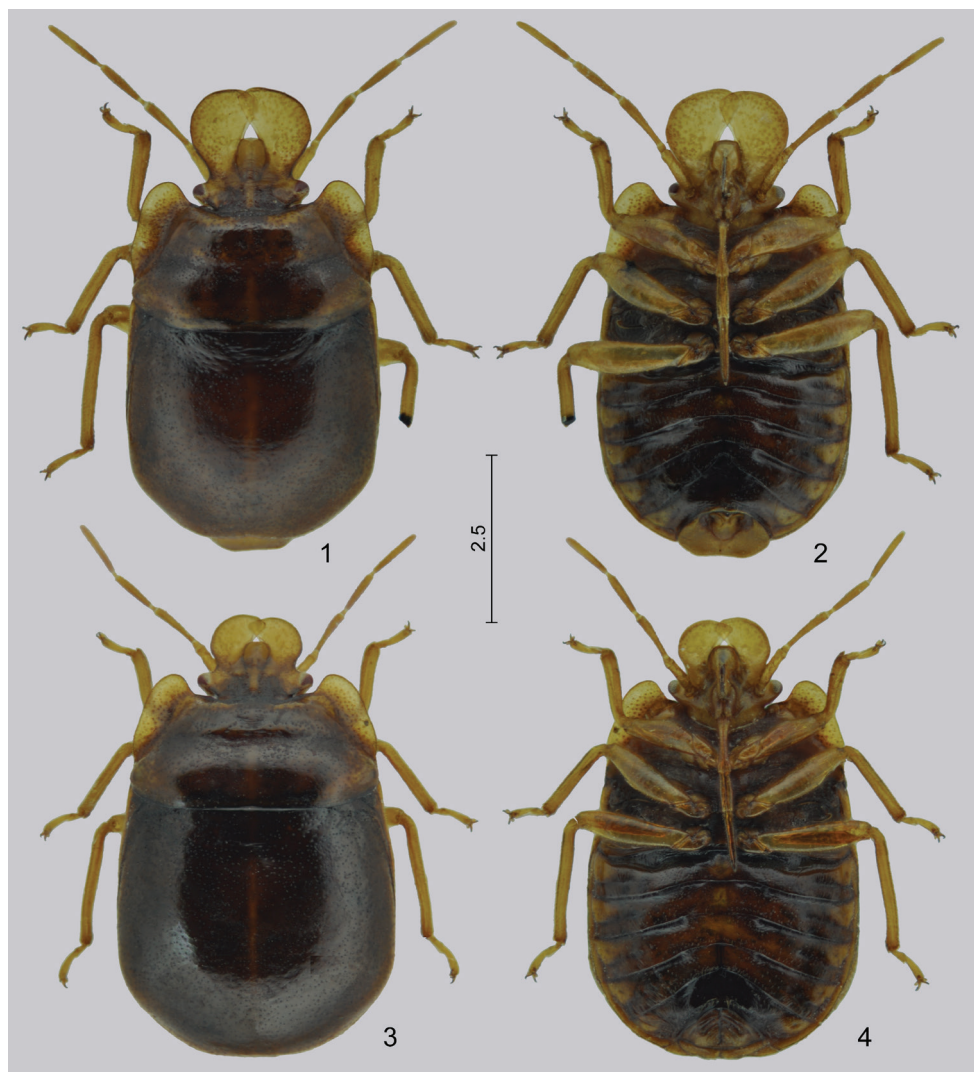
Hemitrochostoma Bergroth, 1913: 176. Type species by monotypy: *Hemitrochostoma altilabris* Bergroth, 1913.

Inflatilabrum Tomokuni, 2012: 40. Type species by original designation: *Inflatilabrum lambirensis* Tomokuni, 2012. **New subjective synonym.**

References. Rédei and Bu 2013: 272 (morphology).

Diagnosis. Recognized within Plataspidae based on the combination of the following characters: body of medium size (6–7 mm), relatively elongate, about 1.5–1.8 times as long as wide, moderately convex dorsally (Figs 1–4); mandibular plates broadly laminate, produced far anteriorly of apex of anteclypeus and broadly overlapping in both sexes (Figs 5–8); labrum highly elevated, crest-like, semicircular in lateral view (Fig. 11).

Redescription. *Body* of medium size (total length about 6–7 mm), elongately oval, moderately convex dorsally, nearly flat ventrally (Figs 1–4). *Colour, integument and*



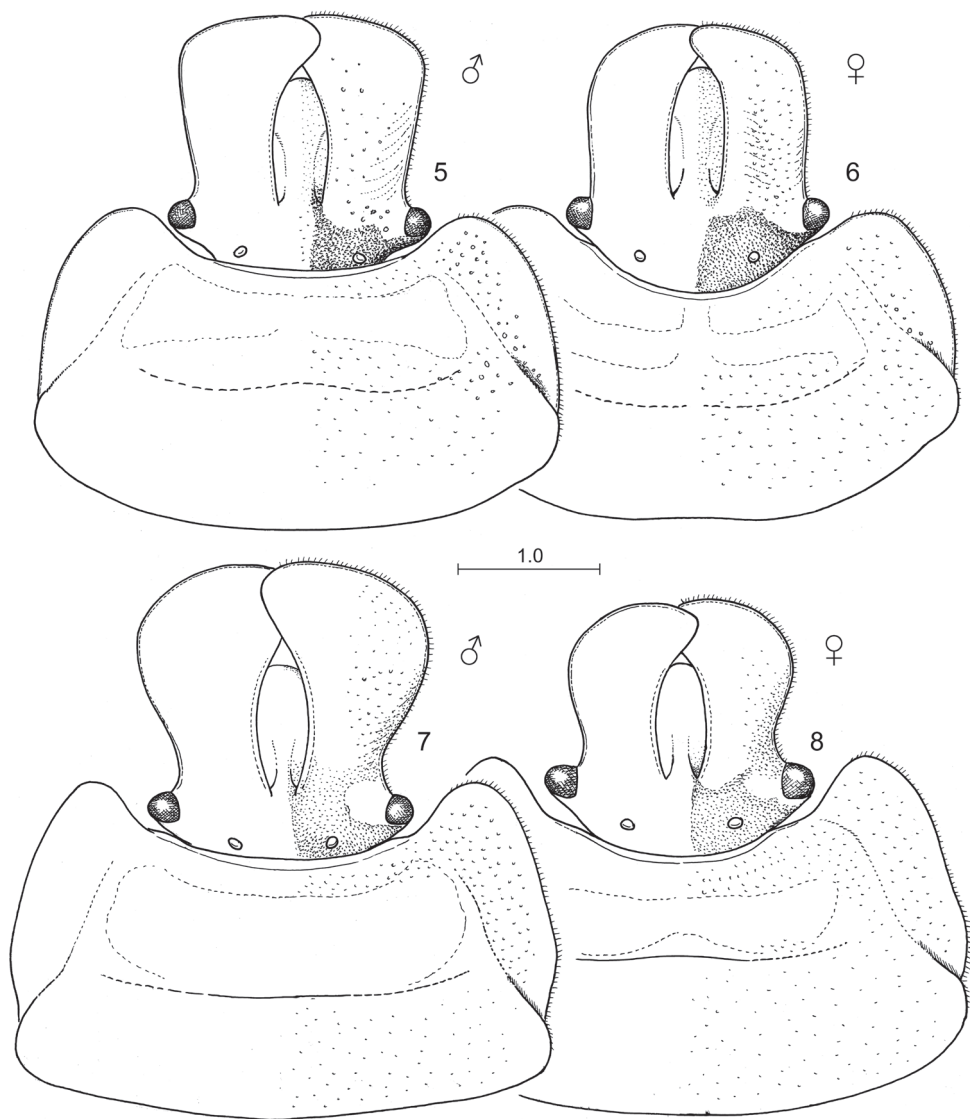
Figures 1–4. *Hemitrochostoma rutabulum* sp. n., male 1–2 and female 3–4. 1, 3 dorsal view 2, 4 ventral view. Scale in mm.

vestiture. Dorsum brown with stramineous areas on head and pronotum; integument dull, smooth, with dense, weak, superficial, rather irregular punctation dorsally, with only insignificant, indistinct punctures ventrally; with scattered, inconspicuous, fine, short, erect setae dorsally and ventrally, antennae and legs with more conspicuous short, semierect pilosity.

Head and cephalic appendages. Head (Figs 5–8) 1.05–1.1 times as long as its width across eyes, about as long as or slightly longer than median length of pronotum, about half as broad across eyes as humeral width of pronotum, width across eyes 1.3–1.35 times (male, female) as broad as interocular distance; sexually dimorphic: males (Figs

5, 7) with more strongly broadened mandibular plates than females (Figs 6, 8); anteclypeus thick, with lateral margins arched, therefore anteclypeus distinctly broader at its middle than apically and basally, dorsally elevated above level of mandibular plates (Fig. 11); mandibular plates broadly, laminately produced, far surpassing apex of clypeus, overlapping medially anteriorly of clypeus but separated from apex of clypeus by a distinct gap, lateral margin of mandibular plates sharp, reflexed, distinctly (*H. altilabris* male, *H. rutabulum* male, female) or insignificantly (*H. altilabris* female) emarginate anteriorly of eye, portion anteriorly of apex of clypeus strongly turned upwards; antennal insertion situated closer to mesal margin of eye than to base of labium (Fig. 10); buccula short, restricted to basal half of ventral side of head; labrum subdivided into a broadly inflated proximal portion (Figs 10–11: lbrp) and a highly elevated, crestlike distal portion semicircular in lateral view (Figs 10–11: lbrd); compound eyes very small (male, female), distinctly protruding laterally; ocelli small, interocellar distance about 2 times as long as distance between ocellus and ipsilateral eye. *Antenna* simple, segment II subdivided into two secondary segments, segment I not reaching apex of head, thickened at its basal half, segment IIb very short, ring-like, segments IIb–IV distinctly flattened. *Labium* reaching or surpassing posterior margin of abdominal ventrite III; segment I (Figs 10–11: lb₁) thick and short, not reaching base of head, diameter of segments II–IV much smaller, segment III distinctly longer than segment I, segments II and IV subequal in length, both distinctly longer than segment I.

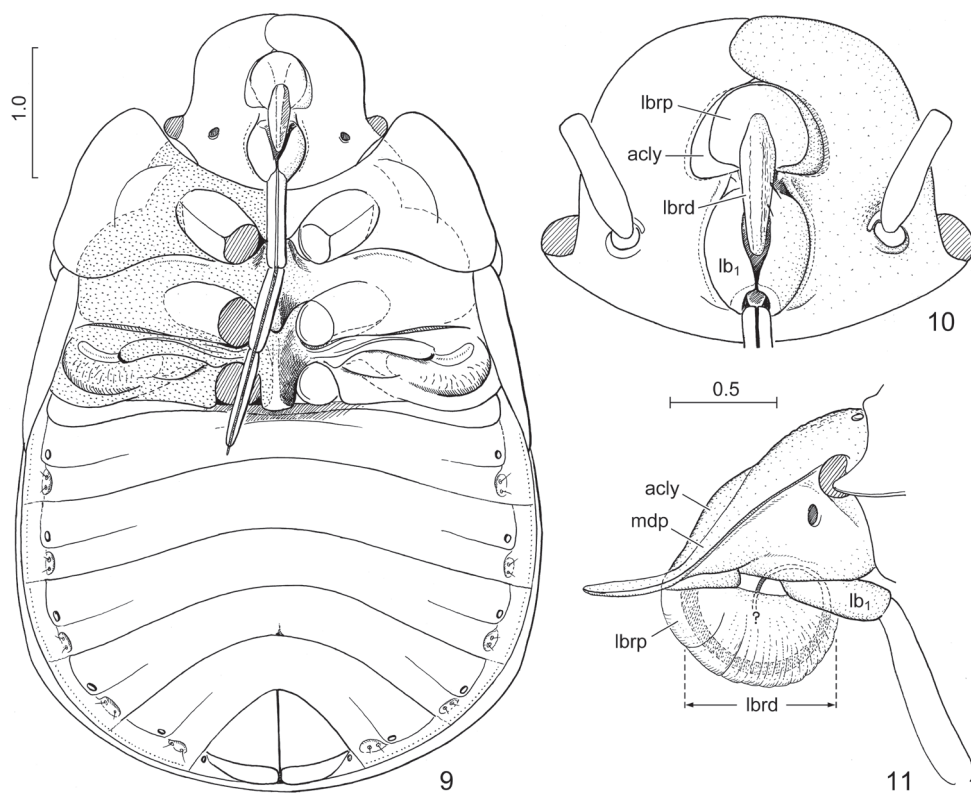
Thorax and thoracic appendages. Pronotum (Figs 5–8) more than two times as broad as its median length, moderately declivous anteriorly; anterior collar narrow but distinct; lateral margin broadly, laminately explanate, more or less strongly produced anterolaterad reaching or surpassing anterior margin of eye, gradually narrowed posteriad, more or less emarginated anteriorly of humeri in dorsal view; humeral angle rounded, obtuse, distinct; posterior margin broadly rounded, posterolateral angle obsolete. *Scutellum* wider than long, lateral margins abruptly broadened at their extreme base, then moderately broadening posteriad, forming a broadly rounded angle at two thirds of its length, then more strongly narrowing towards apex; basal tumescence weak, posteriorly delimited by a broad and very shallow transversal furrow; disk with a very indistinct median carina; basolateral angle not delimited by furrow; with a fine submarginal impression along almost entire length except at extreme base; posterior margin shallowly (female) or more deeply (male) excised above terminalia. *Thoracic pleura and sterna* (Fig. 9). Proepisternum simple, not tumescent; metapleuron with a well developed scent gland ostiole situated about halfway between base of hind coxa and dorsal margin of metapleurite, associated with a distinct, well developed but rather short, highly elevated, elongate, weakly curved peritreme; mesosternum forming a broad, obtuse, rather low median carina, posterior margin V-shaped and distinctly produced between mid coxae; metasternum relatively narrow, elevated and somewhat tumescent, but meso- and metasterna not forming a contiguous carina. Evaporatorium occupying most of thoracic pleuron and sternum except broad lateral explanate margin of propleuron, adjacent broad



Figures 5–8. *Hemistrochostoma* species, head and pronotum in most exposed view. **5** *H. altilabris* Bergroth, 1913, male **6** same, female **7** *H. rutabulum* sp. n., male **8** same, female. Pilosity only shown along margin of head and pronotum. Scale in mm.

region of proepisternum, and pro- and mesothoracic supracoal lobes. *Fore wing.* Exocorium and adjacent small, triangular basal portion of mesocorium exposed in rest. *Legs* short, femora thickened, tibiae with distinct, broad, deep dorsal furrow along their whole length.

Pregenital abdomen (Figs 9, 26) distinctly broader than long; connexival segments distinctly separated, intersegmental sutures running to lateral margin of abdomen;



Figures 9–11. *Hemitrochostoma altilabris* Bergroth, 1913, female. **9** body in ventral view, antennae and legs removed, labium pulled to right, thoracic evaporatorium densely dotted **10** head, ventral view **11** same, lateral view. Lettering: acly = anteclypeus; lb₁ = labial segment I; lbrd = distal portion of labrum; lbrp = proximal portion of labrum; mdp = mandibular plate. Scales in mm.

posterolateral angles of segments IV and V minutely, obtusely, protruding; dorsal laterotergites present in segments III–VI, rather broad; ventral laterotergites greatly fused with the respective sternites (these ventral plates of composite origin are termed ventrites), lateral portions of ventrites III–VII demarcated by a longitudinal furrow, spiracles III–VII situated close to this furrow mesally and about halfway between anterior and posterior margin of each segment; segments III–VII each with 2 pairs of longitudinally arranged trichobothria situated posteriad and somewhat mesad of the respective spiracles in an oval impression; median lengths of ventrites III–VI subequal, that of ventrite VII somewhat longer (female); posterior margin of ventrite VII of female deeply, subtriangularly emarginate (cf. Figs 26, 28, 32); tergite VIII (Fig. 27: t₈) short, narrowly desclerotized along midline.

External male genitalia. Genital capsule (Figs 12–15) relatively small (more narrow than width of head), robust, simple, with dorsal sinus elongate. Paramere (Figs 16–17, 22–23) simple, relatively narrow, S-shaped, gradually tapering towards apex. Phallus described in detail for *H. altilabris*.

External female genitalia (Figs 28–31). Valvifers VIII subtriangular; laterotergites IX subhorizontal, mesal margin subtruncate; ectodermal genital tracts described in detail for *H. altilabris*.

Postgenital abdomen. Male: proctiger elongate, concealing dorsal sinus of posterior aperture of genital capsule in rest, weakly trilobate apically (Figs 13, 15). Female: segment X transversally subdivided into two secondary segments (Fig. 29: t_{10-p} , t_{10-d}) and each of these secondary segments subdivided into a pair of contralateral sclerites along midline.

Distribution and diversity. The genus previously contained only the type species occurring in northern Borneo. Another species is described in the present paper from Peninsular Malaysia (Perak).

Hemitrochostoma altilabris Bergroth, 1913

Figs 5–6, 9–13, 16–21, 24–31

Hemitrochostoma altilabris Bergroth, 1913: 177. Syntype(s) (male): [Malaysia:] Borneo, Sarawak, Trusan; depository unknown (see Discussion).

Inflatilabrum lambirensense Tomokuni, 2012: 40. Holotype (male): Malaysia: Borneo, Sarawak, Lambir Hills National Park, Inoue Trail; NSMT. **New subjective synonym.**

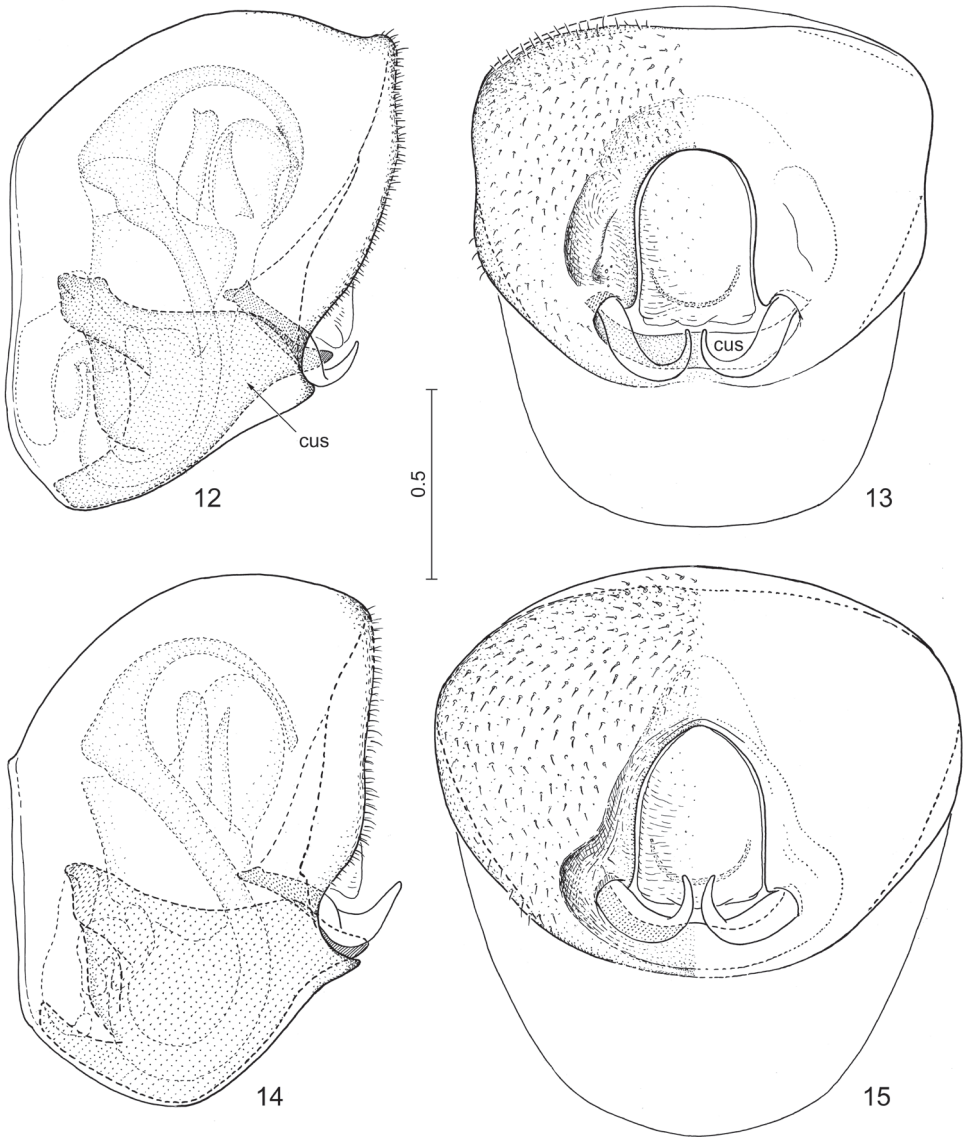
References. Rédei and Bu 2013: 272 (morphology).

Material examined. MALAYSIA. **Borneo:** Sarawak, Kapit Distr., env. of Rumah Ugap, valley of Sur River, 3–9.iii.1994, leg. P. Bílek (3 males 3 females ZJCP, 1 male 1 female HNHM).

Diagnosis. Differs from the only known congener, *H. rutabulum* sp. n., by the less-dilated mandibular plates in both sexes and the less-produced anterior angles of the pronotum (not extending to anterior margin of eye in dorsal view) (Figs 5–6).

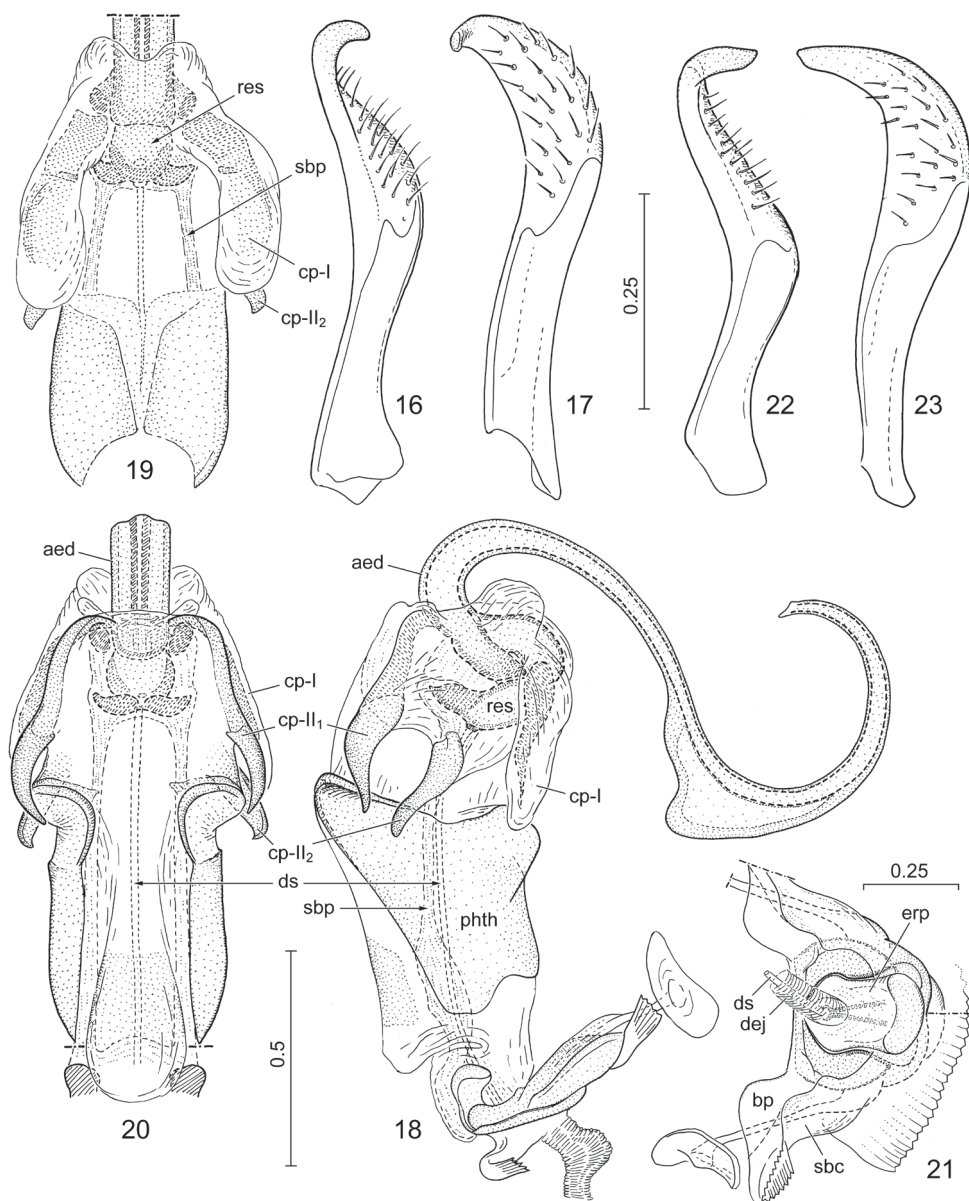
Redescription. Male and female. Photographs of the habitus and diagnostic characters of both sexes were presented by Tomokuni (2012) under the name *Inflatilabrum lambirensense*.

Colour and integument. Dorsum of body brown, following parts ochraceous: mandibular plates except their narrow lateral margin, a middorsal vitta between base of clypeus and base of head usually narrowing towards base of head; explanate lateral margin, a pair of transverse submedian fasciae between collar and calli, some suffused spots at posterior margin of calli, and humeral tubercles on pronotum; a pair of distinct or indistinct spots at basal tumescence and occasionally an indistinct median vitta on disk of scutellum; visible portion of costal margin of fore wing; lateral and posterior margins of scutellum broadly marmorated with ochraceous of various extent; legs ochraceous, antennae slightly darker, brownish ochraceous; venter of head brown, ventrally visible surfaces of mandibular plates and clypeus ochraceous, labium ochraceous, ventrally visible portions of thorax and abdomen brown, explanate lateral margin of propleuron ochraceous, abdominal ventrites somewhat lighter brown than pterothoracic pleura, lateral margin and an adjoining



Figures 12–15. *Hemitrochostoma* spp., genital capsule with phallic organs and postgenital abdomen.

12 *H. altilabris* Bergroth, 1913, posterior view **13** same, posterior view **14** *H. rutabulum* sp. n., lateral view **15** same, posterior view. Lettering: cus = cuplike sclerite. Scale in mm.



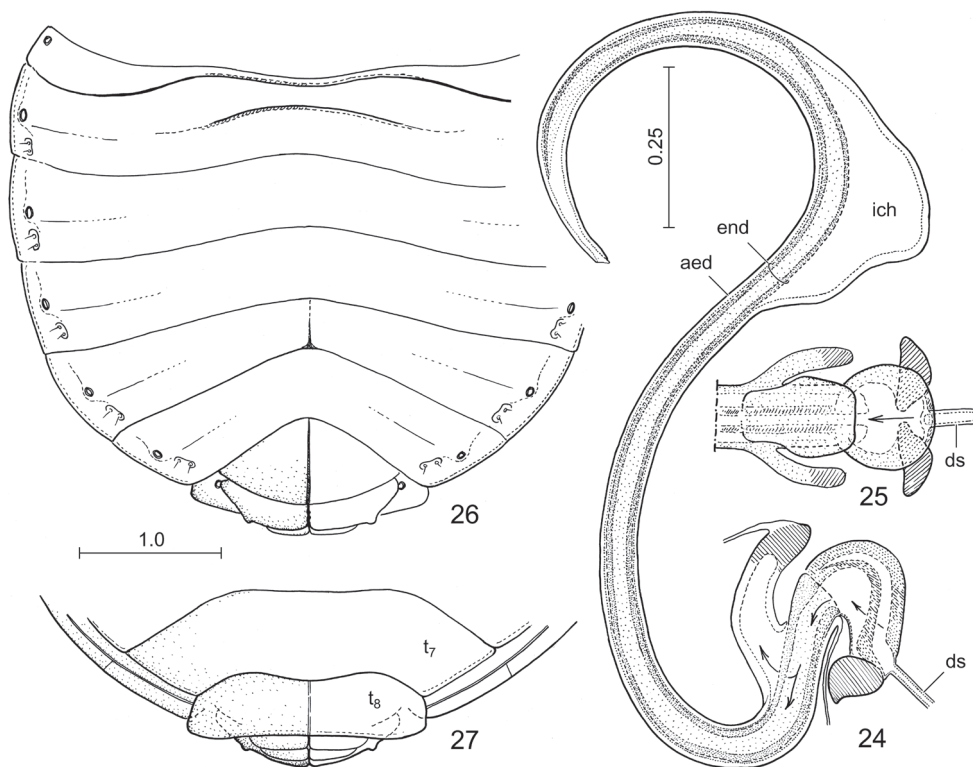
Figures 16–23. *Hemitrochostoma* spp., external male genitalia. **16–21** *H. altilabris* Bergroth, 1913 **22–23** *H. rutabulum* sp. n. **16–17**, **22–23** left paramere **18** phallus, lateral view **19** same, dorsal view, articulatory apparatus and most of aedeagus removed **20** same, ventral view **21** articulatory apparatus. Lettering: aed = aedeagus, bp = basal plates, cp-I, cp-II₁, cp-II₂ = conjunctival processes (see text), dej = ductus ejaculatorius, ds = ductus seminis, erp = erection fluid pump, res = endophallic reservoir, sbc = support bridge complex, sbp = support bridge prolongation. Scales in mm.

sublateral spot at anterior margin of each of ventrites III–VII ochraceous. Integument and vestiture as in the generic description.

Structure. Head (Figs 5–6) with lateral margin of mandibular plates weakly (male) or insignificantly (female) emarginate anteriorly of eye, then more or less straight, slightly diverging anteriorly (male) or subparallel (female), apically abruptly truncate (male, female). *Pronotum* (Figs 5–6) with anterolateral angles distinctly produced anteriorly but not reaching anterior margin of eye (male, female). Other characteristic of the exoskeleton as in generic description. A detailed description, habitus photos and photos of diagnostic characters of both sexes were provided by Tomokuni (2012) under the name *Inflatilabrum lambirensis*.

External male genitalia. Genital capsule (Figs 12–13) with a pair of weak lateral notches in posterior view, therefore lateral margins appearing weakly emarginate in most exposed view; cuplike sclerite (Fig. 12–13: *cus*) large, occupying most of ventral inner surface of genital capsule, visible as a transverse rim-like plate along ventral margin of posterior aperture of genital capsule in posterior view. Paramere as in Figs 16–17. Phallus (Figs 18–21, 24–25): support bridge complex (Fig. 21: *sbc*) and basal plates (Fig. 21: *bp*) strongly fused, without window-like interspace between them, each with a pair of robust, laterally directed arms dorsally; erection fluid pump (Fig. 21: *erp*) short; support bridge prolongation (Figs 18–19: *sbp*) forming a pair of rather thin bands running parallel with ductus seminis (Figs 18, 20: *ds*); phallosome (Fig. 18: *phth*) dorsally and laterally sclerotized, ventrally membranous, sclerotized lateral wall produced into a pair of rounded lobes ventrodistally (cf. Figs 18, 20); conjunctiva voluminous, greatly membranous, provided with a pair of dorsolateral membranous, partially sclerotized processes (probably homologous with *cp-I* of Tsai et al. 2011) (Figs 18–20: *cp-I*) and a pair of lateral processes which are broadly membranous proximally but terminating in 2 strongly sclerotized, long, spine-like projections distally (Figs 18–20: *cp-II₁* and *cp-II₂*); endophallic reservoir (Figs 18–19: *res*) small, with a pair of ventral protuberances associated with distal parts of support bridge prolongation, separated by basal portion of aedeagus s. str. by a deep, narrow incision; aedeagus s. str. (Figs 18, 20, 25: *aed*) greatly elongate, narrow, tubular, strongly curved in an S-shape in the sagittal plane, narrowly enclosing the tubular endophallic duct (Fig. 24: *end*) in most of its length except in the area of a strongly elevated, carina-like dorsal lump immediately distad of its middle which encloses an inner chamber (Fig. 24: *ich*); apex of aedeagus s. str. obliquely truncate.

External female genitalia. Posterolateral margins of valvifers VIII (Fig. 28: *vf₈*) (adjacent with ventrite VII) nearly straight; laterotergites IX (Fig. 28: *lt₉*) subhorizontal, relatively narrow; gynatrium (Fig. 30: *gy*) short, transverse, contralateral ring sclerites (Fig. 30: *rs*) fused into a single uninterrupted ring; spermatheca (Fig. 29: *sth*, Fig. 31): proximal portion of spermathecal duct broad, thick-walled, with a broad lumen, gradually narrowed in its middle portion, distally narrow, tubular; intermediate part of spermatheca short and thick, flexible zone occupying about its proximal half; proximal and distal flanges relatively small; distinct septum and fretum present; apical receptacle simple, globose.



Figures 24–27. *Hemistrochostoma altilabris* Bergroth, 1913. **24** aedeagal complex, lateral view **25** proximal portion of the aedeagal complex, dorsal view **26** abdomen of female, ventral view **27** same, posterior portion, dorsal view. Lettering: aed = aedeagus, ds = ductus seminis, end = endophallic duct, ich = inner chamber, t_7 , t_8 = tergites VII and VIII. Arrows in Figs 24–25 show the pathway of the sperm. Scales in mm.

Measurements (in mm) (3 males / 3 females). Body length 6.2–6.5 / 6.0–6.4; median length of head to apex of clypeus 1.48–1.54 / 1.42–1.50, to apex of mandibular plates 1.68–1.80 / 1.70–1.75, greatest width across mandibular plates subapically 1.52–1.58 / 1.38–1.42, width across eyes 1.76–1.78 / 1.78–1.81, interocular distance 1.34–1.36 / 1.33–1.39, interocellar distance 0.66–0.67 / 0.64–0.71, oculo-ocellar distance 0.27–0.30 / 0.30–0.33; lengths of antennal segments I : IIa : IIb : III : IV as 0.59–0.68 / 0.58–0.64 : 0.10–0.12 / 0.09–0.10 : 0.96–1.01 / 0.93–0.96 : 0.80–0.84 / 0.82–0.86 : 0.92–0.95 / 0.86–0.96; median length of pronotum 1.62–1.66 / 1.60–1.72, humeral width 3.41–3.50 / 3.56–3.68; median length of scutellum 3.08–3.10 / 3.16–3.45, greatest width 3.58–3.66 / 3.92–4.00.

Immatures. Description and photograph of the 5th-instar larva were presented by Tomokuni (2012) under the name *Inflatilabrum lambirensis*.

Distribution. The species is known only from a few localities, all in Sarawak, Borneo, Malaysia. — **MALAYSIA. Borneo: Sarawak:** env. of Rumah Ugap!, Trusan (Bergroth 1913), Lambir Hills National Park (Tomokuni 2002) (Fig. 33).

Bionomics. The bionomics of *H. altilabrum* (as *Inflatilabrum lambirens*) was discussed by Tomokuni (2012). The species feeds on sap of the trunks of *Dryobalanops aromatica* C.F.Gaertn. (Dipterocarpaceae) and another, unidentified tree species. Adults and larvae live in shelters under dead peeling bark of the lower regions of the trunk created by mutualistic ants (Formicidae: *Camponotus* spp.).

Discussion. *Hemitrochostoma altilabris* was described based on an unspecified number of specimens (all males). The type depository was not indicated in the original description (Bergroth 1913). The type(s) could not be located in the Zoological Museum of the University of Helsinki (L. Huldén, pers. comm.) currently housing most of the types of E. Bergroth (Schuh and Slater 1995), and also was not found in other important depositories of Bergroth types: the Zoological Museum of the Humboldt University of Berlin (J. Deckert, pers. comm.), the Senckenberg Deutsches Entomologisches Institut in Müncheberg (S. Blank, pers. comm.), the HNHM, the Naturhistorisches Museum in Vienna, and the Natural History Museum in London (all of them visited by DR). Because the specimens examined by us were collected rather close to the type locality, and the males are in agreement with the description and illustrations of Bergroth (1913), they are readily identified as *H. inflatilabrum*. Although the type material currently cannot be located, so far there is no doubt about the identity of this species and, therefore, designation of a neotype is not justified.

The detailed original description and illustrations of *Inflatilabrum lambirens* leave no doubt that this species is conspecific with *H. altilabris*; therefore, the following new subjective synonymies are proposed: *Hemitrochostoma* Bergroth, 1913 = *Inflatilabrum* Tomokuni, 2012, syn. n.; *H. altilabris* Bergroth, 1913 = *I. lambirens* Tomokuni, 2012, syn. n.

***Hemitrochostoma rutabulum* sp. n.**

<http://zoobank.org/6DFEDCDD-916B-45A6-B33D-24169E88FA6E>

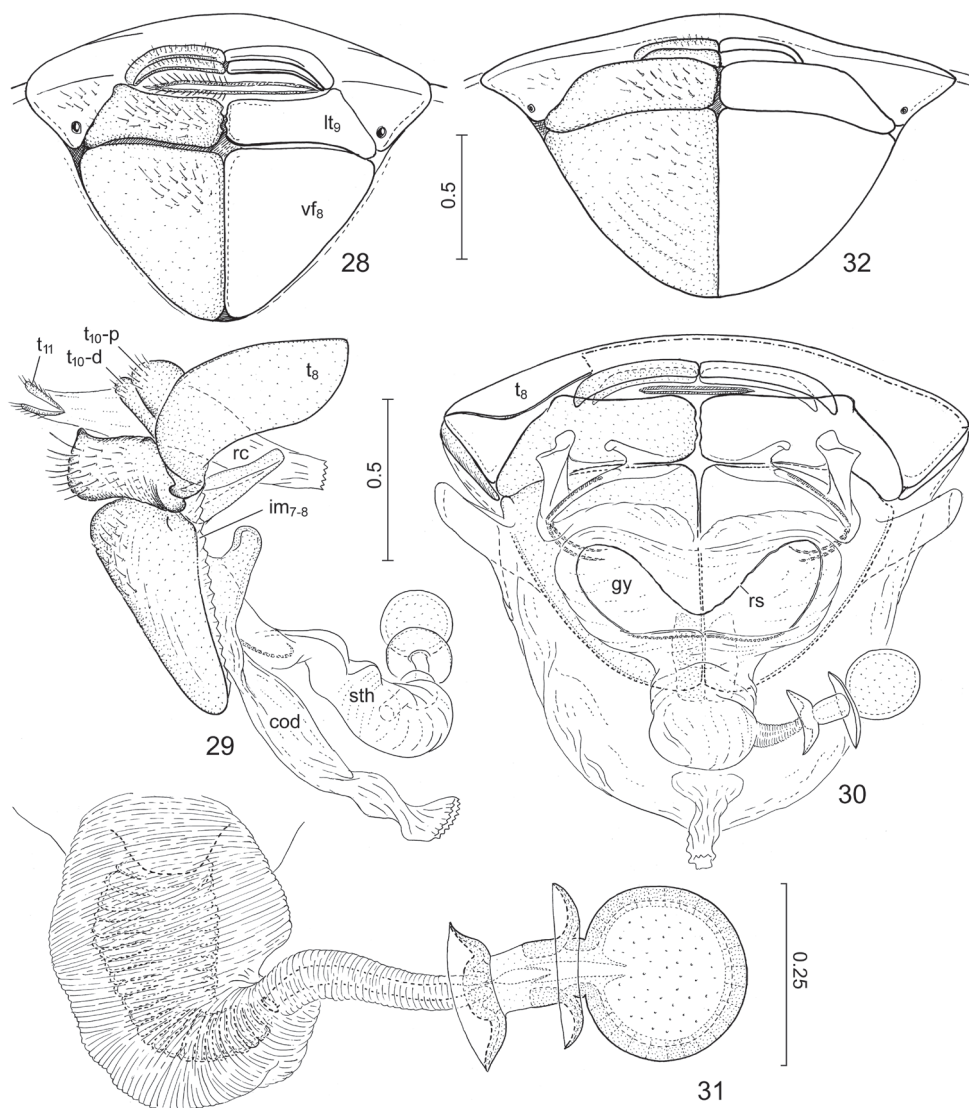
Figs 1–4, 7–8, 14–15, 22–23, 32

Type material. Holotype (male): “MALAYSIA - Perak \ Banjaran Bintang \ Maxwell Hill (Taiping) \ 18. - 19.2.1997 \ Ivo Jeniš”. Mounted on card, tarsus and apical half of tibia of right hind leg lacking, genitalia preserved in plastic microvial filled with glycerol pinned with the specimen, deposited in ZJCP. Paratype: same label as for holotype; intact (1 female, ZJCP).

Diagnosis. Easily distinguished from the only known congener, *H. altilabris* by the much more strongly dilated mandibular plates, particularly in the male (Fig. 7) but also in the female (Fig. 8), and the more produced anterior angles of the pronotum (surpassing anterior margins of eyes in both sexes) (Figs 7, 8). The ground colour of the two examined specimens is considerably darker than in *H. altilabris*, and the scutellum is not marmorated with ochraceous along its lateral and posterior margin.

Description. Macropterous male and female.

Colour and integument. Dorsum of body brown, following parts ochraceous: mandibular plates, clypeus and a confluent middorsal vitta running to base of head; ex-



Figures 28–32. *Hemistrochostoma* species, external female genitalia. **28–31** *H. altilabris* Bergroth, 1913 **32** *H. rutabulum* sp. n. **28, 32** terminalia, posterodorsal view **29** individualized segments VIII–XI, lateral view **30** same, anterodorsal view **31** spermatheca. Lettering: cod = common oviduct, gy = gynatrium, im_{7-8} = intersegmental membrane between segments VII and VIII, lt_9 = laterotergite IX, rc = rectum, rs = ring sclerite, sth = spermatheca, t_8 = tergite VIII, t_{10-p} , t_{10-d} = proximal and distal portions of tergite X, respectively, t_{11} = tergite XI, vf_8 = valvifer VIII. Scales in mm.

planate lateral margin, a pair of transverse submedian fasciae between collar and calli, weak suffusion at posterior margin of calli and on humeral tubercles, and an indistinct median vitta on disk of pronotum; visible portion of costal margin of fore wing; a pair of distinct or indistinct spots at basal tumescence, and a narrow vitta along midline



Figure 33. Distribution of *Hemitrochostoma* species. Circles: *H. altilabris* Bergroth, 1913; square: *H. rutabulum* sp. n. Red symbol represent record based on specimens examined by us, white symbols represent literature data.

starting slightly posteriad of basal tumescence and fading away before posterior margin of scutellum; legs ochraceous, antennae slightly darker, brownish ochraceous; venter of head brown, ventrally visible surfaces of mandibular plates and clypeus ochraceous, labium ochraceous, thoracic pleura (except explanate lateral portion of propleuron) and abdomen dark brown, lateral margin and an adjoining sublateral spot at anterior margin of each of ventrites III–VII ochraceous. Integument and vestiture as in the generic description.

Structure mainly as in generic description. *Head* with lateral margin of mandibular plates distinctly emarginate anteriad of eye (male, female), then strongly broadened, anteriormost portion rounded. Pronotum with anterolateral angles strongly produced anteriad, distinctly surpassing anterior margin of eye in both sexes but more strongly in male.

External male genitalia. Genital capsule (Figs 14–15) broadly rounded laterally. Paramere as in Figs 22–23. Phallus generally similar to that of *H. altilabris*, it was not examined in detail.

Female terminalia (Fig. 32). Posterior margin of ventrite VIII more broadly emarginate than in *H. altilabris*, proximal margin of valvifer VIII rather rounded; laterotergite IX distinctly broader than that of *H. altilabris*. The single available female was not dissected.

Measurements (in mm) (holotype male / paratype female). Body length 6.6 / 6.6; median length of head to apex of clypeus 1.58 / 1.57, to apex of mandibular plates 2.00 / 1.84, greatest width (across mandibular plates subapically) 1.82 / 1.40, width across eyes 1.78 / 1.76, interocular distance 1.31 / 1.30, interocellar distance 0.64 /

0.66; oculo-ocular distance 0.33 / 0.31, lengths of antennal segments I : IIa : IIb : III : IV as 0.74 / 0.63 : 0.12 / 0.11 : 0.82 / 0.78 : 0.86 / 0.76 : 1.01 / 0.90; median length of pronotum 1.40 / 1.76, humeral width 3.50 / 3.72; median length of scutellum 3.10 / 3.75, greatest width 3.66 / 4.25.

Etymology. The specific epithet of the new species is the Latin noun *rutabulum* meaning 'shovel or spatula' (for cooking), referring to the broad, spade-like head of both sexes but particularly the male. Noun in apposition, not to be declined.

Distribution. The species is known only from the type locality in Perak, Peninsular Malaysia (Fig. 33).

Bionomics. Unknown.

Discussion

The systematic relationships of *Hemitrochostoma* are uncertain. Morphological similarities of *Hemitrochostoma* and *Labroplatys* Rédei & Bu, 2013 were discussed by Rédei and Bu (2013).

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We are grateful to Jing-Fu Tsai (Hokkaido University, Sapporo) for comments on the manuscript. This study received financial support from the National Natural Science Foundation of China (grant no. 31472024) and the One Hundred Young Academic Leaders Program of Nankai University to DR.

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An annotated catalogue of the types of Chrysididae (Hymenoptera) at the Swedish Museum of Natural History, Stockholm, with brief historical notes

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Abstract

A critical and annotated catalogue of 72 types of Chrysididae (Hymenoptera) belonging to 53 species and subspecies housed in the Swedish Museum of Natural History is given. The lectotypes of *Chrysis diversa* Dahlbom, 1845, *C. soror* Dahlbom, 1854, *Chrysura sulcata* Dahlbom, 1845 and *Holopyga amoenula* Dahlbom, 1845 are designated. The previous lectotype of *Chrysis diversa* Dahlbom, 1845 is set aside. Five new synonymies are proposed: *Chrysis elegans* var. *smaragdula* Trautmann, 1926 (currently *C. elegans* ssp. *interrogata* Linsenmaier, 1959 repl. name for *smaragdula* Trautmann, nec Fabricius, 1775), **syn. n.** of *C. confluens* (Dahlbom, 1845); *C. eximia* Mocsáry, 1889, **syn. n.** of *C. poecila* Mocsáry, 1889; *C. pyrrhina* Dahlbom, 1845, **syn. n.** of *C. erythromelas* Dahlbom, 1845; *C. separata* Trautmann, 1926, **syn. n.** of *C. lateralis* Dahlbom, 1845; *C. sicula* Abeille de Perrin, 1877, **syn. n.** of *C. erythromelas* Dahlbom, 1845. *Chrysis serena* Radoszkowski, 1891 is the first available name for *C. pyrrhina sensu auctorum*. *C. erythromelas* Dahlbom, 1845 is reevaluated as valid species. The neotype of *Chrysis inaequalis* Dahlbom, 1845 is designated in the Linsenmaier collection (NMLS). Illustrations of 34 types are given.

Keywords

Chrysididae, catalogue, neotype designation, lectotype designation

Introduction

The Chrysididae collection in the Swedish Museum of Natural History (NHRS) is an important historical collection in Europe that includes several types described by Dahlbom and other authors. It is divided in three parts: the general collection, the Swedish collection and the type collection. A few specimens (294 specimens) of Chrysididae can be found in separate historical collections (Boheman's collection).

The general collection consists of 15 drawers that were reorganized by the first author in 2012 in taxonomical and alphabetical order *sensu* Kimsey and Bohart (1991) and it includes about 1700 specimens. The Swedish collection consists of 19 drawers and 1762 specimens belonging to about 50 taxa. All the type specimens were labelled with red type labels and transferred to the type collection, which currently includes 72 types belonging to 53 species and subspecies: 30 holotypes, 20 paratypes, 7 syntypes, 6 lectotypes and 9 paralectotypes. Unfortunately, the original identification labels by Dahlbom are lost, probably removed after a subsequent reorganization of the collection in the nineteenth century. For this reason we encountered some difficulties in identifying some original types (e.g. *Platycelia ehrenbergi* and *Stilbum wesmaeli*).

Dahlbom (1845) did not list all the examined specimens, but he used different Latin words related to the frequency at which he encountered the examined species: *vulgatissima* (very common), *vulgar* (common), *freq.* (= *frequentes*, frequent), *pl. min. freq.* (*plus or minus frequentes*, more or less frequent), *pass.* (= *passim*, literally 'here and there'), *rar.* (= *rarus*, used when he examined few specimens) and *rariss.* (= *rarissima*, when he examined only one specimen). These characterisations were taken into consideration when studying the type material. At that time, the Code of Zoological Nomenclature was not yet published, and Dahlbom (1845, 1854) did not follow the "Principle of Priority". In some cases, he changed the priority of species previously described. These changes led to confusion among the following authors, as shown in the remarks (e.g. *Chrysis mediocris*, *Hedychridium cupreum*, *Holopyga amoenula*). In other cases he changed the original description, after the examination of further material (e.g. *Chrysis sulcata*).

The present paper is mainly focused on the type material described by Dahlbom, but also includes other Chrysidid types described by authors after Dahlbom and housed at the Swedish Museum of Natural History (NHRS). Cameron (1910) and Hammer (1950) described some species and dedicated two new species to Yngve Sjöstedt, the professor and curator of the entomology department of the NHRS: *Chrysis sjostedti* Cameron and *Cleptes sjostedti* Hammer. Some paratypes were donated by Linsenmaier (1959a), who was in contact and exchanged several specimens with Stellan Erlandsson and the Gaunitz family. In the 1960s the museum loaned some exotic specimens to the Swiss entomologist Walter Linsenmaier, who described a new species (*Chrysis tenuimediata* Linsenmaier, 1968). A great part of that loan remained unidentified and was sent back to the Museum after Linsenmaier's death. The Finnish entomologist Erikki Valkeila (1971) deposited the holotype of *Chrysis corusca* and the paratype of *C. scintillans* here. Valkeila was very active and identified many specimens in the NHRS

Chrysididae collection. In the 1980s Bohart borrowed some African types, and kindly deposited some paratypes of Nearctic species. It is unclear how two types by Balthasar (1957) arrived in the collection.

Anders Gustaf Dahlbom was born in Herrberga parish in Östergötland County on March 3, 1806. From his father, the surgeon Anders Dahlbom, he inherited a strong interest in insects (Svenskt Biografiskt Lexikon 2013). He matriculated at Lund University in 1825, studied natural history, medicine and pharmacology and completed his master's degree (Dahlbom 1829), with a thesis on Chrysididae (*Monographia Chrysidum Sveciae*). He became a docent of natural history in 1830 in Lund and from 1843 lecturer in entomology as well as curator of the entomological collections at the Museum of Zoology at Lund University. In 1857, two years before he died, Dahlbom was appointed professor (Dal 1996). Dahlbom was a pioneer in applied entomology and wrote a handbook for farmers and naturalists about common benefits and potential problems with the Scandinavian insects that can be found in and around a house or farm (Dahlbom 1838). However, most of his works are on systematic entomology and are characterized by careful descriptions and sharp-eyed observations (Svenskt Biografiskt Lexikon 2013). He took part in several entomological research journeys with his teacher Johan Wilhelm Zetterstedt in northern Sweden and abroad.

Dahlbom had the opportunity to visit some of the museums that were the most important in Europe at that time: Berlin (MNHU), Copenhagen (ZMUC), London (BMNH), Paris (MNHN), and his types are currently found in Berlin (MNHU), Copenhagen (ZMUC), Lund (MZLU), Stockholm (NHRS), Turin (MRSN) and Vienna (MHNW). He published his observations and studies on Chrysididae in four publications: *Exercitationes Hymenopterologicae*, *Monographia Chrysidum Sveciae* (Dahlbom 1831), *Dispositio Methodica Specierum Hymenopterorum. Particula II – Chrysis in sensu Linnaeano* (Dahlbom 1845), *Syd-Africanska Chrysidides* (Dahlbom 1850), *Hymenoptera europaea praecipue borealia* (Dahlbom 1854). The latter is considered a landmark in the study of Chrysididae. For the first time he provided keys to genera and species and an attempt to organize all the known information on Chrysidids at that time. In total he described 213 new species (Dahlbom 1854) of which more than 150 are still valid (Kimsey and Bohart 1991), and his descriptions were used as models for that time. Dahlbom examined Fabricius' types deposited at Kiel (ZMUC) and in Vienna (MHNW), Klug's types in Berlin (MNHU) and Spinola's types from his private collection (MRSN, Rosa and Xu 2015). Dahlbom passed away on May 3, 1859, in Lund. Most of his large collection, his library, a rich archive of correspondence with international and national researchers, and a catalogue of the collections and their history were donated to the entomological collections in Lund (MZLU) (Svenskt Biografiskt Lexikon 2013).

Material and methods

Terminology and classification of the genera follows Kimsey and Bohart (1991). Classification of species follows Fauna Europaea (Rosa and Soth 2012), Linsenmaier (1959,

1968, 1987, 1997a, 1997b, 1999), Rosa (2006), Van der Smissen (2010) and Móczár (1998a, b), for the genus *Cleptes*. These works have been taken in consideration also for the reorganization of the general collection. The 4th edition of the International Code of Zoological Nomenclature (ICZN), in effect since 1st January 2000, has been applied to the present work.

The type list is arranged alphabetically and the following data are given: name of the species and of the author, the complete reference of the description, type locality, current systematic placement, category of the type, number and sex of specimens, complete label, in which handwritten text is given in italics; labels are separated from each other by square brackets; a stroke marks the end of a line. The state of preservation is given only in case of damaged types.

Only selected types were illustrated, such as the newly designated neotype and lectotypes. Pictures of the types were taken with Nikon D-80 connected to the stereomicroscope Tegal SCZ and stacked with the software Combine ZP (by Paolo Rosa); the white calibration of the photcamera was applied to reduce the blue effect of the neon light of the Tegal microscope. Two pictures were taken with Canon EOS 7D combined with the software Zerene Stacker (“HV” photos = by Hege Vårdal).

All the chrysidid types housed at the NHRS were labelled with NHRS-HEVA catalogue numbers and databased in the DINA-system used by several Swedish natural history collections. This data is presented on Naturarv which is the Search Portal for Natural History Collections in Sweden (www.naturarv.se). GBIF harvest data from this system on a regular basis. High resolution photographs of the types presented in this paper will be uploaded on the database of biological images Morphbank (www.morphbank.net).

Other specimens examined or discussed are deposited in the following institutions:

BME	Bohart Museum of Entomology, University of California, Davis, USA.
BMNH	The Natural History Museum, London, United Kingdom.
HNHM	Hungarian Natural History Museum, Budapest, Hungary.
ISEA–PAS	Invertebrate collections of the Institute of Systematics and Evolution of Animals, Polish Academy of Sciences in Krakow, Poland.
MNHN	National Museum of Natural History, Paris, France.
MNHU	Museum of Natural History of the Humboldt-Universität, Berlin, Germany.
MRSN	Regional Museum of Natural Science, Turin, Italy.
MZH	Finnish Museum of Natural History, University of Helsinki; Helsinki, Finland.
MZLU	Lund Zoological Museum, University of Lund, Sweden.
NHMW	Natural History Museum, Vienna, Austria.
NHRS	Swedish Museum of Natural History, Stockholm, Sweden.
NMLS	Natur-Museum, Luzern, Switzerland.
NMPC	National Museum of Natural History, Prague, Czech Republic.
ZMUC	Zoological Museum, University of Copenhagen, Denmark.
ZMUK	Zoological Museum, University of Kiel, Germany.

Catalogue of the types in NHRS

Argochrysis albicornis Bohart, 1982

Argochrysis albicornis: Bohart (in Bohart & Kimsey) 1982: 189.

Type locality. U.S.A. (holotype from Borrego Valley, San Diego Co., California; paratypes: 44 ♂♂ and 58 ♀♀ from California and Nevada).

Paratype 1 ♂. [1,000 Palms Cyn., Cal. Riverside Co. IV-9-1964] [R.M. Bohart collector] [Paratype *Argochrysis albicornis* ♂ R.M. Bohart] <red label> [NHRS-HE-VA000001057].

Paratype 1 ♀. [Calif 2 mi E Lone Pine Inyo Co. V-19-1970] [E.E. Grissell Colr] [Paratype *Argochrysis albicornis* ♀ R.M. Bohart] <red label> [NHRS-HE-VA000001058].

Remarks. The holotype is deposited at the BME.

Current status. *Argochrysis albicornis* Bohart, 1982.

Argochrysis armilla Bohart, 1982

Argochrysis armilla: Bohart (in Bohart & Kimsey) 1982: 189.

Type locality. U.S.A. (holotype from Sagehen Creek, Nevada Co., California; paratypes 42 ♂♂ and 41 ♀♀ from the same locality).

Paratype 1 ♂. [Sahegen Crk Cal. Nevada Co. VI 25 1966] [R.L. Brumley Coll.] [Paratype *Argochrysis armilla* ♂ R.M. Bohart] <red label> [NHRS-HEVA000001063].

Paratype 1 ♀. [Sahegen Crk Nevada Co. Cal. VII 13 68] [RM Bohart Colr.] [Paratype *Argochrysis armilla* ♀ R.M. Bohart] <red label> [NHRS-HEVA000001064].

Remarks. The holotype is deposited at the BME.

Current status. *Argochrysis armilla* Bohart, 1982.

Argochrysis litura Bohart, 1982

Argochrysis litura: Bohart (in Bohart & Kimsey) 1982: 193.

Type locality. U.S.A. (holotype from Tanbark Flat, Los Angeles Co., California; paratypes 34 ♂♂ and 99 ♀♀ from Arizona, California and Idaho).

Paratype 1 ♀. [Arroyo Seco Camp Calif. Monterey Co. V-15-1973] [C. Goodpasture Colr] [Paratype *Argochrysis* ♀ *litura* R.M. Bohart] <red label> [NHRS-HE-VA000001096].

Remarks. The holotype is deposited at the BME.

Current status. *Argochrysis litura* Bohart, 1982.

***Ceratochrysis concava* Bohart, 1982**

Ceratochrysis concava: Bohart (in Bohart & Kimsey) 1982: 172.

Type locality. U.S.A. (holotype from Whitewater, Riverside Co., California; paratypes 20 ♂♂ and 32 ♀♀ from Arizona, California, Nevada).

Paratype 1 ♂. [Mt. Diablo Cal. V-12-39] [G.E. Bohart Collector] [Paratype *Ceratochrysis concava* ♂ R. Bohart] <red label> [NHRS-HEVA000001068].

Paratype 1 ♀. [Mt. Diablo, Cal. V-16-40] [J.W. MacSwain Collector] [Paratype *Ceratochrysis concava* ♀ R. Bohart] <red label> [NHRS-HEVA000001069].

Remarks. The holotype is deposited at the BME.

Current status. *Ceratochrysis concava* Bohart, 1982.

***Ceratochrysis minata* Bohart, 1982**

Ceratochrysis minata: Bohart (in Bohart & Kimsey) 1982: 177.

Type locality. U.S.A. (holotype from Davis, California; paratypes 34 ♂♂ and 30 ♀♀ from Alberta, California, Colorado, Idaho, Nevada, Nebraska, New Mexico, Oregon, Texas and Wyoming).

Paratype ♂. [Tracy, Calif. San Joaquin Co. V-26 1949] [J.W. MacSwain Collector] [Paratype *Ceratochrysis minata* ♂ R. Bohart] <red label> [NHRS-HEVA 000001109].

Paratype ♀. [Tracy, Calif. San Joaquin Co. VI-3 1949] [J.W. MacSwain Collector] [Paratype *Ceratochrysis minata* ♀ R. Bohart] <red label> [NHRS-HEVA000001110].

Remarks. The holotype is deposited at the BME.

Current status. *Ceratochrysis minata* Bohart, 1982.

***Chrysis bohemani* Dahlbom, 1845**

Plate 1

Chrysis Bohemani: Dahlbom 1845: 12.

Type locality. South Africa: “Port Natal”.

Holotype ♀ (not ♂): [Caffraria] [J. Wahlb.] [Type] [*Bohemani* (sic) *Dahlb.*] [275 82] <red label> [NHRS-HEVA000001065].

Remarks. The type is a female, with the tip of the ovipositor visible. The species is dedicated to Carl Henrik Boheman (1796–1868) a Swedish entomologist. Therefore the correct name should be *bohemani* and not *bohemanni*. However, according to the Code (ICZN 1999: Article 32.5.1) in the original publication there is no clear evidence of an inadvertent error; moreover (ICZN 1999: Article 32.5.1.1), at the end of the same pub-



Plate 1. *Chrysis bohemannii* Dahlbom, 1845, holotype. **A** Metasoma, dorsal view **B** head, frontal view.

lication (Dahlbom 1845), a *corrigendum* is given including the correction of the name *Scönherri* in *Schönherri*, but not the correction of the name *bohemannii*. Furthermore, in the following volume (Dahlbom 1854), Carl Henrik Boheman is cited in the introduction and in the text, but Dahlbom went on using the name *Chrysis bohemannii*, fixing the wrong spelling, which is in current use (Bohart 1988; Madl and Rosa 2012; Strumia 2009).

Current status. *Trichrysis bohemannii* (Dahlbom, 1845) (transferred by Bohart 1988: 349).

Chrysis ciscirtana Linsenmaier, 1959

Chrysis ciscirtana: Linsenmaier 1959: 97.

Type locality. Palestine.

Paratype 1 ♂. [Jerusalem 5.V.43 Palestina Houska lgt.] [*Paratype* *Chrysis* L. *ciscirtana* Lins. ♂ Linsenmaier det. 59] <handwritten in red> [NHRS-HEVA000001067].

Remarks. The holotype is deposited in the Linsenmaier collection at the NMLS.

Current status. *Chrysura ciscirtana* (Linsenmaier, 1959) (transferred by Kimsey and Bohart 1991: 487).

Chrysis corusca Valkeila, 1971

Plate 2

Chrysis corusca: Valkeila 1971: 84.

Type locality. Sweden: “Nrk. Åsbro Lerbäck”.

Holotype ♀. [Sweden Närke Lerbäck, Åsbro 1968 G. Hallin] [390 81] <red label> [*Chrysis* ♀ *corusca* n.sp. det. E. Valkeila – 69 *Holotypus*] [NRM Sthlm Loan 2571/08] [Naturhistoriska Riksmuseet Stockholm Loan no 1483/96] [*Chrysis* ♀ *schlencki* Lins. det. O. Niehuis 1997] [NHRS-HEVA000001070].

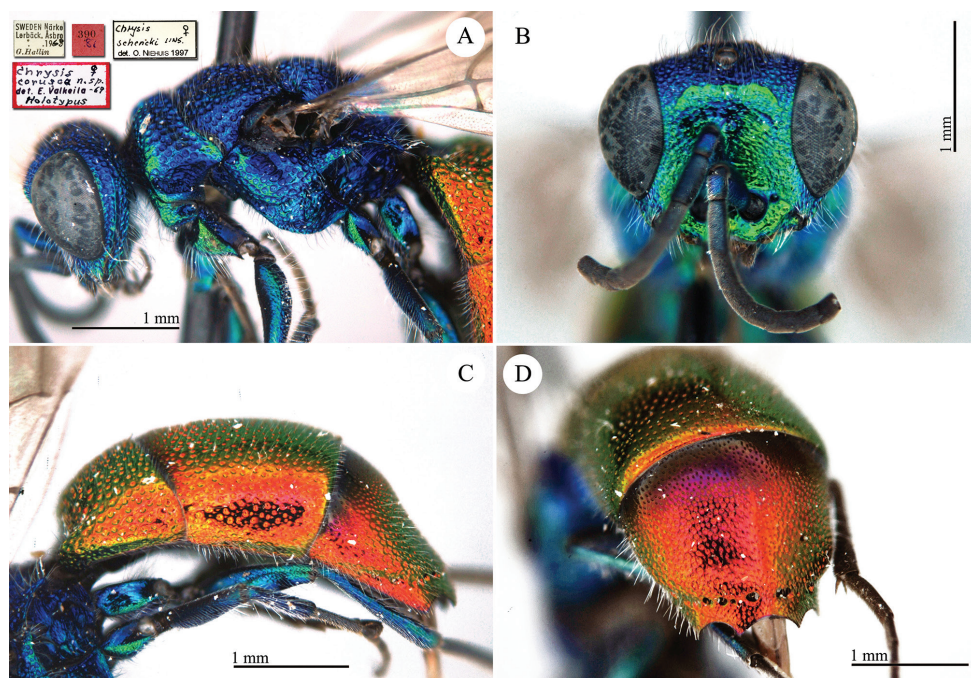


Plate 2. *Chrysis corusca* Valkeila, 1971, holotype. **A** Head and mesosoma, lateral view **B** head, frontal view **C** metasoma, lateral view **D** third metasomal tergite, dorso-lateral view.

Remarks. For a very long time *Chrysis corusca* remained an enigmatic species. Linsenmaier (1987, 1997a) did not even cite it in his revisional works on the European species. Also the most important European revisions or checklists published in the 1990s (Kunz 1994; Mingo 1994; Strumia 1995) did not include *C. corusca*. Kimsey and Bohart (1991: 400) were the first authors to include *C. corusca* in a catalogue with the status of valid species. Diagnostic characteristics were cited in the original description, Niehuis (2000: 184) found other better and usable characteristics, and later listed *C. corusca* as a valid species widely distributed in Germany (Niehuis 2001: 120). A detailed morphological analysis of this species was finally provided by van der Smissen (2010: 69) in her monographical work on the *Chrysis ignita* group. Soon and Saarma (2011) included *C. corusca* in their molecular analysis. The distribution of this species is still poorly known and related to central and north European countries (Paukkunen et al. 2014). However we do believe that *C. corusca* could have a wide distributional range and that data are missing because of misidentifications with other species within the *C. ignita* species group (Rosa et al. 2013).

In the original description Valkeila listed 3 females (holotype and 2 paratypes) from Närke Lerbäck, Åsbro (leg. G. Hallin). At the moment only the holotype is present in the general collection. The two paratypes are in Gunnar Hallin's private collection, which is scheduled for donation to the NHRS (H. Vårdal, pers. comm.).

Current status. *Chrysis corusca* Valkeila, 1971.

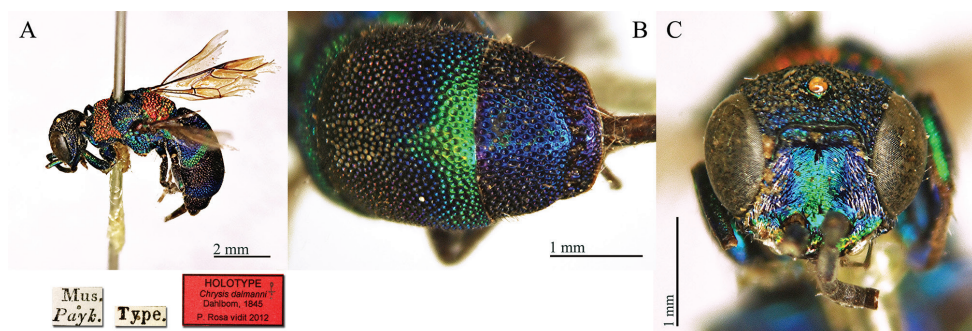


Plate 3. *Chrysis dalmanni* Dahlbom, 1845, holotype. **A** Habitus, dorso-lateral view **B** second and third metasomal tergites, dorsal view **C** head, frontal view.

Chrysis dalmanni Dahlbom, 1845

Plate 3

Chrysis Dalmanni: Dahlbom 1845: 12.

Type locality. unknown.

Holotype ♀. [Mus. Payk.] [Type] [NHRS-HEVA000001071].

Remarks. *Chrysis dalmanni* is an Afrotropical species, known from South Africa (Mocsáry 1902b: 543; Edney 1952: 432; Kimsey and Bohart 1991: 402); Lesotho is also mentioned, but without precise locality (Madl and Rosa 2012: 29). The species is dedicated to Johan Wilhelm Dalman (1787–1828), a Swedish physician and a naturalist interested in entomology and botany. Similarly to the case of *C. bohemanii*, the correct spelling should be *dalmani* and not *dalmanni*. However, also in this case (Dahlbom 1845, 1854) it is clear Dahlbom's intention to double the final "n", making the original surname with a German appearance.

Current status. *Chrysis dalmanni* Dahlbom, 1845.

Chrysis delicatula Dahlbom, 1850

Plate 4

Chrysis delicatula: Dahlbom 1850: 138.

Type locality. South Africa, Natal province.

Holotype ♀. [Caffraria] [J. Wahlb] [Type] [*Chrysis delicatula* Dahlb.] [Typus] <red label> [268 82] <red label> [NHRS-HEVA000001072].

Remarks. The type is damaged, the head is missing.

Current status. *Chrysis delicatula* Dahlbom, 1850.



Plate 4. *Chrysis delicatula* Dahlbom, 1850, holotype. **A** Habitus, lateral view **B** metasoma, dorsal view.

Chrysis diversa Dahlbom, 1845

Plate 5

Chrysis diversa: Dahlbom 1845: 13.

Type locality. Egypt.

Lectotype (here designated) ♀: [Egypt] [Hedb.] [47 86] <red label> [Riksmuseum Stockholm] <green label> <red label> [Paralectotypus *Chrysis diversa* ♀ Dahlbom 1845 des. by Bohart P. Rosa vidit 2010] <red label> [*Chrysis palliditarsis* Spinola P. Rosa det. 2010] [NHRS-HEVA000001073] (Plate 5).

Paralectotype 1 ♀. [Egypt] [Hedb.] [48 86] <red label> [Riksmuseum Stockholm] <green label> <red label> [Paralectotypus *Chrysis diversa* ♀ Dahlbom 1845 des. by Bohart P. Rosa vidit 2010] <red label> [*Chrysis palliditarsis* Spinola P. Rosa det. 2010] [NHRS-HEVA000001074].

Remarks. Dahlbom (1845: 13) described *Chrysis diversa* without any information on the type-series. Later Dahlbom (1854: 226) listed that he examined only two specimens: “*Habitat in Aegypto, a D. Hedenborg detecta. Specimina duo e Museo R. Acad. Scient. Stockholm. communicavit D. Boheman.*” In the collection three female specimens are found. They bear red labels with the numbers 47, 48, 49 and they were all collected by Hedenborg in Egypt. Two specimens are equal and belong to the species *C. palliditarsis* Spinola, 1838; whereas the third specimen, although with similar colouration and habitus, is different and belongs to the species *C. viridissima* Klug, 1845. The latter specimen is not part of the original type-series and cannot be considered as syntype. The other two specimens, found in the collection with catalogue numbers 47 (NHRS-HEVA000001073) and 48 (NHRS-HEVA000001074) can be considered as syntypes. Bohart (in Kimsey and Bohart 1991: 446) designated the lectotype of *Chrysis diversa* and placed it in synonymy with *Chrysis palliditarsis*. Unfortunately, Bohart selected the specimen not syntypic and not belonging to *C. palliditarsis* (n° 49), but the specimen belonging to *C. viridissima*. It bears the labels: [Egypt] [Hedb.] [49 86] <red label> [Riksmuseum Stockholm] <green label> [*Chrysis diversa* ♀ Dahlbom

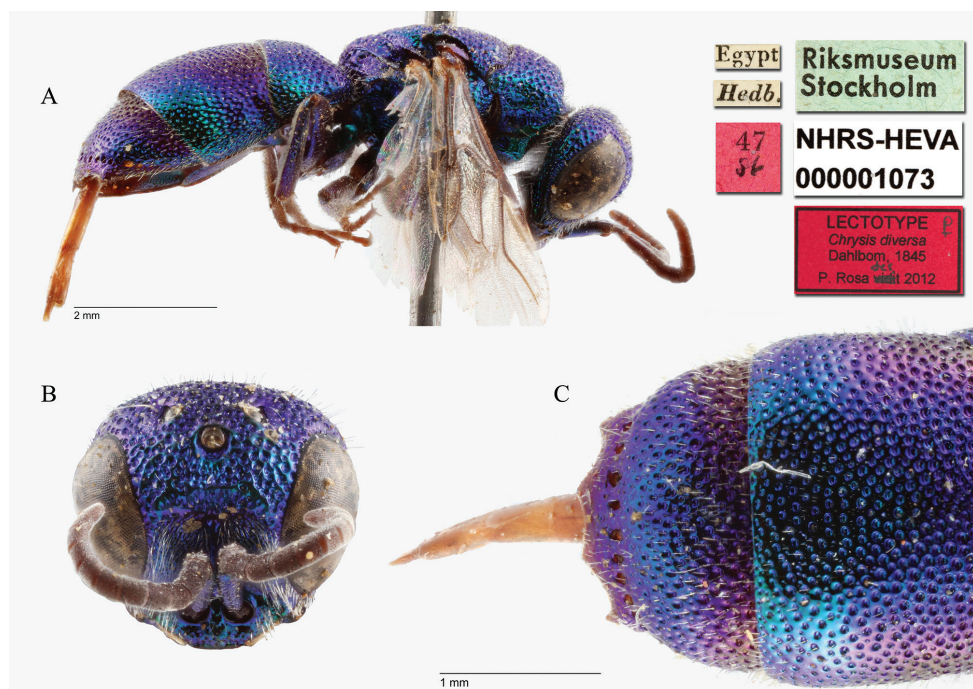


Plate 5. *Chrysis diversa* Dahlbom, 1845, lectotype (photo HV). **A** Habitus, lateral view **B** head, frontal view **C** second and third metasomal tergites, dorsal view.

Lectotype R.M. Bohart <red label> [NHRS-HEVA000001131]. This specimen must be excluded from the type-series because the anal margin is quite different from the anal margin of *C. diversa* as found in the original description: “*Abdominis segmenti 3:iii series ante-apicalis e punctis modicis non confluentibus constituta; dentes apicales breves obtusi. Corpus 2 ½ lin. long*”. All three specimens share the same shape of the pit row of the third tergite, but only two specimens have apical teeth short and more or less obtuse and their body length is “2 ½ lin.”. The female of *C. viridissima* has different anal teeth: the median ones are rounded and the lateral ones are spiniform; moreover it is longer than the other two specimens. More differences are found between the two species (e.g. the length of the malar space (Plate 5B)) but without relation to the original description. According to the ICZN (Art. 74.2) if it is demonstrated that a specimen designated as a lectotype was not a syntype, it loses its lectotype status.

We here designate one of the two female syntypes as the lectotype of *C. diversa* Dahlbom, 1845 to fix the synonym *C. diversa* Dahlbom = *C. palliditarsis* Spinola. If we would consider Bohart’s lectotype designation as valid, then the synonym *C. diversa* Dahlbom = *C. viridissima* Dahlbom would generate confusion, since *C. diversa* has the priority over *C. viridissima*, which is currently in prevailing use.

Current status. *Chrysis palliditarsis* Spinola, 1838 (synonymised by Kimsey and Bohart 1991: 446).

***Chrysis elvira* Balthasar, 1957**

Plate 6

Chrysis elvira: Balthasar 1957: 151.

Type locality. Afghanistan: “*Umgebung von Sarekanda (4100m) in Badakschan-gebirge (28. VII. 1953)*”.

Holotype ♀. [J. Klapperich Sarekanda, 4100m 28.7.53, Gebirge Badakschan NO – Afghanistan] [*Chrysis elvira* n.sp. Balth. ♀ Holotypus] <red label handwritten by Balthasar] [NHRS-HEVA000001080].

Remarks. One paratype found in the Linsenmaier Collection at the NMLS.

Current status. *Chrysis elvira* Balthasar, 1957.

***Chrysis equestris* Dahlbom, 1854**

Plate 7

Chrysis equestris: Dahlbom 1854: 307.

Type locality. unknown.

Holotype ♀. [Mus. Payk.] [Type] [Typus] <red label> [374 58] <red label> [Naturhistoriska Riksmuseet Stockholm Loan no 993/98] <green label> [NHRS-HEVA000000008].

Remarks. Dahlbom (1845: 11) described *Chrysis zetterstedti* based on a type series including male and female from Sweden and another specimen from Norway. Later Dahlbom (1854: 307) described the female as a separate species ‘*Specimen unicum e Collectione Paykulli Mus. R. Acad. Scient. Stockholm, communicavit D. Boheman*’. This specimen is both syntype of *C. zetterstedti* Dahlbom, 1845 and holotype of *C. equestris* Dahlbom, 1854. Both types of *C. zetterstedti* and *C. equestris* have been examined by Linsenmaier (1959: 163); the other two males (not syntypes) of *C. zetterstedti* listed by Dahlbom (1854: 305) are housed in MZLU (Paukkunen et al. 2014).

Current status. *Chrysis equestris* Dahlbom, 1854.

***Chrysis erythromelas* Dahlbom, 1845**

Plate 8

Chrysis erythromelas: Dahlbom 1845: 11.

Type locality. unknown [not Italy, Sicily].

Holotype ♀. [Mus. Payk.] [Type] [NHRS-HEVA000001081].

Remarks. Dahlbom (1845: 11 [not 1854: 155]) described *Chrysis erythromelas* on a single specimen without any type locality, as written later more clearly by Dahlbom

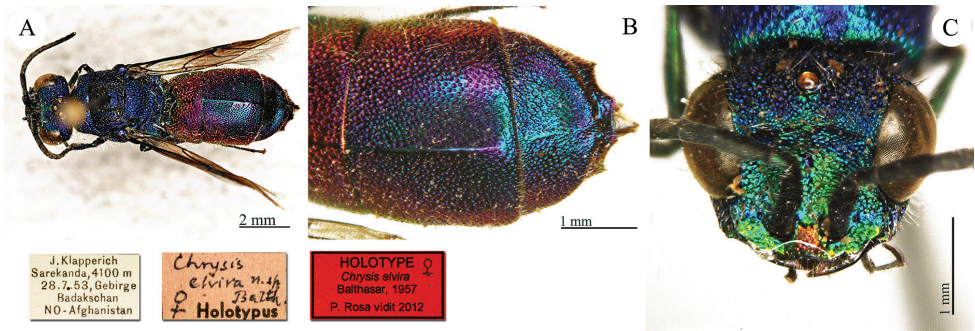


Plate 6. *Chrysis elvira* Balthasar, 1957, holotype. **A** Habitus, dorsal view **B** metasoma, dorsal view **C** head, frontal view.

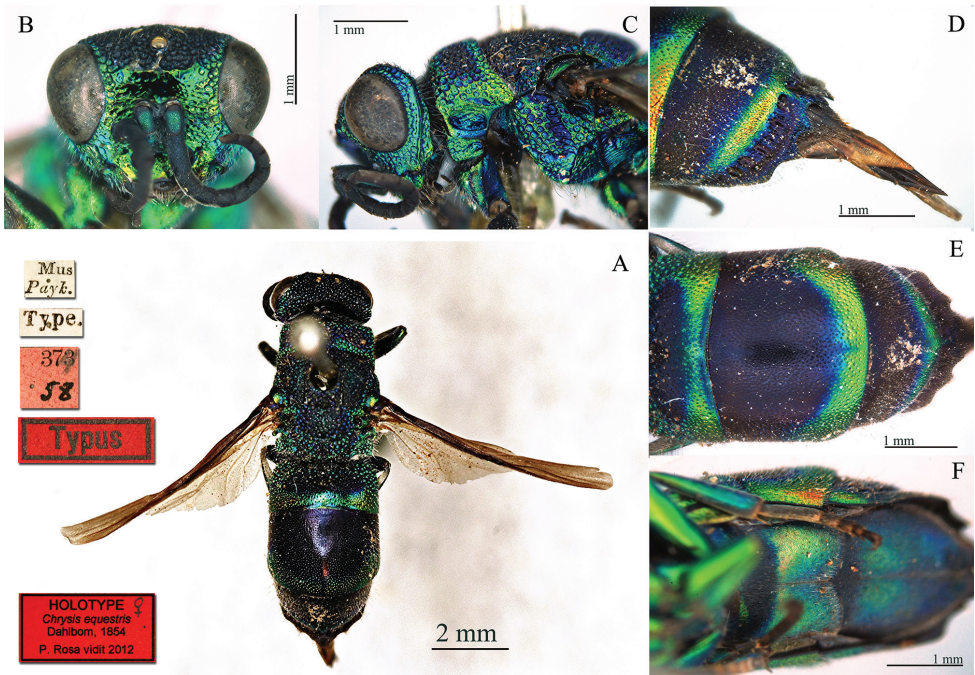


Plate 7. *Chrysis equestris* Dahlbom, 1854, holotype. **A** Habitus, dorsal view **B** head, frontal view **C** head and mesosoma, lateral view **D** third metasomal tergite, dorso-lateral view **E** metasoma, dorsal view **F** metasomal sternites, ventral view.

himself (1854: 155): “*Specimen e Collectione Pajkulliana Musei Reg. Acad. Scient. Stockholm. communicavit D. Boheman, patria non indicata*”. In the NHRS collection there are two specimens with the same label [Mus. Payk.] and belonging to the same species; but only one is labelled as [Type] and we consider it as the holotype. It is damaged after an old dermestid attack; it lacks the right flagellum, both right fore- and hindwing, left hindwing and right hindleg.

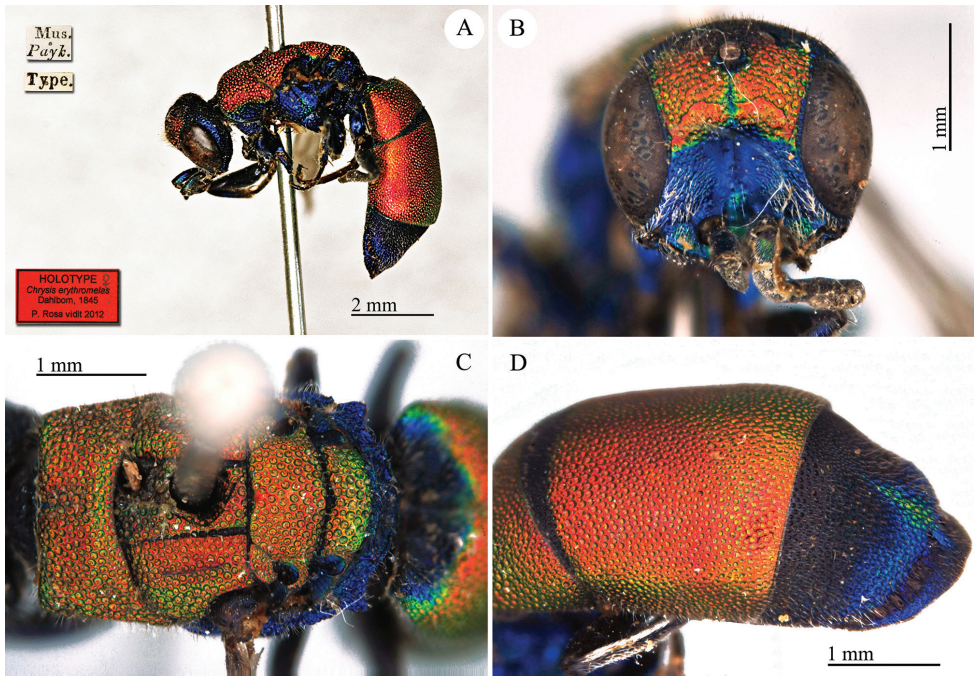


Plate 8. *Chrysis erythromelas* Dahlbom, 1845, holotype. **A** Habitus, lateral view **B** head, frontal view **C** mesosoma, dorsal view **D** second and third metasomal tergites, dorso-lateral view.

For a long time, *C. erythromelas* has been considered as a variety of *C. viridula* Linnaeus, 1761 by the most important authors (Mocsáry 1889: 444; Dalla Torre 1892: 108; Trautmann 1927: 165; Berland and Bernard 1938: 107). Kimsey and Bohart (1991: 424) synonymised it with *C. integra* Fabricius, 1787. Without following the Principle of Priority, Linsenmaier (1951: 101) considered *C. erythromelas* as a variety of *C. cylindrica* Eversmann, 1857. Later Linsenmaier (1959: 132) placed *C. erythromelas* in relation with *C. integra* ssp. *sicula* Abeille de Perrin, 1877, but he was not sure about the correct relationship: “*Der Name erythromelas Dahlbom 1845 bezieht sich auf diese Spezies, doch kann ich nicht beurteilen, ob er als Synonym zu integra Nominatform aufzufassen ist, oder ob er an Stelle von ssp. sicula zu treten hätte (er wurde nach einem ♀ ohne Patria aufgestellt, auch ohne sichere Geschlechts-Bestimmung)*”. Finally Linsenmaier (1997a: 277) synonymised *C. sicula* with *C. ornata* Smith, 1851; but this synonym is in error, since *C. ornata* is described from England and it is related to *C. viridula* Linnaeus s. str.. *C. integra* and related forms are distributed only in the Mediterranean area. The name *C. erythromelas* was even used to identify other species belonging to the *C. viridula* group. For example Invrea (1920: 417; 1921: 344) identified the females of *C. pulcherrima* Lepeletier, 1806 as *C. bidentata* var. *erythromelas*. The examination of the holotype confirms that *C. erythromelas* is the first available name for the species named *C. sicula* Abeille de Perrin, 1877 or *C. integra* ssp. *ornata* Smith, 1851 *sensu* Linsenmaier (1997a) and widely distributed in northern Africa (see the material housed in the Linsenmaier collection) and in Sicily. The species is easily iden-

tifiable from *C. integra* Fabricius by the deep and long frontal sulcus elongated between the fore ocellus and the facial scapal basin, halving the transversal frontal carina (TFC); punctuation on metasoma with shining intervals between the punctures, with smaller dots between the larger punctures; last tergite with pit row deeply elongated (Plate 8).

Current status. *Chrysis erythromelas* Dahlbom, 1845, **status revived**.

***Chrysis imperialis* Dahlbom, 1845**

Chrysis imperialis: Dahlbom 1845: 11.

Type locality. Algeria.

Holotype ♂. [Paykull] [Algier] [NHRS-HEVA000001089].

Remarks. *Chrysis imperialis* Dahlbom, 1845 *nec* Westwood, 1842 is unavailable and the oldest available name from among its synonyms is *C. tricolor* Lucas, 1849. However the validity of this species is not clear and currently it is considered a north African subspecies of *C. semicincta* Lepeletier, 1806.

Current status. *Chrysis semicincta* ssp. *tricolor* Lucas, 1849 (Linsenmaier 1959: 124).

***Chrysis jugum* Dahlbom, 1850**

Plate 9

Chrysis Jugum: Dahlbom 1850: 136.

Type locality. South Africa: “Natal”.

Holotype ♀. [Caffraria] [J. Wahlb.] [*jugum*] [269 82] <red label> [NHRS-HEVA000001090].

Current status. *Chrysis jugum* Dahlbom, 1850.

***Chrysis klapperichi* Balthasar, 1957**

Chrysis klapperichi: Balthasar 1957: 148.

Type locality. Afghanistan: “Umgebung von Schau (2000m) im Kokscha-Tal in Badakshan-Gebirge (19.VII.1953)”.

Holotype ♀. [J. Klapperich Schau, 2000 m 19.7.53, Kokschatal, Badakschan NO – Afghanistan] [*Chrysis klapperichi* ♀ *n.sp.* Balth. Holotypus] [NHRS-HEVA000001092].

Remarks. In Kimsey and Bohart (1991: 436) the type repository is reported as the NMPC.

Current status. *Chrysis martinella* ssp. *solox* Semenov, 1954 (synonymised by Linsenmaier 1968: 74).

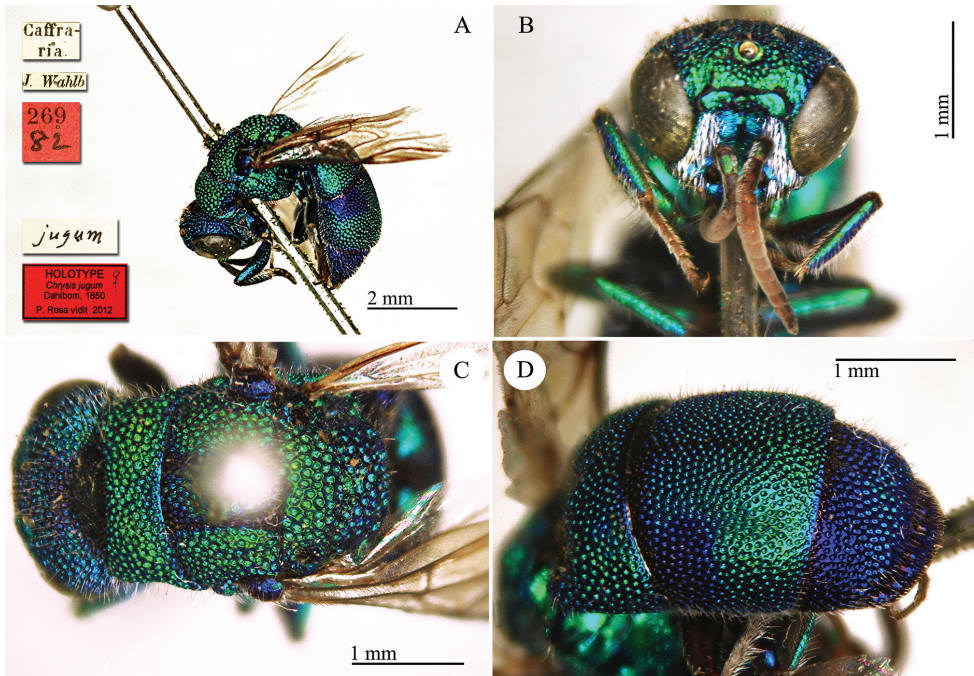


Plate 9. *Chrysis jugum* Dahlbom, 1850, holotype. **A** Habitus, lateral view **B** head, frontal view **C** head and mesosoma, dorsal view **D** metasoma, dorso-lateral view.

Chrysis grohmanni ssp. *krkiana* Linsenmaier, 1959

Chrysis grohmanni ssp. *krkiana*: Linsenmaier 1959: 109.

Type locality. Croatia: Krk island.

Paratype 1 ♂. [*Insel Krk leg. Mader Coll. Linsenmaier*] [*Chrysis* ♂ *grohmanni krkiana* Lins. Linsenmaier det. 59] [NHRS-HEVA000001093].

Paratype 1 ♀. [*Insel Krk leg. Mader Coll. Linsenmaier*] [*Chrysis* ♀ *grohmanni krkiana* Lins. Linsenmaier det. 59] [NHRS-HEVA000001094].

Remarks. The two specimens do not bear the typical handwritten note ‘paratype’ by Linsenmaier; but after the study of his collection in NMLS we can state that they are paratypes. Often Linsenmaier labelled only the holotype and the allotype, especially when describing subspecies with long series. These two specimens were donated by Linsenmaier and have the same handwritten locality and year of identification as the other specimens belonging to the type series in the Linsenmaier collection. This subspecies is clearly separated from the nominal form (Rosa 2003: 307).

Current status. *Chrysis grohmanni* ssp. *krkiana* Linsenmaier, 1959.

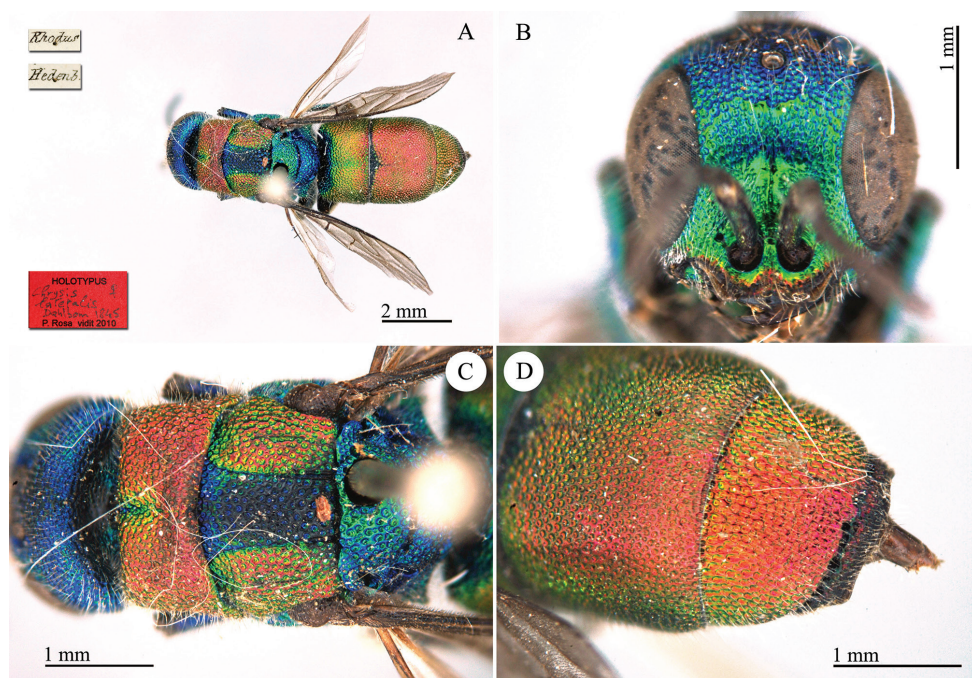


Plate 10. *Chrysis lateralis* Dahlbom, 1845, holotype. **A** Habitus, dorsal view **B** head, frontal view **C** mesosoma, dorsal view **D** second and third metasomal tergites, dorso-lateral view.

Chrysis lateralis Dahlbom, 1845

Plate 10

Chrysis lateralis: Dahlbom 1845: 10.

Type locality. Greece: Rhodes.

Syntype 1 ♀. [Rhodus] [Hedenb.] [NHRS-HEVA000001095].

Remarks. This species belongs to the *Chrysis elegans* group and is conspecific with *C. separata* Trautmann, 1926. None of the most important authors (Dahlbom 1854; Mocsáry 1889; du Buysson (in André) 1891–1896; Trautmann 1927; Berland and Bernard 1938; Linsenmaier 1951, 1959, 1968) mentioned this species. Only Dalla Torre (1892: 74) and later Kimsey and Bohart (1991: 431) listed it as a valid species in the *comparata-scutellaris* group, without type examination. The female syntype has all the typical characteristics of *C. separata*, species widespread from Zante (typical locality) to Middle East. A second syntype is housed in the Dahlbom collection in MZLU. We here propose *Chrysis separata* Trautmann, 1926, as a **new synonym** of *Chrysis lateralis* Dahlbom, 1845.

A similar case was found studying Dahlbom's type of *Chrysis confluens* (Dahlbom, 1845). *C. confluens* was described from Rhodes and belongs to the *C. elegans* group. *C. confluens* was synonymised by Dahlbom himself (1854: 159, var. h) with *Chrysis ele-*

gans Lepeletier, 1806 and remained in synonymy with *C. elegans* in all the most important works. However, nobody noticed that the description was perfectly matching the description of *C. elegans* var. *smaragdula* Trautmann, 1926 *nec* Fabricius, 1775, also described from Rhodes. Linsenmaier (1959: 137) replaced the name *C. elegans smaragdula* Trautmann with *C. interrogata* Linsenmaier, 1959 without taking care of the possible synonymy with *C. confluens* (Dahlbom). There is no doubt about *C. elegans* var. *smaragdula* Trautmann, 1926 (currently *C. elegans* ssp. *interrogata* Linsenmaier) as a **new synonym** of *Chrysis confluens* (Dahlbom, 1845), because *C. confluens* is one of the most common species on the island and its peculiar colour is unique in this species group: “*Corpus æneo- aut subaurato-viride*” and “*Caput et thorax cyaneo- et viridi-variegata. Abdom. segmenti 3:tii series punctorum ante apicalis numerosorum orbiculatorum subconfluentium. Corpus 2 ½ lin. long.*”. This peculiar green or golden-green colouration is well emphasized by the name *smaragdula*, which in Latin means emerald green.

Both names *C. separata* and *C. interrogata* have been used mainly by Linsenmaier and a few other authors (i.e. Rosa 2005b; Strumia and Yildirim 2009), and according to the ICZN there is no reason for applying the Reversal of Precedence. The type of *C. confluens* is housed in the Dahlbom collection in MZLU.

Current status. *Chrysis lateralis* Dahlbom, 1845.

***Chrysis lucifera* Bohart, 1982**

Chrysis lucifera: Bohart (in Bohart & Kimsey) 1982: 123.

Type locality. U.S.A. (holotype from Tanbark Flat, Los Angeles Co., California; paratypes: 11 ♂♂ and 41 ♀♀ from California, Idaho, Nevada, Oregon, Utah, Washington, Wyoming).

Paratype 1 ♂. [Mt. Diablo, Cal. V-12-1937] [R.M. Bohart Colr] [Paratype *Chrysis* ♂ *lucifera* R.M. Bohart] <red label> [NHRS-HEVA000001097].

Paratype 1 ♀. [Hopland Grade Lake Co. Cal. V-19-1961] [S.M. Fidel Collector] [Paratype *Chrysis* ♀ *lucifera* R.M. Bohart] <red label> [NHRS-HEVA000001098].

Remarks. The holotype is deposited at the BME.

Current status. *Chrysis lucifera* Bohart, 1982.

***Chrysis manicata* Dahlbom, 1854**

Plate 11

Chrysis manicata: Dahlbom 1854: 276.

Type locality. Greece: Rhodes.

Syntype 1 ♂. [Rhodus] [Hedenb.] [det. W. Trautmann] [*Tetrachrysis pallidicornis* var. *chloris* Mocsáry] <handritten by Trautmann> [NHRS-HEVA000001099].

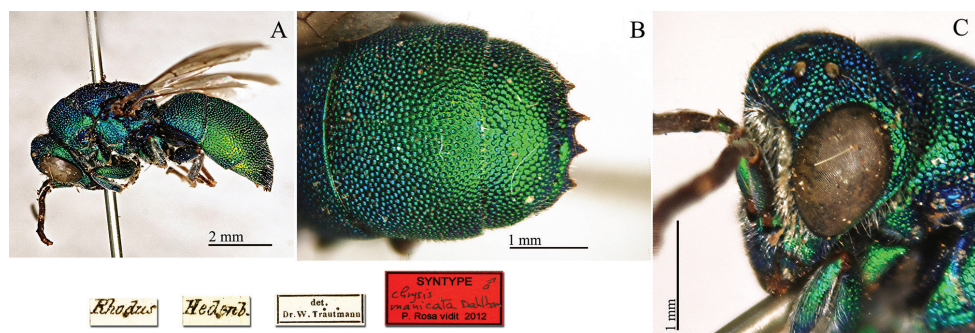


Plate 11. *Chrysis manicata* Dahlbom, 1854, syntype. **A** Habitus, lateral view **B** second and third metasomal tergites, dorsal view **C** head, lateral view.

Syntype 1 ♂. [Rhodus] [Hedenb.] [det. W. Trautmann] [NHRS-HE-VA000001100].

Remarks. In MNHU there are two other syntypes, male and female, labelled: [Rhodus, Mai, Loew S.] [*manicata* Dahlb. ♂] [Bischoff det.] [Syntypus *Chrysis manicata* ♂ Dahlbom P. Rosa vidit 2010] <in red>.

Current status. *Chrysis manicata* Dahlbom, 1854.

***Chrysis modica* Dahlbom, 1850**

Plate 12

Chrysis modica: Dahlbom 1850: 140.

Type locality. South Africa: “Natal”.

Lectotype ♀. [Caffraria] [J. Wahlb.] [Typus] <red label> [*Chrysis modica* Dahlb.] [270 82] <red label> [*Chrysis modica* Dahlbom Lectotype ♀ R.M. Bohart] <red label> [NHRS-HEVA000001111].

Remarks. Dahlbom (1845: 14) described *Chrysis mediocris* on a single specimen from Guinea, received by Westermann and currently housed in his collection at the MZLU. Later Dahlbom (1850: 140) described the same species under a new name, *C. modica*, adding one specimen from Port Natal collected by J. Wahlberg and deposited at the NHRS, and another specimen from Promontorium Bonae Spei [= Cape of Good Hope] found in Spinola’s collection (MRSN). In his last work Dahlbom (1854: 326) gave a detailed description in Latin of *C. modica*, and described a new European species with the name *C. mediocris* Dahlbom, 1854. The latter is a junior homonym of *C. mediocris* Dahlbom, 1845 (currently *C. subsinuata* Marquet, 1879). The first available name for *C. modica* Dahlbom, 1850 is therefore *C. mediocris* Dahlbom, 1845. Bohart (in Kimsey and Bohart 1991: 437) designated the lectotype.

Current status. *Chrysis mediocris* Dahlbom, 1845 (synonymised by Kimsey and Bohart 1991: 437).

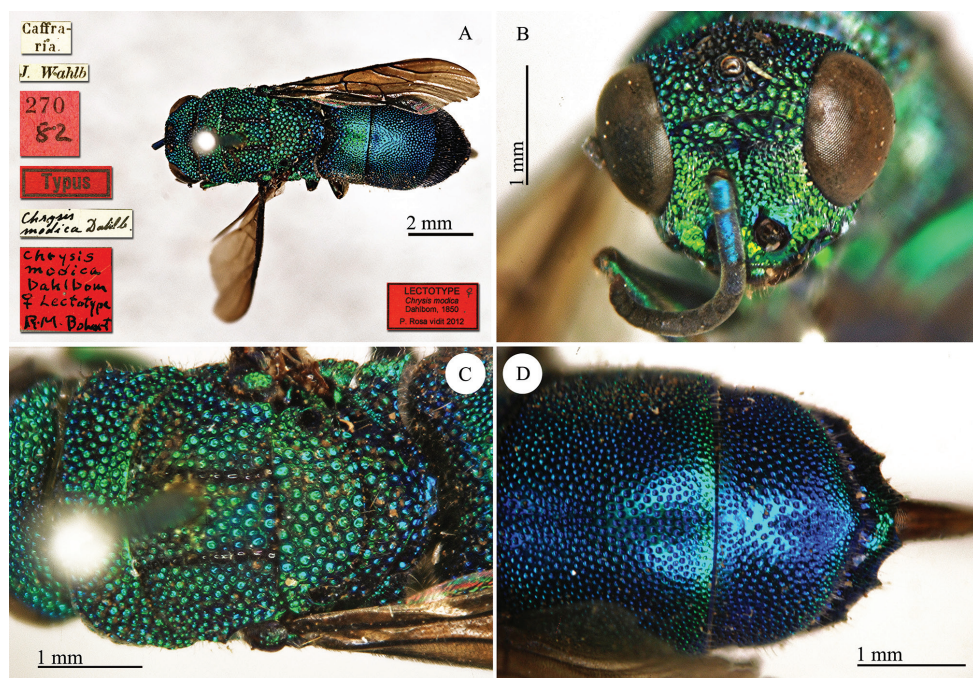


Plate 12. *Chrysis modica* Dahlbom, 1850, lectotype. **A** Habitus, dorsal view **B** head, frontal view **C** mesosoma, dorsal view **D** second and third metasomal tergites, dorsal view.

Chrysis nisseri Dahlbom, 1845

Plate 13

Chrysis Nisseri: Dahlbom 1845: 14.

Type locality. Columbia: “Remedios”.

Holotype ♀. [Remedios] [Nisser] [Type] [NHRS-HEVA000001113].

Remarks. Dahlbom (1845) described *Chrysis nisseri* based on a female collected by Nisser at Remedios. Kimsey and Bohart (1991: 443) examined a male holotype in MZLU. This specimen was not located at the MZLU.

Current status. *Chrysis nisseri* Dahlbom, 1845.

Chrysis obsoleta Dahlbom, 1845

Plate 14

Chrysis obsoleta: Dahlbom 1845: 8.

Type locality. unknown.

Holotype ♂. [Mus. Payk.] [*Chrysis ignita* var. *obsoleta* Dahlb. Dispos. 1845] [NHRS-HEVA000000856].

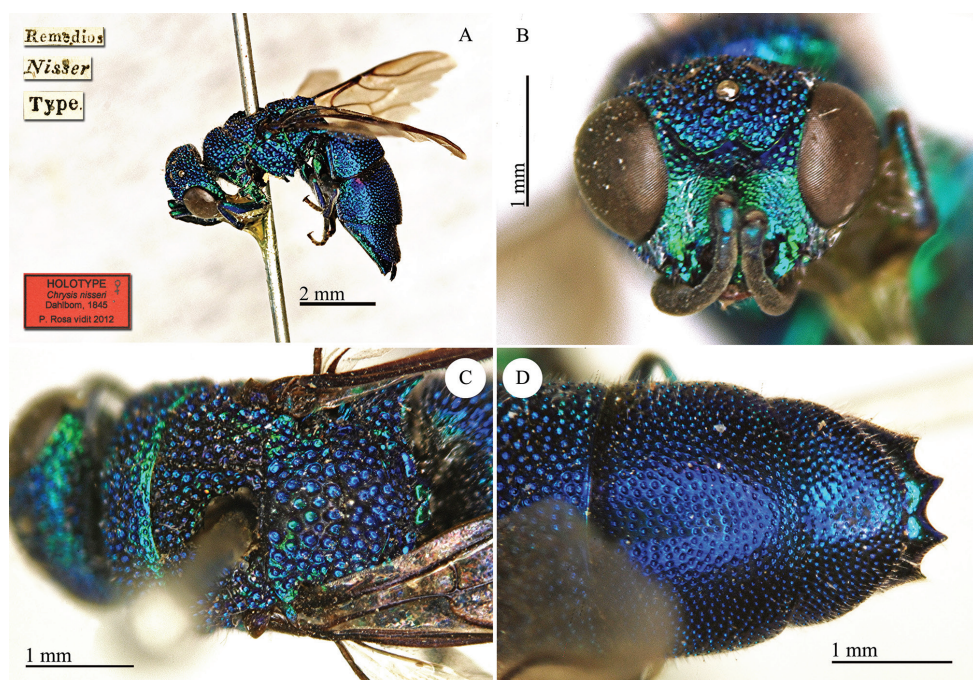


Plate 13. *Chrysis nisseri* Dahlbom, 1845, holotype. **A** Habitus, lateral view **B** head, frontal view **C** mesosoma, dorsal view **D** metasoma, dorsal view.

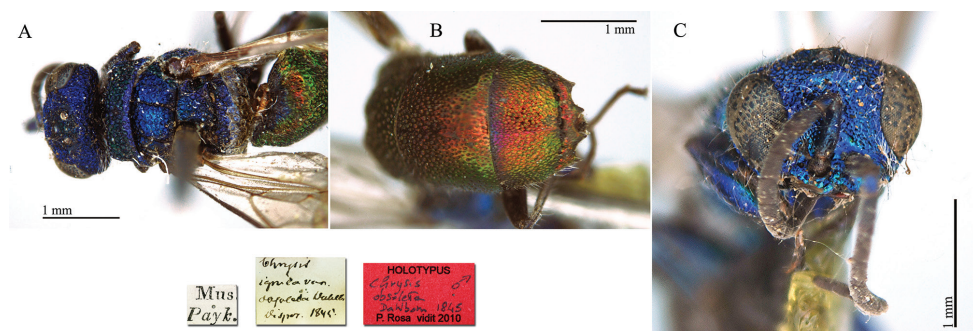


Plate 14. *Chrysis obsoleta* Dahlbom, 1845, holotype. **A** head and mesosoma, dorsal view **B** second and third metasomal tergites, dorsal view **C** head, frontal view.

Remarks. The specimen is badly conserved. The metasoma was broken and glued using large quantity of glue, which now includes also part of the legs. All the European authors and Kimsey and Bohart (1991: 420) considered this small and slender specimen as synonym of *Chrysis ignita* (Linnaeus). The specimen clearly belongs to another species, probably *C. angustula* Schenck, 1856. Villu Soon (pers. comm.) confirmed that it possibly belongs to *C. angustula* but perhaps even *C. solida* Haupt, 1956. Since the name *C. obsoleta* Dahlbom has the priority on almost all the other names in the *ignita* group, we suggest considering it as a **nomen**

oblitum, to maintain the prevailing usage of the names within this complicated species-group (Art. 23.9 of the Code).

Current status. *Chrysis ignita* (Linnaeus, 1758) (synonymised by Mocsáry 1889: 488).

***Chrysis prominula* Dahlbom, 1845**

Plate 15

Chrysis prominula: Dahlbom 1845: 14.

Type locality. unknown.

Holotype ♀. [Mus. Payk.] [*prominula*] [NHRS-HEVA000001114].

Remarks. The type is partially damaged after an old dermestid attack. It lacks the right antenna, the left mid- and hindlegs, partially the right forewing and part of the metanotum.

Current status. *Chrysis prominula* Dahlbom, 1845.

***Chrysis purpureifrons* ssp. *helleniensis* Linsenmaier, 1968**

Chrysis (Chrysogona) purpureifrons ssp. *helleniensis*: Linsenmaier 1968: 48.

Type locality. Greece (holotype from Athen; allotype from Corinth; paratype localities not listed).

Paratypes 2 ♂♂ and 1 ♀. [Graecia, Pelop. 18 km Südlich Tripolis 15.V.62 leg. Linsenmaier] [*Paratypen Chrysis L. purpureifrons helleniensis* Lins. Linsenmaier det. 63] <handwritten in red> [NHRS-HEVA000001087].

Remarks. The holotype is housed in the Linsenmaier Collection at NMLS.

Current status. *Chrysura purpureifrons* ssp. *helleniensis* (Linsenmaier, 1968) (transferred by Kimsey and Bohart 1991: 494).

***Chrysis pyrrhina* Dahlbom, 1845**

Plate 16

Chrysis pyrrhina: Dahlbom 1845: 9.

Type locality. unknown.

Holotype ♂. [Mus. Payk.] [Type] [*pyrrhina Dahlbom 143*] [NHRS-HEVA000001115].

Remarks. The species was described with the name “*Chrysis pyrrhinia* Dalm. ♂ Mus. Paykull” and emendated in the same work (Dahlbom 1845: *corrigenda* at pag. 21). The type locality reported by Kimsey and Bohart (1991: 454 “Yugoslavia, Dal-

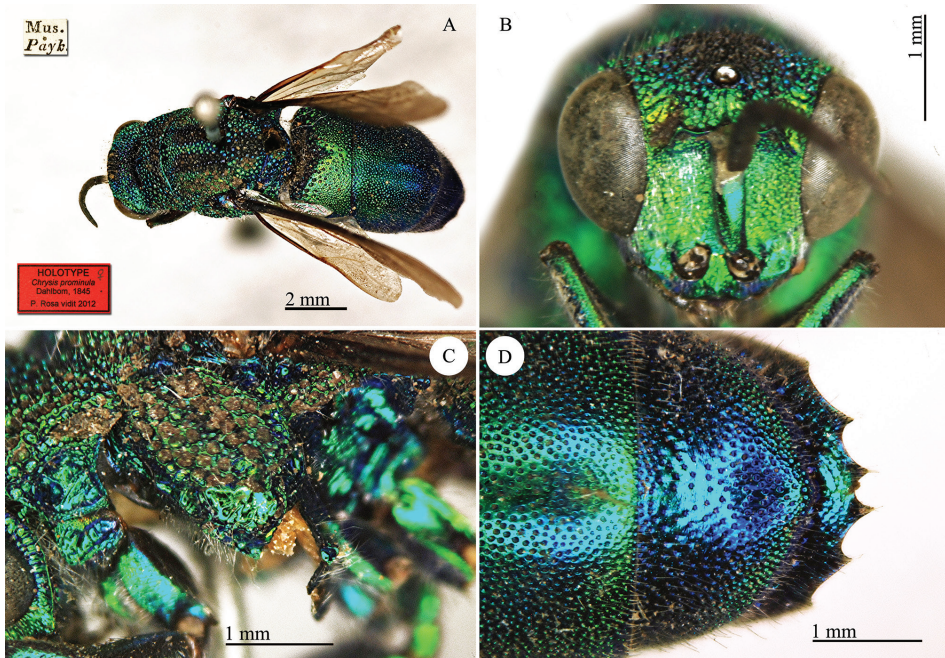


Plate 15. *Chrysis prominula* Dahlbom, 1845, holotype. **A** Habitus, dorsal view **B** head, frontal view **C** mesopleuron, lateral view **D** third metasomal tergite, dorsal view.

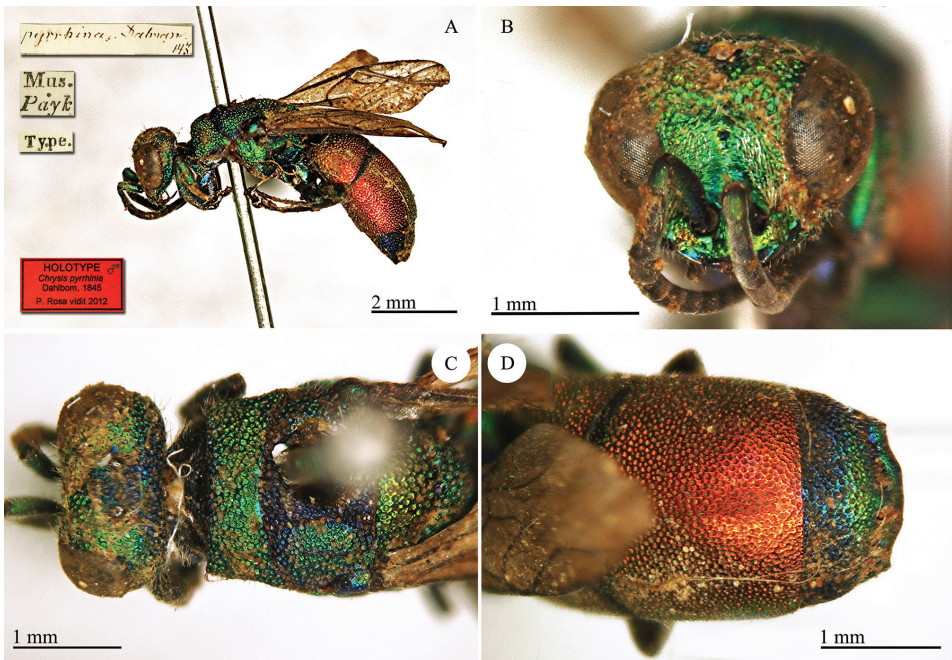


Plate 16. *Chrysis pyrrhina* Dahlbom, 1845, holotype. **A** Habitus, lateral view **B** head, frontal view **C** head and mesosoma, dorsal view **D** metasoma, dorsal view.

matia”) is in error. Possibly they confused Dalm. [= Dalman] with Dalmatia. The type locality is unknown, as confirmed in Dahlbom (1854: 259): “*Chrysis pyrrhina Dalman Mus. Paykulli; teste D. Boheman, qui specimen unicum, patria non notata, e Museo R. Acad. Scient. Stockholm. amice communicavit*”.

Very likely Paykull received the male (described as *pyrrhina*) and the female (described as *erythromelas*) together, from the same locality, probably in north Africa. They both belong to the same species, *C. erythromelas* Dahlbom, 1845, even if the male shows some peculiar characteristics which are not found in other northern African or Sicilian specimens: short pronotum, lateral angles on T-III more acute. The metasoma is entirely reddish, but this unusual colour was found also in other specimens in the Linsenmaier collection.

After Linsenmaier (1959) the name *C. pyrrhina* was used to identify a common Mediterranean species (Mingo 1994; Mingo and Gayubo 1985, 1986a, 1986b; Mingo et al. 1988, 1990; Rosa 2004, 2005a, 2005b; Strumia 1995, 1996, 2005, 2007a, 2007b; Strumia and Pagliano 2010; Strumia et al. 2010). The type of *C. pyrrhina* does not match Linsenmaier’s interpretation of the species and a new name must be given to this species.

The first available name from among its synonyms is *Chrysis serena* Radoszkowski, 1891. The type of *C. serena* was checked and it is currently housed in the Radoszkowski collection in ISEA-PAS (Rosa et al. 2015). Linsenmaier (1968: 82) considered *C. serena* as a subspecies of *C. pyrrhina*, with coarser and denser punctation on the metasoma, with micro-punctated intervals between the punctures and mesosoma greener in colour. The distribution given by Linsenmaier for *C. serena* is Persia, S Russia, Palestine, Syria, Asia Minor and Manchuria. It is well known that in the Euro-Asiatic chrysidids, patterns in punctation have a gradient, becoming coarser from west to east. Similarly many common *Chrysis* are greener in the eastern area of their distribution in Europe. *C. serena* simply represents the eastern form with coarser punctation.

Current status. *Chrysis erythromelas* Dahlbom, 1845.

***Chrysis rufiventris* Dahlbom, 1854**

Plate 17

Chrysis rufiventris: Dahlbom 1854: 119.

Type locality. unknown.

Holotype ♂. [Mus. Payk.] [Type] [NHRS-HEVA000001116].

Current status. *Chrysura rufiventris* (Dahlbom, 1854) (transferred by Kimsey and Bohart 1991: 495).

***Chrysis schoenherri* Dahlbom, 1845**

Plate 18

Chrysis Scönerherri: Dahlbom 1845: 10.

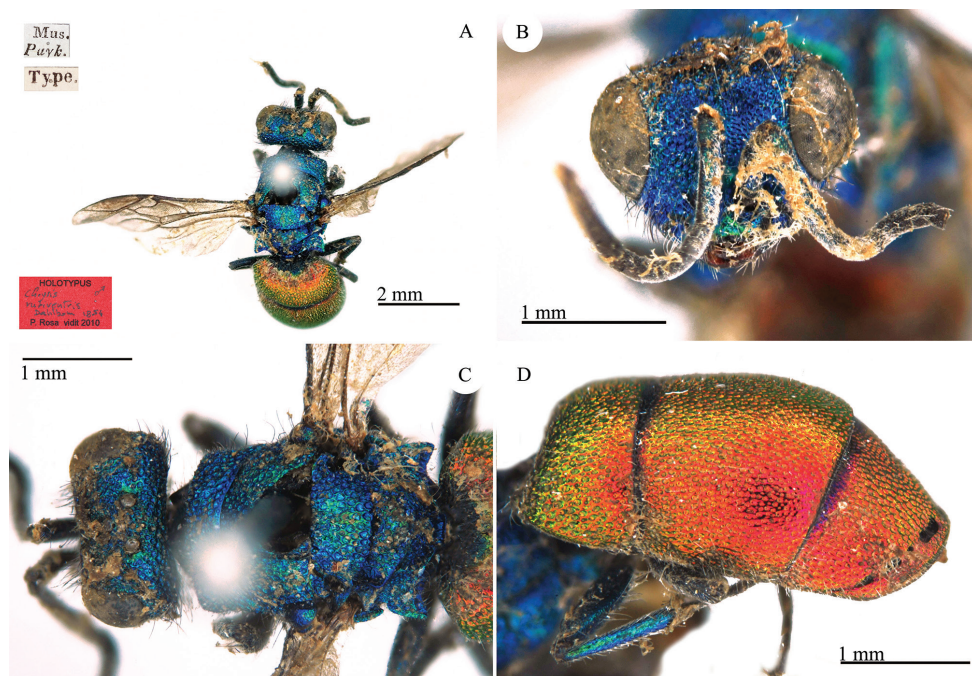


Plate 17. *Chrysis rufiventris* Dahlbom, 1854, holotype. **A** Habitus, dorsal view **B** head, frontal view **C** head and mesosoma, dorsal view **D** metasoma, lateral view.

Type locality. South Africa.

Holotype ♀. [Caffraria] [J. Wahlb.] [Typus] <red label> [*Chrysis schoenherri* Dahlb.] [271 82] <red label> [NHRS-HEVA000001118].

Remarks. The type lacks the left forewing. The emendated name *C. schönherri* was introduced by Dahlbom (1850: 139). Carl Johan Schönherr was a Swedish entomologist born in Stockholm from a German family.

Current status. *Chrysis schoenherri* Dahlbom, 1845.

Chrysis scintillans Valkeila, 1971

Plate 19

Chrysis scintillans: Valkeila 1971: 85.

Type locality. Finland: “Vanaja”.

Paratype 1 ♀. [Jmt. Undersåker [unreadable] 16.7.48 [Valliste 1000m C.B. Gaunitz] [*Chrysis* L. *mediata* ssp. *fenniensis* Lins. Linsenmaier det. 59] [*Chrysis scintillans* n.sp. det. E. Valkeila – 69] [Typus] <red label> [NHRS-HEVA000001117].

Remarks. The paratype lacks both right wings. The correct name for the locality of this paratype is found in the original description. The holotype is deposited at the

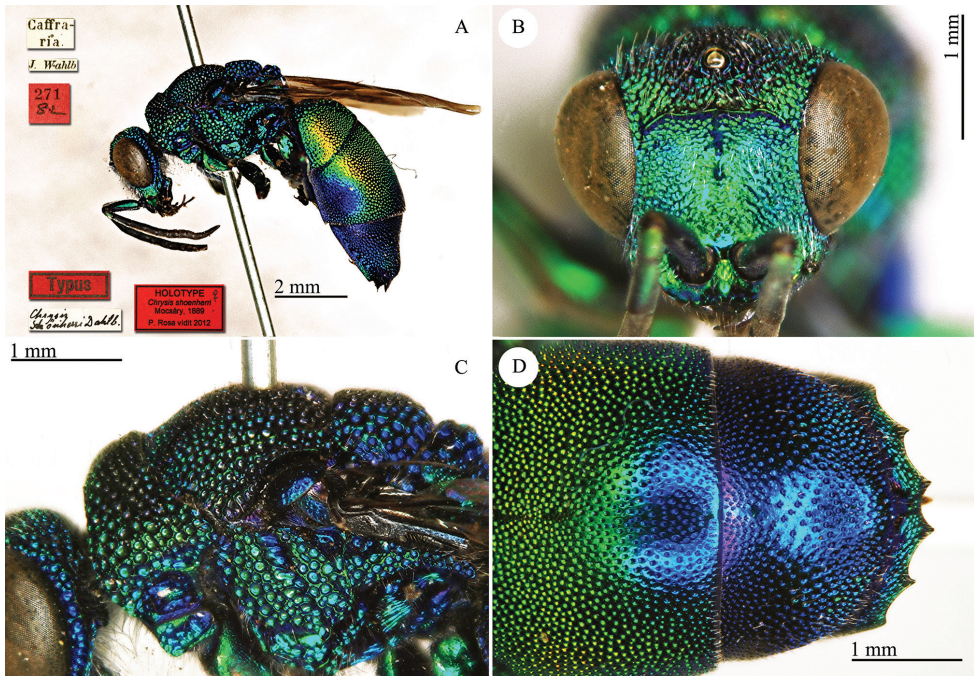


Plate 18. *Chrysis schoenherri* Dahlbom, 1845, holotype. **A** Habitus, lateral view **B** head, frontal view **C** mesosoma, lateral view **D** third metasomal tergite, lateral view.

MZH. *Chrysis scintillans* was described based on seventy-six specimens from Finland, Russia and Sweden. Paukkunen et al. (2014: 41) synonymised it with *C. solida* Haupt, 1956, and found that the paratypes belong to different species: *C. schencki* Linsenmaier, 1968 (36 exx.), *C. solida* Haupt, 1956 (33 exx.), *C. ignita* group (2 exx.), *C. impressa* Schenck, 1856 (2 exx.), *C. angustula* Schenck, 1856 (1 ex.) and *C. subcoriacea* Linsenmaier, 1959 (1 ex.). The paratype preserved in NHRS belongs to *C. schencki* (V. Soon and J. Paukkunen, in litt.). Valkeila considered the punctuation of the terga as a more important character in species identification rather than other characteristics, such as the width of the ovipositor.

Current status. *Chrysis solida* Haupt, 1956 (synonymised by Paukkunen et al. 2014: 41).

Chrysis sinuata Dahlbom, 1845

Plate 20

Chrysis sinuata: Dahlbom 1845: 12.

Type locality. South Africa: “*Capitis Bonae Spei*”.

Syntype 1 ♀. [Cap. B. Spei] [Mus. Payk.] [NHRS-HEVA000001119].

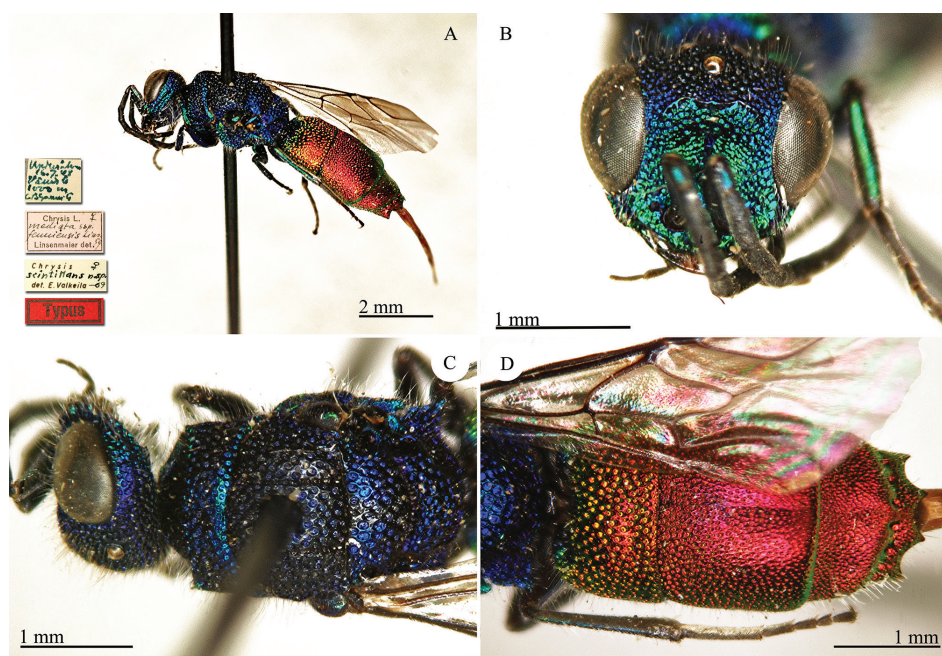


Plate 19. *Chrysis scintillans* Valkeila, 1971, paratype. **A** Habitus, lateral view **B** head, frontal view **C** head and mesosoma, dorsal view **D** metasoma, dorsal view.

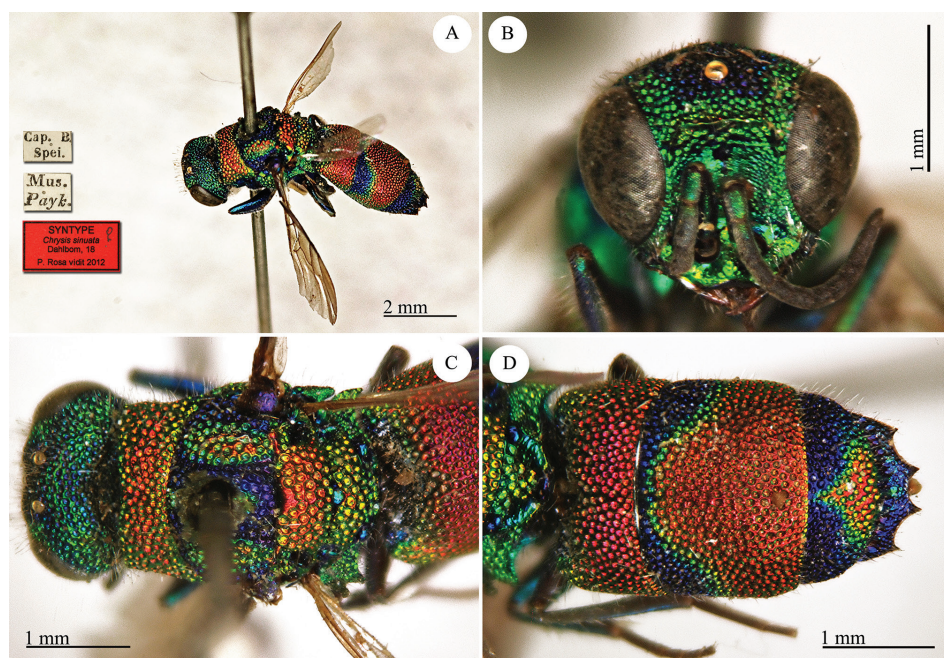


Plate 20. *Chrysis sinuata* Dahlbom, 1845, syntype. Syntype. **A** Habitus, dorso-lateral view **B** head, frontal view **C** head and mesosoma, dorsal view **D** metasoma, dorsal view.

Remarks. The name *Chrysis sinuata* Dahlbom, 1845, *nec* Brullé, 1833 is not available and was replaced by Mocsáry (1889) with the name *C. poecila*. See the other notes under *C. sinuosa* Dahlbom.

Current status. *Chrysis poecila* Mocsáry, 1889, a replacement name for *C. sinuata* Dahlbom, 1845 *nec* Brullé, 1833.

***Chrysis sinuosa* Dahlbom, 1854**

Plate 21

Chrysis sinuosa: Dahlbom 1854: 153.

Type locality. South Africa: “*Capitis Bonae Spei*”.

Holotype ♂. [Cap. B. Spei] [Mus. Payk.] [Type] [*sinuosa* Dahlbom 84] [NHRS-HEVA000001120].

Remarks. The type of *C. sinuosa* lacks the right flagellum and the right foreleg. Dahlbom (1845: 11–12) described *Chrysis sinuata* based on two syntypes, a male and a female, with the same colour “*Divis IV. Thorax variegatus. Abdomen cyaneo-. viridi- et aureo-fasciatum*”. He described the female with four teeth on the anal margin (“*Subdivis. 2. Abdominis segmentum 3:tium apice 4-dentatum*”) (Plate 20D) and the male without teeth on the anal margin, but with a simple undulation (“*Subdiv. 3. Abdominis segmentum 3:tium apice undulatum*”) (Plate 21D). These two specimens clearly belong to two different species-groups. Later, Dahlbom (1854: 153) recognised the male as belonging to a different species and described it with the name *C. sinuosa*. He left the female under the name *C. sinuata* Dahlbom, 1845, without noticing that this name was already used by Brullé (1833).

Mocsáry (1889: 296), without type examination, considered *C. sinuosa* Dahlbom, 1845 and *C. sinuata* Dahlbom, 1854 (“*ex parte, solum* ♂” [the male only]) as synonyms of *C. bellula* Guérin-Ménéville, 1842. Mocsáry (1889: 440) also replaced the name *C. sinuata* Dahlbom, 1845, *nec* Brullé, 1833 (“*ex parte, solum* ♀”) with *C. poecila* Mocsáry, 1889. *C. bellula* is now considered endemic to Madagascar, absent from South Africa (Azevedo et al. 2010: 858). Since Mocsáry (1889: 428) did not examine Dahlbom’s types, he described again *C. sinuata* Dahlbom, 1845 as a new species from South Africa with the name *C. eximia* Mocsáry, 1889. We examined the type of *C. eximia*, which is deposited at the NHMW.

In this case, the replacement name *C. poecila* Mocsáry has priority over *C. eximia* Mocsáry and therefore we propose the new synonym *C. eximia* Mocsáry, 1889 = *C. poecila* Mocsáry, 1889. Edney (1952: 423) followed Mocsáry in the interpretation of *C. (Holochrysis) bellula* Brullé, but without reporting any differences between the sexes. He also described *C. ceres* Edney, 1952, which resulted synonym of *C. sinuosa* Dahlbom. Kimsey and Bohart (1991: 463), without the examination of Dahlbom’s types, synonymised *C. sinuata* Dahlbom, *C. poecila* Mocsáry and *C. ceres* Edney with *C. sinuosa* and used *eximia* Mocsáry, 1889 as the valid name. Madl and Rosa (2012) followed the interpretation given by Kimsey and Bohart (1991).

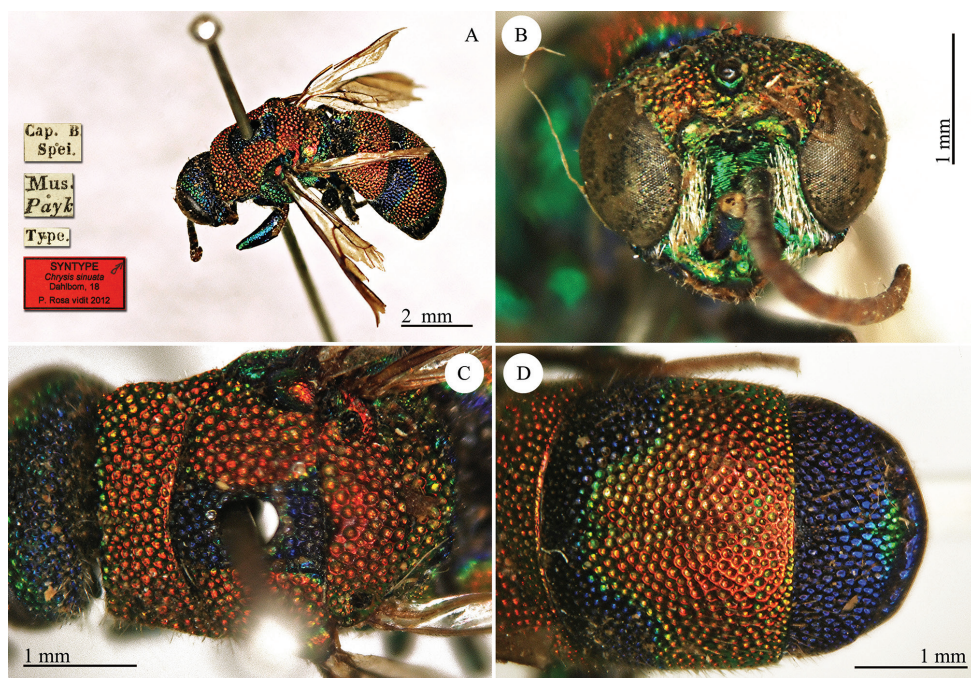


Plate 21. *Chrysis sinuosa* Dahlbom, 1854, holotype. Syntype. **A** Habitus, dorso-lateral view **B** head, frontal view **C** mesosoma, dorsal view **D** second and third metasomal tergites, dorsal view.

According to the types, the two valid species and their synonymies are:

(1) *Chrysis poecila* Mocsáry, 1889 replacement name for *C. sinuata* Dahlbom, 1845 *nec* Brullé, 1833 (synonyms: *C. eximia* Mocsáry, 1889; *C. westwoodi* Mocsáry, 1912) (*C. splendidula-senegalensis* group);

(2) *Chrysis sinuosa* Dahlbom, 1845 (synonym: *Chrysis ceres* Edney, 1954) (*C. capitalis* group).

Current status. *Chrysis sinuosa* Dahlbom, 1854.

Chrysis soror Dahlbom, 1854

Plate 22

Chrysis soror: Dahlbom 1854: 240.

Type locality. Greece: “*Habitat in insula Rhodo, a D. Hedenborg detecta; Mus. D. Loew*”.

Lectotype (here designated) ♂: [Rhodus] [Hedenb.] [det. W. Trautmann] [*Tetrachrysis abbreviaticornis* Buys. ??] <handritten by Trautmann> [NHRS-HE-VA000001121].

Remarks. Dahlbom (1854) described *Chrysis soror* based on more male specimens collected at Rhodes by Hedenborg and Loew. Kimsey and Bohart (1991: 464) listed

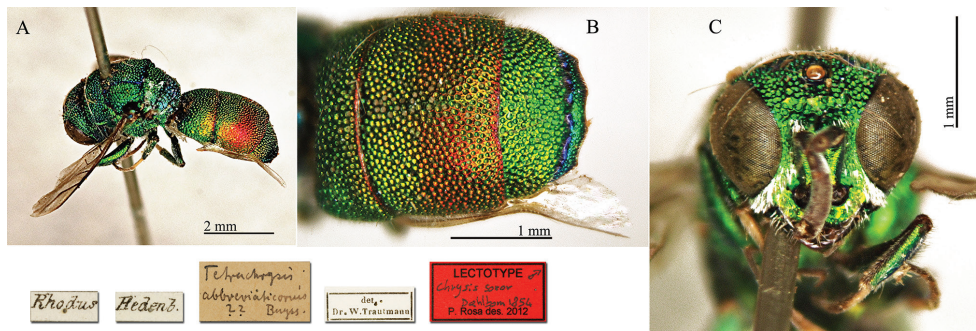


Plate 22. *Chrysis soror* Dahlbom, 1855, lectotype. **A** Habitus, lateral view **B** second and third metasomal tergites, dorsal view **C** head, frontal view.

the holotype in MNHU, but we could not find it with the help of the curator Frank Koch; Loew's Chrysididae are not conserved in MNHU, as well as in BMNH or NHRS. Since it is possible that one or more syntypes could be found in another collection, we select the male specimen housed at the NHRS as lectotype, which matches perfectly the current interpretation of the species.

The lectotype is partially damaged; it lacks the left flagellum, tarsi of the right midleg and the left hindleg except for the coxa. The metasoma is glued to the mesosoma.

Current status. *Chrysis soror* Dahlbom, 1854.

Chrysis tenuimediata Linsenmaier, 1968

Chrysis (*Papuachrysis*) *tenuimediata*: Linsenmaier 1968: 53.

Type locality. Burma: "N.O. Burma, Kambaiti, 2000m".

Holotype ♀. [N. E. Burma Kambaiti; 2000 m 23/4.1934 Malaise] [Riksmuseum Stockholm] <green label> [♀ Type *Chrysis* L. *Papuachrysis tenuimediata* Lins. Linsenmaier det.64] <handwritten in red> [*Chrysis* L. *subgen. Adscitis* det. Linsenmaier 1994] [NHRS-HEVA000001126].

Remarks. Linsenmaier (1997a: 284) disagreed with the placement of *C. tenuimediata* proposed by Kimsey and Bohart (1991) and described the subgenus *Chrysis* (*Adscitis*) based on *C. tenuimediata*.

Current status. *Primeuchroeus tenuimediatus* (Linsenmaier, 1968) (transferred by Kimsey and Bohart 1991: 543).

Chrysis violacuna Bohart, 1982

Chrysis violacuna: Bohart (in Bohart & Kimsey) 1982: 134.

Type locality. U.S.A. (holotype, 59 ♂♂ and 56 ♀♀ paratypes from Utah).

Paratype 1♂. [UTAH Rich Co. S.W. Shore Bear Lake Reared, FD Parker] [16605F Rearing No.] [Paratype *Chrysis violacuna* ♂ R.M. Bohart] <red label> <pinned with cocoon> [NHRS-HEVA000000858].

Paratype 1♀. [UTAH Rich Co. S.W. Shore Bear Lake Reared, FD Parker] [16674C Rearing No.] [Paratype *Chrysis violacuna* ♀ R.M. Bohart] <red label> <pinned with cocoon> [NHRS-HEVA000000859].

Remarks. The holotype is deposited at the BME.

Current status. *Chrysis violacuna* Bohart, 1982.

Chrysis wahlbergi Dahlbom, 1845

Plate 23

Chrysis Wahlbergi: Dahlbom 1845: 14.

Type locality. South Africa: “Natal”.

Lectotype ♂. [Caffraria] [J. Wahlb.] [272 82] <red label> [*wahlbergi*] [*Lectotype Chrysis wahlbergi* ♂ Dahlbom R.M. Bohart] <red label> [NHRS-HEVA000001127].

Paralectotype ♀. [Caffraria] [J. Wahlb.] [273 82] <red label> [*wahlbergi*] [NHRS-HEVA000001128].

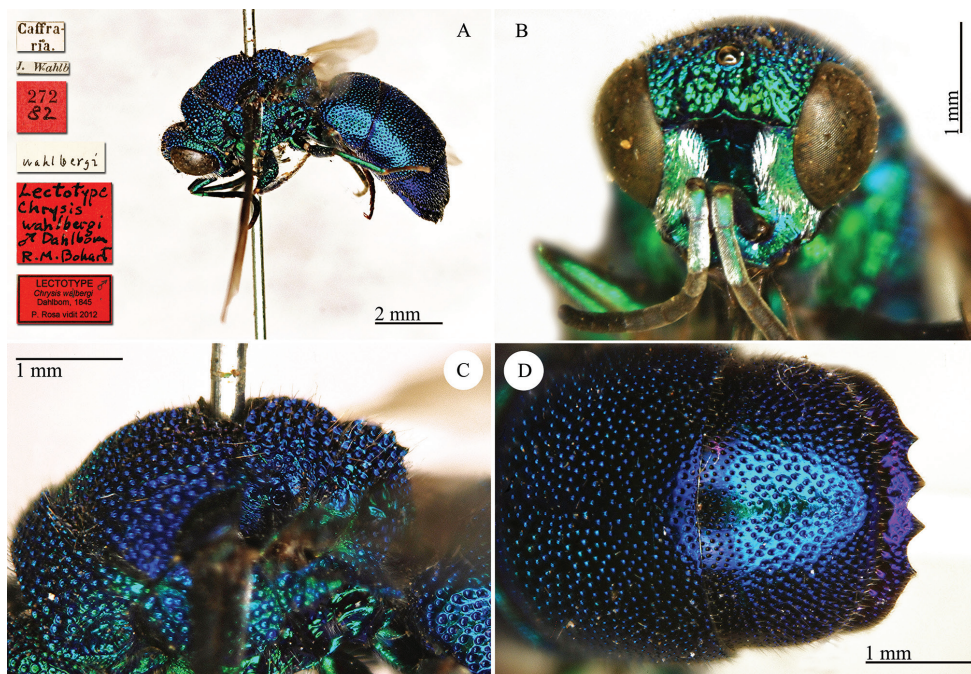


Plate 23. *Chrysis wahlbergi* Dahlbom, 1845, lectotype. **A** Habitus, lateral view **B** head, frontal view **C** mesosoma, lateral view **D** second and third metasomal tergites, dorsal view.

Remarks. Lectotype designation by Bohart (in Kimsey and Bohart 1991: 478).

Current status. *Chrysis wahlbergi* Dahlbom, 1845.

***Chrysura candens* Dahlbom, 1845**

Chrysura candens: Dahlbom 1845: 7.

Type locality. Greece: Rhodes.

Holotype ♀. [Mus. Payk.] [NHRS-HEVA000001066].

Remarks. *Chrysura candens* Dahlbom is a secondary junior homonym of *C. candens* Germar, 1817. Dalla Torre (1892: 49, 58) placed *C. candens* in synonym of *C. candens* Klug (!) Germar, 1817 (partim) and *C. elegans* Lepeletier (partim). The type is surely related to large species (3 ½ *lin. long.*), not comparable with *C. candens* Germar. The type is partially damaged; it lacks the left fore wing, femura, tibiae and tarsi of left mid- and hindlegs, and tarsi of the left foreleg.

Current status. *Chrysis elegans* Lepeletier, 1806 (synonymized by Mocsáry 1889: 301).

***Chrysura foveata* Dahlbom, 1845**

Plate 24

Chrysura foveata: Dahlbom 1845: 6.

Type locality. Egypt.

Syntype ♀. [Egypt] [Hedb.] [NHRS-HEVA000001083].

Syntype ♂. [Egypt] [Hedb.] [NHRS-HEVA000001084].

Remarks. *Ch. foveata* was described based on few specimens (*rar.*) considered as females, but in the collection one female and one male are found. Dahlbom (1854: 172) gave a subsequent description of the species, which is not very precise, especially with respect to the colour. Kimsey and Bohart (1991: 497) placed *Chrysura foveata* in synonym with *Chrysura trimaculata* (Förster, 1853), without type examination. This synonym is in error; *Ch. foveata* was described from Egypt, whereas *Ch. trimaculata* is a Euro-Sibirc species, not distributed in northern Africa and belonging to a different genus. *Ch. foveata* belongs to the *Chrysis hydropica* group.

Current status. *Chrysis foveata* (Dahlbom, 1845) (transferred by Mocsáry 1889: 292).

***Chrysura humboldti* Dahlbom, 1845**

Plate 25

Chrysura Humboldtii: Dahlbom 1845: 6.

Type locality. Greece: Rhodes.

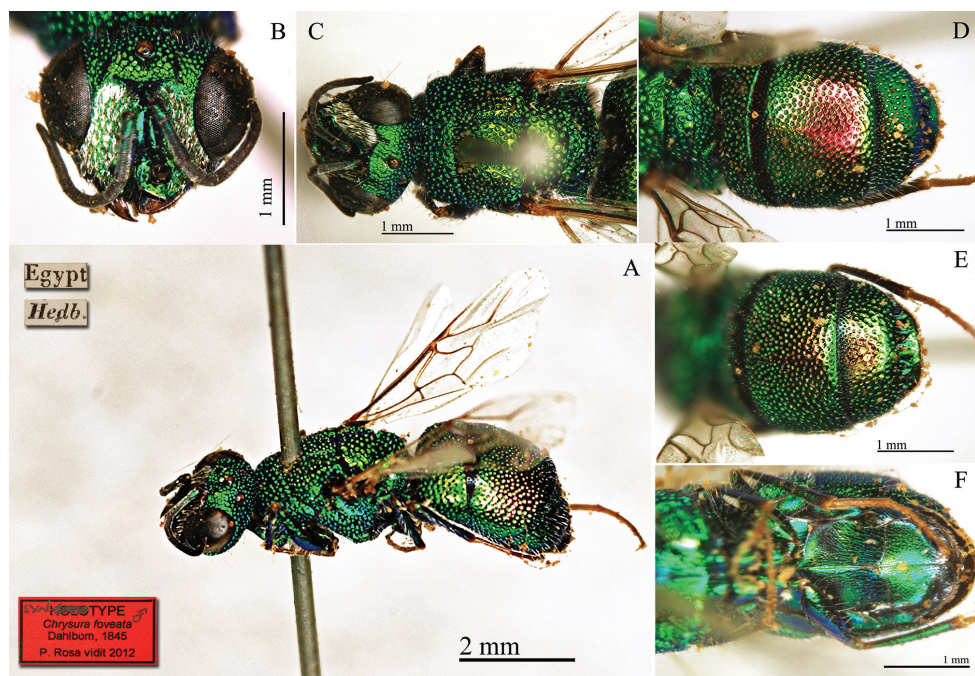


Plate 24. *Chrysura foveata* Dahlbom, 1845, syntype male. **A** Habitus, dorso-lateral view **B** head, frontal view **C** head and mesosoma, dorsal view **D** metasoma, dorsal view **E** third metasomal tergite, dorsal view **F** metasomal sternites, ventral view.

Holotype ♂. [Rhodus] [Hedb.] [Type] [NHRS-HEVA000001088].

Current status. *Pseudospinolia humboldti* Dahlbom, 1845 (transferred by Kimsey and Bohart 1991: 547).

Chrysura sulcata Dahlbom, 1845

Plate 26

Chrysura sulcata: Dahlbom 1845: 7.

Type locality. Greece: Rhodes.

Lectotype (here designated) ♀: [Rhodus] [Hedb.] [Type] [NHRS-HEVA000001125].

Notes. Dahlbom (1845) described *Ch. sulcata* based few specimens from Rhodes “*Ch. sulcata nob. Rhodus rar. Hedenborg.*”. Since Dahlbom wrote “*rar.*” and not “*rariss.*” he examined at least two specimens. The original diagnosis (Dahlbom 1845) is quite different from the description given in 1854 and the current interpretation of the species. Dahlbom (1845) described *sulcata* as a species with red sternites “*Divis. 2. Abdominis dorsum totum aureum. Venter igneus*”, whereas the species today identified as *Ch. sulcata* has blue or blue-green sternites, which is a useful characteristic to separate

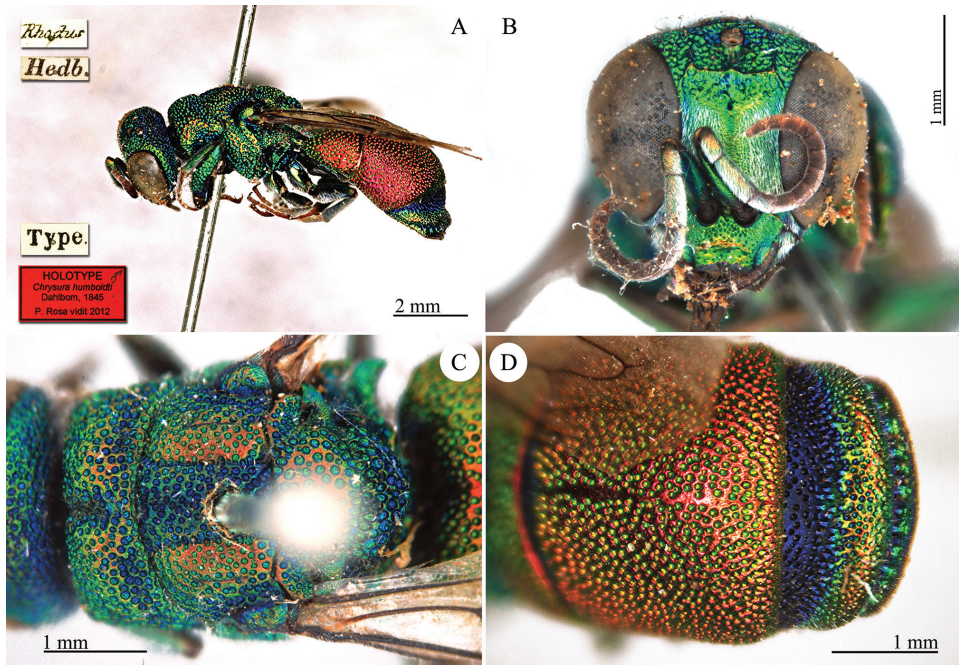


Plate 25. *Chrysura humboldti* Dahlbom, 1845, holotype. **A** Habitus, lateral view **B** head, frontal view **C** mesosoma, dorsal view **D** second and third metasomal tergites, dorsal view.

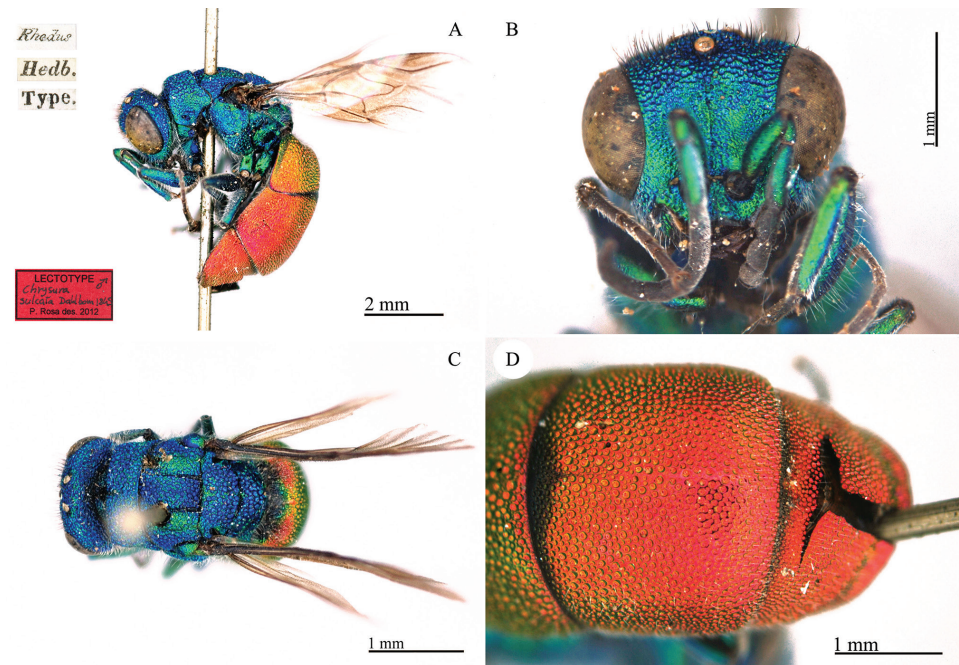


Plate 26. *Chrysura sulcata* Dahlbom, 1845, lectotype. **A** Habitus, lateral view **B** head, frontal view **C** habitus, dorsal view **D** second and third metasomal tergites, dorso-lateral view.

it from *Ch. rufiventris* Dahlbom, 1854 in south Europe. Moreover, he described *Ch. sulcata* with green mesosoma ("*Thorax viridis*"), whereas all the specimens studied have blue mesosoma, with green reflections on the lateral sides of the mesonotum.

In the general collection, under the name *Ch. sulcata*, two specimens were found. These are a specimen of *Ch. sulcata* and a second specimen (without head), which belongs to *Chrysis aestiva* Dahlbom, 1845, also described from Rhodes. It bears the same labels: [Rhodes] [Hedb.]. This specimen is obviously different, since it has two small teeth along the anal margin; but we noticed that the position of the ovipositor somehow hides the two small teeth. Perhaps it is possible that Dahlbom did not see these two small teeth and considered this specimen as a syntype. The latter has red sternites and green mesosoma.

Later Dahlbom (1854: 116), after the examination of a Sicilian specimen housed at the NHMW, gave a better and detailed description of the species, which was accepted by all the following authors and is currently recognised. The specimen examined at the NHMW is lost and was considered as a syntype by Kimsey and Bohart (1991). Since the original description is ambiguous and the species could be described from several specimens, in accordance with the ICZN (Art. 73) we hereby designate the lectotype of *Ch. sulcata* on the male specimen bearing the label [Type] and characterised by the broken last tergite (Plate 26D). The designated lectotype matches the current interpretation of the species given by Dahlbom (1854) and Linsenmaier (1959).

Current status. *Chrysura sulcata* Dahlbom, 1845.

***Cleptes fasciata* Dalman, 1823**

Plate 27

Cleptes fasciata: Dalman 1823: 90.

Type locality. Brazil.

Lectotype ♀. [*Brasilia Freyreiss*] [Schh.] <Schönherr> [Naturhistoriska Riksmuseet Stockholm Loan no 333/96] <green label> [*Cleptidea* ♀ *fasciata* Dalm. det. L. Móczár, 1996] [Lectotypus *Cleptes fasciata* Dalman des. Móczár 996] <red label> [NHRS-HEVA000001082].

Remarks. Lectotype designated by Móczár (1996: 136); a paralectotype is deposited at the HNHM.

Current status. *Cleptidea fasciata* (Dalman, 1823) (transferred by Mocsáry 1904: 569).

***Cleptes sjostedti* Hammer, 1950**

Cleptes Sjostedti: Hammer 1950: 2.

Type locality. China: "Provinz Kiansu, leg. Kolthoff, Oktober".

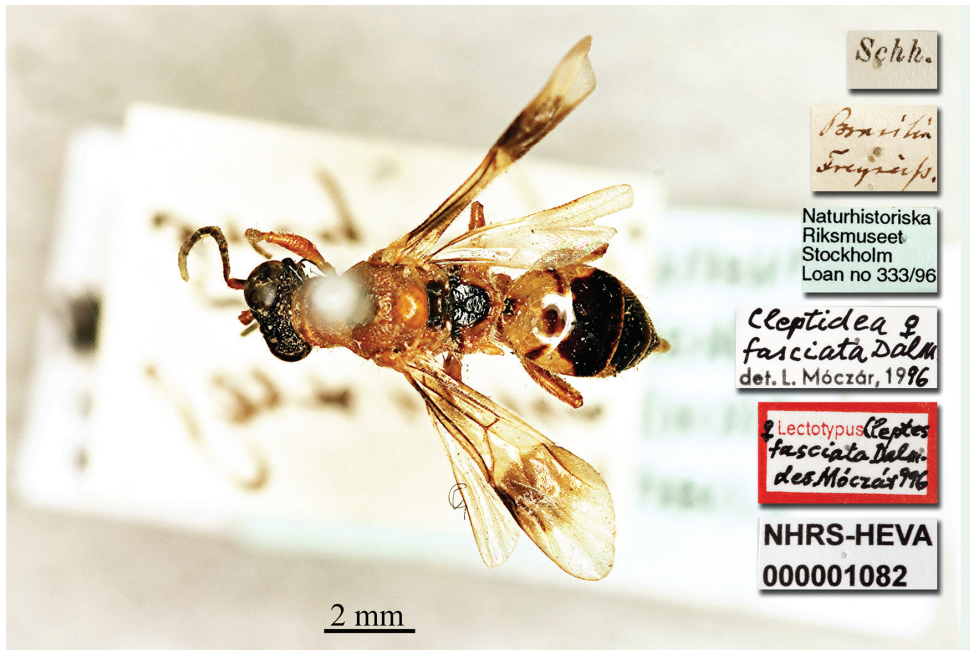


Plate 27. *Cleptes fasciata* Dalman, 1823, holotype. Habitus, dorsal view.

Holotype ♀. [Provins Kiangsu] [China Kolthoff] [Type] <red label> [*Cleptes sjöstedti mihi* ♀ det. Hammer] <handwritten by Hammer> [NHRS-HEVA000001124].

Remarks. Hammer described *Cleptes sjöstedti* based on two females, a holotype and a paratype. Móczár (1998a: 341) searched for the holotype in NHRS, but the senior curator, Fredrik Ronquist, could not find it. Consequently Móczár (1998a), according to the ICZN (Art. 75), designated the neotype based on the paratype housed in Hammer's collection in NHMW. The discovery of the original holotype automatically sets aside Móczár's neotype designation (Art. 75.8, status of rediscovered former name-bearing types). Pictures of the holotype are provided by Rosa et al. (2014).

The correct spelling of the name should be *sjostedti* and not *sjoestedti* as reported by Móczár (1998a: 325) and Kimsey and Bohart (1991: 435) in the following case of *Chrysis sjostedti* Cameron. These two species were dedicated to Yngve Sjöstedt, professor and curator of the NHRS; according to the ICZN (Art. 32.5.2.1); only in case of a German name the correct writing would be *sjoestedti*.

Current status. *Cleptes sjostedti* Hammer, 1950.

Cymura splendida Dahlbom, 1845

Cymura splendida: Dahlbom 1845: 4.

Type locality. Turkey: "Bosfor".

Holotype ♂. [Bosfor Hed. 32] [NHRS-HEVA000001122].

Current status. *Hedychrum coelestinum* Spinola, 1838 (synonymised by Dahlbom 1854: 60).

***Hedychrum massaicum* Cameron, 1910**

Plate 28

Hedychrum massaicum: Cameron 1910: 299.

Type locality. Tanzania: “Kilimandjaro. 2nd November”.

Holotype ♂. [Kilimandj. Sjöstedt] [2 Nov] [Typus] [*Hedychrum massaicum*] <handwritten by Cameron> [173 85] <red label> [Riksmuseum Stockholm] <green label> [*Holotype Hedychrum massaicum* ♂ Cameron det L D French] <red label> [NHRS-HEVA000001101].

Remarks. The type is badly damaged by dermestids. It lacks the antennae, the right part of the head, including mouthparts and occiput and the right foreleg. Together with this type there are two other specimens ([NHRS-HEVA000001134] and [NHRS-HEVA000001135]) collected in the same locality by Sjöstedt and on Mount Meru, but to be excluded from the type-series because they were collected on different days. Cameron (1910) described *H. massaicum* based only on the specimen

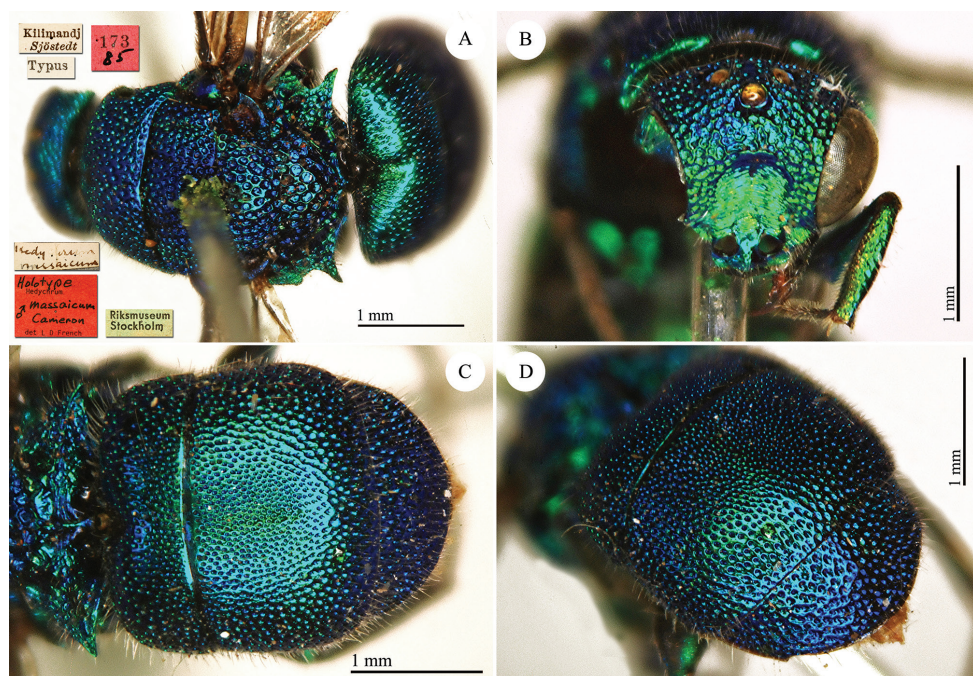


Plate 28. *Hedychrum massaicum* Cameron, 1910, holotype. **A** Habitus, dorsal view **B** head, frontal view **C** metasoma, dorsal view **D** second and third metasomal tergites, dorso-lateral view.

collected on the 2nd of November. The other two specimens have been collected the 6th of September and in January. French identified all of them as *H. massaicum* but one of the specimens [175 85] collected in January belongs to a different species. Bohart (Kimsey and Bohart 1991: 216) examined the “holotype” deposited at the MZLU, but this specimen was not found, and all the material collected by Sjöstedt is deposited at the NHRS.

Current status. *Hedychrum massaicum* Cameron, 1910.

Hexachrysis sjöstedti Cameron, 1910

Hexachrysis Sjöstedti: Cameron 1910: 297.

Type locality. Tanzania: “Kilimandjaro: Kiboto, cultivated zone, 1,300-1,900 m. 7th May”.

Holotype ♀. [Kilimandj. Sjöstedt] [Kibonoto 1300 – 1900 m] [Typus] [*Chrysis sjöstedti*] <handwritten by Cameron> [177 85] <red label> [Riksmuseum Stockholm] <green label> [*Chrysis malachitica* ♀ Dahlbom R.M. Bohart det.] [NHRS-HEVA000001123].

Remarks. The type is seriously damaged. It lacks great parts of the head; a small part is still connected to the mesosoma and includes TFC, ocelli, right part of the face, including mandibles and part of the antenna; all the legs, sternites and internal tergites and sternites are lost. We compared this specimen with the type of *Chrysis malachitica* Dahlbom, 1854 (deposited at the ZMUC). Small differences exist in colour, punctuation and shape of the pronotum, probably due to the distances between the two populations.

Current status. *Chrysis malachitica* Dahlbom, 1854 (synonymised by Kimsey and Bohart 1991: 435).

Holopyga amoenula Dahlbom, 1845

Plate 29

Holopyga amoenula: Dahlbom 1845: 4.

Type locality. Greece: Rhodes.

Lectotype (here designated) ♂: [Rhodus] [Hedb.] [NHRS-HEVA000001059].

Paralectotype 2 ♂♂. [Rhodus] [Hedb.] [NHRS-HEVA000001060] and [NHRS-HEVA000001061].

Paralectotype 1 ♂. [Rhodus] [Hedb.] [Naturhistoriska Riksmuseet Stockholm Loan no 188/96] [NHRS-HEVA000001062].

Paralectotype 1 ♂. [Rhodus] [Hedb.] [det. dr. W. Trautmann] [Naturhistoriska Riksmuseet Stockholm Loan no 188/96] <green label> [NHRS-HEVA000000857].



Plate 29. *Holopyga amoenula* Dahlbom, 1845, lectotype (photo HV). **A** Habitus, lateral view **B** head, frontal view **C** metasoma, lateral view.

Remarks. *Holopyga amoenula* is the type species of *Holopyga* Dahlbom, 1845. In the general collection at the NHRS we found more similar specimens under the name “*Holopyga amoenula* Dahlbom” with the same labels: “Rhodus” and “Hedenborg”. They belong to different species. Dahlbom (1845: 4) wrote: “*Holopyga amoenula* nob. ♂ Rhodus rar. Hedenborg”. It is not possible to know how many specimens he examined, but we guess few specimens (*rar.*), as written in the introduction. Later Dahlbom (1854: 53) wrote: “*Duo specimina ex Insula Rhodo vidi, unum a D. Hedenborg alterum a D. Loew lecta.*” The second specimen is not a type, because the material collected by Loew was not included in the original description.

The history of the name *Ho. amoenula* is rather confused, since it was used by many authors to identify almost all the European species of *Holopyga*. The synthesis of this confused situation can be found in Kimsey and Bohart (1991: 225), where many species belonging to different species groups are placed in synonym with *Ho. amoenula* (Rosa 2006: 136). More generally, the most common European species, currently known as *Ho. generosa* (Förster, 1853) (= *ovata* Dahlbom, 1854) is found in synonym with *Ho. amoenula* after Mocsáry’s monograph (1889: 127). The same taxonomical overview was proposed by Mingo (1994: 73, 204) whereas in the other most important monographs (i.e. Trautmann 1927: 50, and Berland and Bernard 1938: 42), *Ho. amoenula* was considered as variety of *Ho. gloriosa*. The name *gloriosa* Fabricius has been suppressed by the ICZN Commission (ICZN 1998, Opinion 1906) and the spe-

cies previously identified with this name *sensu* Linsenmaier are related with a different species-group, which includes *Ho. lucida* (Lepeletier), *Ho. inflammata* (Förster), *Ho. caucasica* Mocsáry, etc.

Only after Linsenmaier's revision (1959) of the European species, *Ho. amoenula* was correctly identified and recognized as a distinct, valid species endemic to Rhodes. The discussion on the name *amoenula* originates in Dahlbom's monograph (1854: 53). Dahlbom considered *Ho. amoenula* as variety (var. d) of the new described species *Ho. ovata*, contrary to the Principle of Priority that was not yet applied at that time. Two subspecies of *Ho. amoenula* are present in southern Europe: *Ho. amoenula* ssp. *oriensa* Linsenmaier and ssp. *occidentia* Linsenmaier. The possibility that they could be valid species should be taken in consideration.

Since there are different specimens in the collection, and species collected by Hedenborg on Rhodes under the name *Ho. amoenula*, we hereby designate as the lectotype the specimen which match the current interpretation of the species. It is pinned, in perfect condition and we dissected the genitalia, glued with the specimen (Plate 29).

Current status. *Holopyga amoenula* Dahlbom, 1845.

***Holopyga dohrni* Dahlbom, 1854**

Plate 30

Holopyga dohrni: Dahlbom 1854: 48.

Type locality. Cuba and U.S.A.: “*Habitat in Cuba Cel. Dohrn, in New York Cel. Kriechbaumer, qui mihi specimina amice donarunt.*”.

Paralectotype 1 ♂. [*Cuba*] [*Dohrn*] [NHRS-HEVA000001075].

Paralectotype 1 ♂. [*Cuba*] [*Dohrn*] [NHRS-HEVA000001076].

Remarks. Dahlbom (1854) described *Holopyga dohrni* based on a type-series including specimens from Cuba, received from Dohrn, and New York, received from Kriechbaumer. Mocsáry (1889: 122) without type examination placed *Ho. dohrni* Dahlbom in synonymy with of *Ho. ventralis* (Say). This synonym was accepted by several authors (Dalla Torre 1892: 30, Bodenstein 1951: 720; Krombein 1979: 1225). Bohart and Kimsey (1982: 28) listed type “unknown” and placed *Ho. dohrni* in synonymy with *Ho. ventralis*, with restricted distribution to New York; later Bohart (in Kimsey and Bohart 1991: 236) examined the syntype collected in New York and considered it as a holotype. With this assumption (locality restricted to N.Y.) and term (holotype), Bohart (in Kimsey and Bohart 1991) explicitly indicated that he was selecting from the type series that particular specimen to serve as the name-bearing type (Art. 74.5). Therefore the syntype deposited at the MZLU must be considered as the lectotype.

The two Cuban paralectotypes collected by Dohrn are deposited at the NHRS and belong to a different species, probably to *Ho. cyaniventris* (Cresson, 1865).

Current status. *Holopyga ventralis* (Say, 1824).

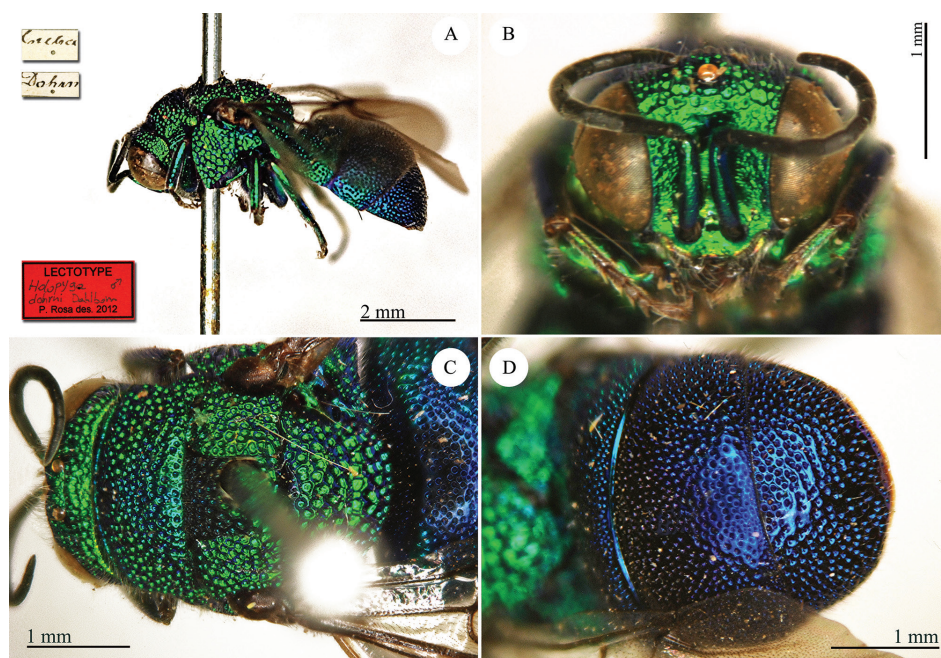


Plate 30. *Holopyga dohrni* Dahlbom, 1854, lectotype. **A** Habitus, lateral view **B** head, in frontal view **C** mesosoma, dorsal view **D** second and third metasomal tergites, dorsal view.

Omalus coriaceus Dahlbom, 1850

Plate 31

Omalus coriaceus: Dahlbom 1850: 135.

Type locality. South Africa.

Holotype ♀. [Caffraria] [J. Wahlb.] [Type] [NHRS-HEVA000000860].

Current status. *Holophris coriaceus* (Dahlbom, 1850) (transferred by Mantero 1910: 548).

Pentachrysis kibonotoensis Cameron, 1910

Pentachrysis kibonotoensis: Cameron 1910: 298.

Type locality. Tanzania.

Holotype ♂ [not ♀]: [Kilimandj. Sjöstedt] [Kibonoto 1800-1900 m] [*Pentachrysis kibonotoensis* ns ♂] [Riksmuseum Stockholm] <green label> [176 85] <red label> [Praestochrysis spina ♂ (*Brullé*) R M Bohart det] [NHRS-HEVA000001091].

Remarks. The type is seriously damaged by an old dermestid attack. It lacks the antennae (except scapus), the compound eyes, part of the scapal basin, tibia and tarsi

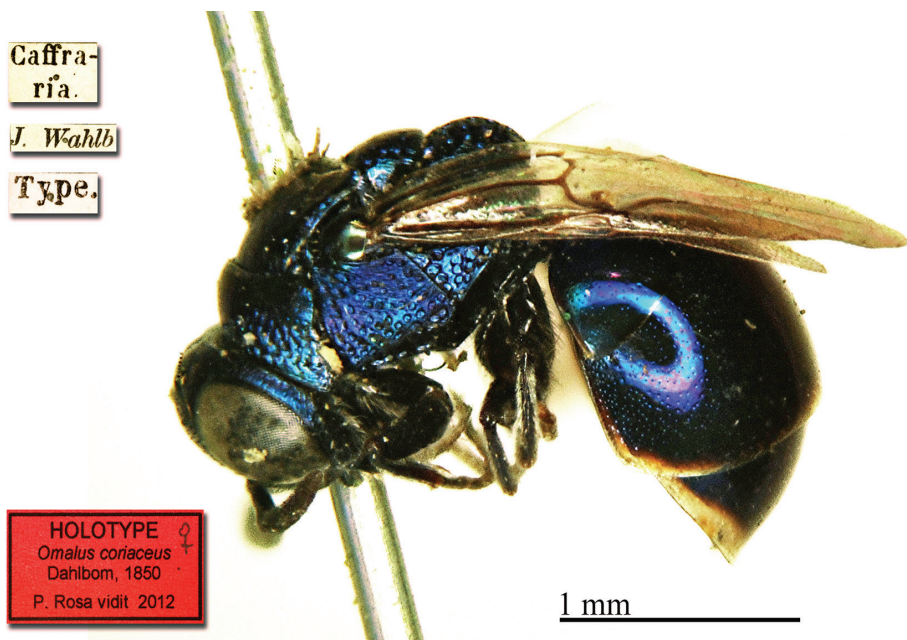


Plate 31. *Omalus coriaceus* Dahlbom, 1850, holotype. Habitus, lateral view.

of the left foreleg, both hindlegs and the sternites and internal urites. Also the first metasomal tergite is partially damaged.

Current status. *Praestochrysis spina* (Brullé, 1846) (synonymised and transferred by Kimsey and Bohart 1991: 535).

Platycelia ehrenbergi Dahlbom, 1845

Platycelia Ehrenbergi: Dahlbom 1845: 8.

Type locality. Egypt.

Holotypus (?) 1 ♀. [Egypt] [Hedb.] [NHRS-HEVA000001077- NHRS-HEVA000001079].

Remarks. Dahlbom (1845: 8) described "*Platycelia Ehrenbergi nob. Ægypt. rariss. Hedenborg.*". The use of "*rariss.*" suggests that Dahlbom examined only one specimen. Confirmation is given by Dahlbom himself (1854: 220) "*Habitat in Ægypto, a D. Hedenborg detecta. Unicum specimen vidi, e Museo Reg. Acad. Scient. Stockholm. a D. Boheman communicatum.*". In the collection three specimens belonging to the same species were located bearing the same labels. Boheman sent only one specimen of this series to Dahlbom, who described the species. Later the specimen was reintroduced in the original series and the label handwritten by Dahlbom was destroyed. Currently the holotype is "lost" within the series, and a neotype could be designated by the first

revisor. We do not select a neotype, because all the three specimens correspond to the current interpretation of the species and therefore the neotype designation seems to be unnecessary.

A revision of the *C. ehrenbergi* species-group is needed, because many subspecific names were proposed and their relation is not clear. Trautmann (1926: 7) described *Cephalochrysis ehrenbergi* var. *vogti*; Linsenmaier (1968: 106, 107) described three different subspecies: *Chrysis (Platycelia) ehrenbergi* ssp. *vinaria*, *C. ehrenbergi* ssp. *hylae*, *C. ehrenbergi* ssp. *chrysodorsa* (= *C. ehrenbergi vogti* Trautmann). Linsenmaier (1968: 106) wrote that *C. ehrenbergi* exists with different ecological and geographical forms: “ehrenbergi Dhlb. existiert in, mindestens im ♀ Geschlecht, durch die Färbung deutlich getrennten, ökologischen und geographischen Formen. Die Nominatform scheint auf Ägypten beschränkt zu sein. ♀ grün, K und Th oben bronzefarben oder mit weniger intensiven kupfernen Reflexen, Abd oben rosa-kupfern.”. However, some ecological or geographical forms could be valid species, as in the case of *Chrysis ignita* (Linnaeus).

Linsenmaier always considered *Platycelia* Dahlbom as a valid and well-characterized subgenus; Linsenmaier (1997a: 285) observed that Kimsey and Bohart (1991) elevated some subgenera to generic level (e.g. *Spintharina* Semenow), whereas other subgenera equally or even more characteristic (e.g. *Platycelia* Dahlbom, *Pyria* Lepeletier, etc.) were downgraded to species-group even if clearly separated from the heterogeneous genus *Chrysis* Linnaeus. The generic status and placement of *Platycelia* should be checked in the future, with the help of molecular analysis.

Current status. *Chrysis ehrenbergi* (Dahlbom, 1845) (transferred by Dalla Torre 1892: 58).

***Stilbum hedenborgi* Dahlbom, 1845**

Stilbum Hedenborgi: Dahlbom 1845: 16.

Type locality. Sudan: “Bahr el Abiad”.

Syntypes 2 ♀♀. [Bahr el Abiad] [Hedenborg] [NHRS-HEVA000001085] and [NHRS-HEVA000001086].

Current status. *Chrysis stilboides* Spinola, 1838 (synonymised and transferred by Mocsáry 1889: 590).

***Stilbum wesmaeli* Dahlbom, 1845**

Plate 32

Stilbum Wesmaëli: Dahlbom 1845: 16.

Type locality. Greece: Rhodes.

Holotype ♂. [Rhodus] [Hedb.] [NHRS-HEVA000001129].

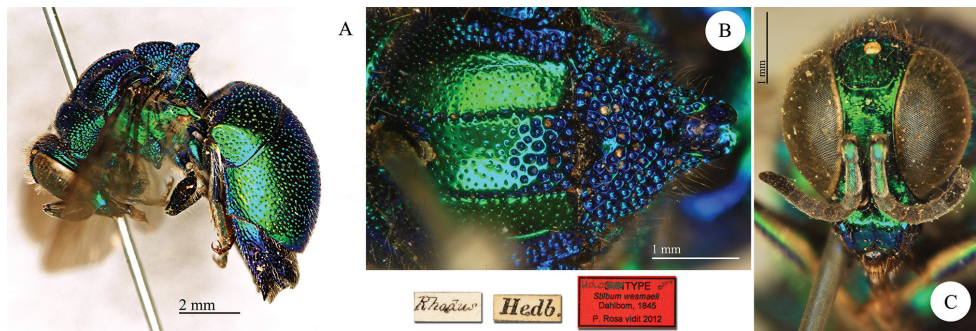


Plate 32. *Stilbum wesmaeli* Dahlbom, 1845, holotype. **A** Habitus, lateral view **B** mesonotum and metanotum, dorsal view **C** head, frontal view.

Remarks. Dahlbom (1845) described *S. wesmaeli* without any note on the type series. More information can be found in his monographical work (Dahlbom 1854: 359): “*Habitat in insula Rhodo; specimen unicum e Mus. Reg. Acad. Scient. Stockholm. communicavit Dom. Boheman.*”. Currently there are three specimens in the collection collected on Rhodes by Hedenborg. Only one has a different printed label [Hedb.] [NHRS-HEVA000001129] instead of [Hedenb.] [NHRS-HEVA000001137-1138]. Hedenborg visited Rhodes more than once, and these three specimens should have been collected in two different journeys. We consider as holotype the one with a different label (NHRS-HEVA000001129).

After Dahlbom (1854), all the most important authors considered *S. wesmaeli* as synonym of *S. cyanurum* (Forster, 1771) (Mocsáry 1889: 190; Dalla Torre 1892: 38; Bishoff 1913: 26; Trautmann 1927: 80; Linsenmaier 1951: 107). However, it was not even mentioned by Mader (1933) and Zimmermann (1937) in their revisions of the genus *Stilbum*. In his major revisions, Linsenmaier (1959: 181 and 1968: 123) used the name *S. calens* ssp. *subcalens* Mader, 1933 (invalid name because described as *aberratio*) in place of *S. wesmaeli* for the corresponding subspecies distributed in the Mediterranean basin (Dalmatia, Balcan Contries, Rhodes, Persia, southern Switzerland (Misox), southern France, Spanien, northern Africa (Linsenmaier 1959) and Lebanon (Linsenmaier 1968)).

In the last publications, Linsenmaier (1997a: 287, 1997b: 134, 1999: 254) used *S. calens* ssp. *wesmaeli* Dahlbom as the oldest name for this species, synonymizing *S. subcalens* and *S. macedonicum* Trautmann, 1926 with *S. calens* ssp. *wesmaeli*. Linsenmaier (1959) treated the invalid name *subcalens* as subspecies of *S. calens*, and thus made this name available as species-group name (ICZN 1999, article 45.6.3.). As Linsenmaier was the first author to make the name available, he should be considered as the author of *S. subcalens* (ICZN 1999, article 50.3.1.).

The type and the other specimens of *S. wesmaeli* in NHRS are not related to *S. calens* (Fabricius), but belong to a different population of *S. cyanurum* (Forster) probably endemic to the island. Dahlbom (1845, 1854) descriptions are clear and this species is easily identifiable by the typical shape of the metanotal protrusion, which is deeply bilobed (“*postscutelli processus emarginatus*”). All the specimens from Rhodes show this special feature, and for this reason we consider this isolated population as a possible valid subspecies.

Current status. *Stilbum cyanurum* ssp. *wesmaeli* (Dahlbom, 1845).

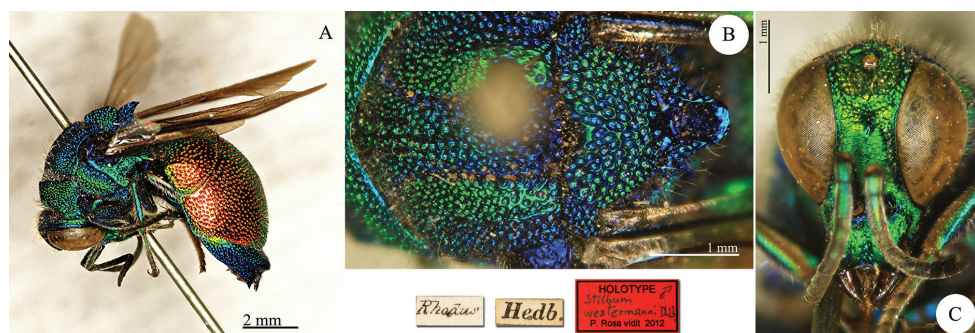


Plate 33. *Stilbum westermanni* Dahlbom, 1845, holotype. **A** Habitus, lateral view **B** mesonotum and metanotum, dorsal view **C** head, frontal view.

Stilbum westermanni Dahlbom, 1845

Plate 33

Stilbum Westermanni: Dahlbom 1845: 16.

Type locality. Greece: Rhodes.

Holotype ♂. [Rhodus] [Hedb.] [NHRS-HEVA000001130].

Remarks. *Stilbum westermanni* is related to *S. calens* Fabricius. Linsenmaier (1997a: 287, 1997b: 134, 1999: 254) confused the two species described by Dahlbom from Rhodes (*wesmaeli* and *westermanni*), and proposed the wrong combination *S. calens* ssp. *wesmaeli* instead of *S. calens* ssp. *westermanni*. According to Linsenmaier (1997b), this subspecies is more distributed along the coast of the Mediterranean basin.

Current status. *Stilbum calens* ssp. *westermanni* Dahlbom, 1845.

Missing types

During the revisional work in the general collection, the following types were not found, which should be deposited at the NHRS according to the literature.

Chrysis gloriosa Dahlbom, 1845

Chrysis gloriosa: Dahlbom 1845: 10, *nec* Fabricius, 1793

Type locality. unknown.

Remarks. Dahlbom (1845) based the description of *C. gloriosa* on a specimen related to *C. grohmanni* Dahlbom, 1854, as written by the same author (Dahlbom 1854: 271). Since the locality is unknown and many subspecies of *C. grohmanni* have been described in the Mediterranean countries, it is impossible to comment this name.

***Chrysis inaequalis* Dahlbom, 1845**

Plate 34

Chrysis inaequalis: Dahlbom 1845: 8.**Type locality.** Turkey: “Bosfor”.**Neotype** (here designated) ♂: [*Helvetia*] [*Roveredo* 28.8.46] [♂ *Chrysis* L. *inaequalis* D. det. Lins.] [NML_ENT GBIF_Chr 00038702] deposited at NMLS.**Remarks.** *Chrysis inaequalis* is one of the most common species in Europe. It was described from Turkey (Bosfor), but the type is lost. In the general collection we could only find two females of *C. inaequalis* collected at Rhodes by Hedenborg. According to Linsenmaier the “typical” *C. inaequalis* is present only in central-, southern Europe and in northern Africa; in the rest of the distributional range, from Greece to central Asia, the subspecies *C. inaequalis sapphirina* Semenov-Tian-Shanskij, 1912 is present. *C. sapphirina* is the eastern form with green-coloured males and both sexes coarsely punctuated. Linsenmaier (1959) cited *C. inaequalis* s. str. in North China and Manchuria, but later, in his collection, he identified all the eastern specimens as *C. inaequalis* ssp. *sapphirina*. Linsenmaier (1959) did not notice that the typical locality of *C. inaequalis* correspond with the distribution given for *C. inaequalis* ssp. *sapphirina sensu auctorum*.

For this reason a neotype designation of *C. inaequalis* is needed. We could not find any other specimen from Bosphor (Istanbul and adjacent areas), but in Linsenmaier’s collection we found many specimens collected in western Turkey, both on the European and the Asiatic side. The closest localities are Edirne (on the European side) and Ayvalik (on the Asiatic side). Even if it is not required for a neotype designation, Ayvalik is a seaside town on the northwestern Aegean coast of Turkey, it is possible that Hedenborg visited this town moving from Rhodes or Egypt to Istanbul. In fact Hedenborg was the medical doctor of the Swedish Embassy at Istanbul, and not only a famous naturalist who published different papers on his journeys in Rhodes and Egypt.

However, since the name *C. inaequalis* is in prevailing use for the identification of the western European specimens for the last 100 years, we prefer to designate a neotype based on one specimen collected in central Europe, rather than on a specimen collected nearby the typical locality. If we designate a neotype on an eastern Mediterranean species, the name *C. sapphirina* would fall in synonymy with *C. inaequalis* and the western subspecies would be named: *C. inaequalis* ssp. *taeniophrys* Förster, 1853, which is the first available name. Moreover, if future examinations made with the help of molecular techniques will demonstrate that western and the eastern subspecies (*sensu* Linsenmaier) are separated and valid species, the valid name for *C. inaequalis* in Europe would become *C. taeniophrys* Förster, a name never used after the description given by Förster. In addition, the

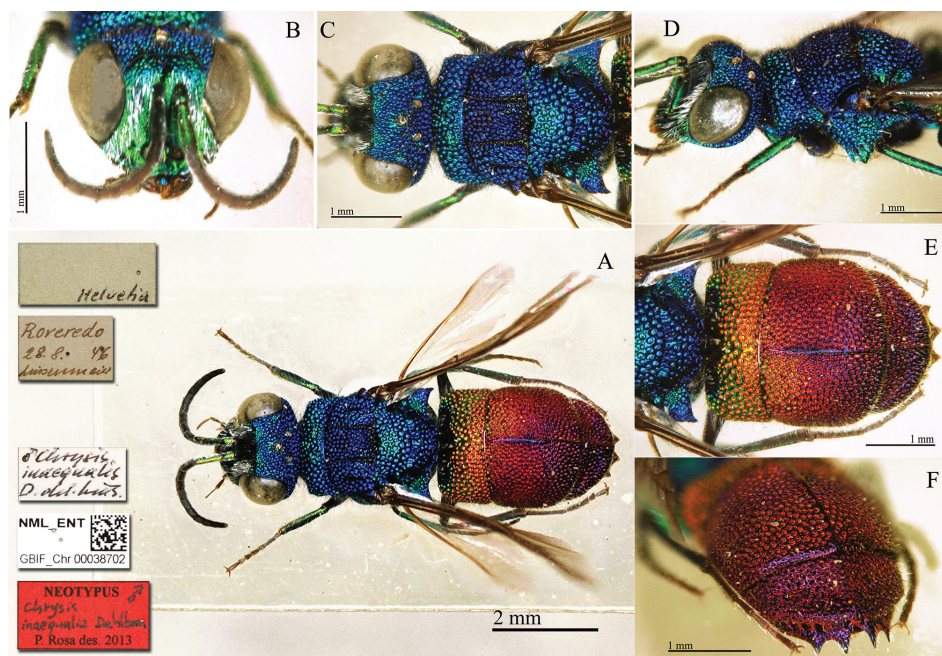


Plate 34. *Chrysis inaequalis* Dahlbom, neotype. **A** Habit, dorsal view **B** head, frontal view **C** head and mesosoma, dorsal view **D** mesosoma, lateral view **E** metasoma, dorsal view **F** second and third metasomal tergites, dorso-lateral view.

type of *C. taeniophrys* Förster is lost, and we could not check that it is truly the first available name for the western form of *C. inaequalis*. By designating a western European specimen, we keep the stability of name use. Therefore, the male specimen collected in Switzerland at Roveredo on the 28th of August 1948 by Linsenmaier (NML_ENT GBIF_Chry 00038702) is selected, housed in the Linsenmaier collection at the NMLS.

Current status. *Chrysis inaequalis* Dahlbom, 1845.

Cleptes aurata Dahlbom, 1845

Cleptes aurata: Dahlbom 1845: 2, nec Panzer, 1798.

Type locality. “Bosfor, Hedenborg”.

Remarks. Móczár (1998b: 511) designated the neotype of *Cleptes aurata* Dahlbom on a female specimen collected by Houska in Palestina and deposited at the HNHM.

Current status. *Cleptes dahlbomi* Semenov-Tian-Shanskij, 1909 (replacement name for *Cleptes aurata* Dahlbom, 1845).

Specimens labelled as types but never described

In the general collection at the NHRS there is a specimen labelled: [J. Klapperich Sarekanda, 4100m 28.7.53, Gebirge Badakschan NO – Afghanistan] [*Chrysis badakschensis* n.sp ♀ Holotypus] <red label handwritten by Balthasar>. This species was never described by Balthasar and it belongs to the *Chrysis comparata* group, *analis* subgroup.

Conclusions

The study of the type material by Dahlbom is fundamental to further knowledge on the European and western Palaearctic fauna. While studying his works, some interesting observations on types were found that were overlooked in recent revisions, probably because they were written in Latin. After reading Dahlbom's main works (1845, 1854), we concluded that there is no correspondence between many descriptions and the current interpretation of the species. For this reason and in preparation of the volume on the Italian Fauna, a revisional work on the European types at the most important museums has been initiated by the first author (Rosa 2009; Paukkunen et al. 2014; Rosa and Xu 2015; Rosa et al. 2015), with multiple discoveries at different museums.

During the study of the type specimens housed in the NHRS, 72 types belonging to 53 taxa were examined. Some nomenclatural and taxonomic changes are proposed. Moreover, in contrast to the catalogue of the Chrysididae of the world (Kimsey and Bohart 1991), we found that two additional holotypes are deposited at the NHRS (*Chrysis equestris* Dahlbom, 1854 and *Omalus coriaceus* Dahlbom, 1850); three syntypes belonging to two species are deposited at the NHRS (*Chrysis manicata* Dahlbom, 1854 and *Chrysis soror* Dahlbom, 1854); and four holotypes and two syntypes are deposited at the NHRS and not at the MZLU or at the NMPC (*Chrysis elvira* Balthasar, 1957, *Chrysis klapperichi* Balthasar, 1957, *Chrysis nisseri* Dahlbom, 1845, *Hedychrum massaicum* Cameron, 1910, *Holopyga dohrni* Dahlbom, 1854).

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A new species of *Neomida* Latreille from Colombia, with additional records and a complementary description for *Neomida suilla* (Champion) (Coleoptera, Tenebrionidae, Diaperini)

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Abstract

Neomida diminuta sp. n. is described, based on a single male specimen from Colombia, and a redescription of *N. suilla* (Champion) is given. Data on the morphology of the aedeagus for both species, and on the female abdominal terminalia for *N. suilla* are provided. New records of *N. suilla* from Atlantic Forest remnants in the states of Espírito Santo and Minas Gerais, Brazil are given.

Keywords

Tenebrionidae, Diaperini, *Neomida*, new species, redescription, new records, Brazil, Colombia

Introduction

Species of the genus *Neomida* Latreille, 1829 (Coleoptera: Tenebrionidae: Diaperini) are strict fungivorous beetles that dwell in hard conks of Polyporales and Hymenochaetales hosts. *Neomida* has approximately 50 described species, most from tropical and subtropical regions (Schawaller 2002). In America, the genus is most diversified in the neotropics; it does not occur in the Andean region, and has only three Nearctic species, *N. bicornis*

(Fabricius), *N. occidentalis* (Champion) and *N. ferruginea* (LeConte). Members of *Neomida* are diagnosed by the following features (taken from Triplehorn 1965): antennal club loose and with seven antennomeres; eyes emarginate anteriorly close to antennal insertions, forming a lower portion at least twice as long as the upper portion; head of males usually bearing horns or tubercles on frons or clypeus, or both; prosternal process convex; elytral punctation seriate; basal tarsomere of hind tarsi short. However, these features are usually subject to exceptions or shared with species of other Diaperini genera. For instance, *Neomida acera* Triplehorn is devoid of secondary sexual features on male head; the long and loose antennal club of *Neomida* is similar to those of *Diaperis* Geoffroy, *Ulomoides* Blackburn and *Pentaphyllus* Dejean (Triplehorn 1965); and species of *Platydemia* Laporte and Brullé also have seriate elytral punctation. *Neomida* and *Platydemia* are highly diversified and use similar fungi as hosts, but can be easily distinguished at a glance: the body of *Neomida* is distinctly convex and subparallel-sided, while *Platydemia* are comparatively more flattened and ovoid, with male horns on the head often asymmetric. The Neotropical fauna of *Neomida* comprises 30 described species, 16 restricted to the northern and three to the southern neotropics, and 11 species are found in both (Triplehorn 2006).

In recent field collections in southeast Brazil we found *N. suilla*, a species known from a few named specimens in museum collections and amongst the least studied Neotropical *Neomida*. Additionally a small undescribed *Neomida* erroneously identified as *Cis* Latreille (Ciidae) was recognized among the material borrowed from the Muséum national d'Histoire naturelle in Paris. The aims of the present work are to provide new records and a complete description for *N. suilla*, and describe a new species belonging to the same genus.

Material and methods

Specimens of *N. suilla* were found in basidiomes of *Ganoderma* sp. (Ganodermataceae) collected in Rio Doce, in the state of Minas Gerais, and Linhares, in the state of Espírito Santo. Both localities are in the Brazilian Atlantic Forest. The beetles were reared in the laboratory, in the same fungi in which they were found, so as to obtain a high number of specimens for dissecting and depositing in scientific collections. Five adults were preserved in absolute alcohol, which are preserved below -22 °C for future molecular analyses. Forty specimens are dry mounted and several others are preserved in 70% alcohol.

Species identification was possible due to morphological data and images provided in the work of Triplehorn (2006). Specimens were examined and measured, and adult male and female abdominal terminalia extracted under a Zeiss Stemi 2000-C stereomicroscope. Female terminalia, including spermatheca, were stained with a solution of 0.5% Chlorazol Black E in 85% alcohol to enhance contrast. Whole mount preparations of dissected sclerites were made using a water-soluble mounting media based on polyvinyl alcohol and lactic acid. We photographed slides under a Zeiss AxioLab compound microscope equipped with a Zeiss AxioCam ERc 5s digital camera (Figs 3–4) and a Zeiss AxioCam MRc (Figs 7–9, 11–12), and adult specimens under a Zeiss

Discovery V8 stereomicroscope with a Zeiss AxioCam MRc digital camera (Figs 1–2) and a Zeiss Discovery V20 stereomicroscope with a Zeiss AxioCam 506 (Figs 5–6, 10). Final images were the result of montaging 25 to 125 image slices at different focal lengths using the extended focus module of Zeiss Axiovision 4.8 software (Figs 1–2) and Zeiss ZEN 2012 (Figs 5–6, 10).

We based the redescription of *N. suilla* on a male plesiotype (a specimen used for a redescription, supplementary description, or illustration published subsequent to the original description; sensu Evenhuis 2008), and the description of *N. diminuta* sp. n. on a single male from Colombia. Terms for external morphology, including sclerites of abdominal terminalia, follow Lawrence et al. (2011). The term basale refers to the phallobase, and apicale to the fused parameres (Lawrence et al. 2011). The following symbols are used for measurements (in mm) and ratios: EL, elytral length (at midline, from base of scutellum to elytral apex); EW, greatest elytral width; GD, greatest depth of the body (from elytra to metaventricle); PL, pronotal length along midline; PW, greatest pronotal width; TL, total length (=EL+PL; head not included). The ratio GD/EW was recorded as an indication of degree of convexity; TL/EW indicates degree of body elongation.

The distribution map (Fig. 13) was created using latitude and longitude coordinates estimated by tracking localities in the online database GeoNames (Wick 2010) and plotting them in a map using DIVA-Gis 7.5.

Labels were printed in white paper, unless otherwise specified. Label data are cited verbatim in quotation marks; a backslash separates different labels. Square brackets are used to denote our comments on label data. The number and gender of specimens bearing these labels are stated immediately before the label data.

Acronyms of depositories

ANIC	Australian National Insect Collection, CSIRO Ecosystem Sciences (Canberra, Australia)
CELC	Coleção Entomológica do Laboratório de Sistemática e Biologia de Coleoptera, Universidade Federal de Viçosa (Viçosa, Minas Gerais, Brasil)
MNHN	Muséum national d'Histoire naturelle (Paris, France)
OSUC	The Ohio State University Insect Collection (Columbus, Ohio, USA)

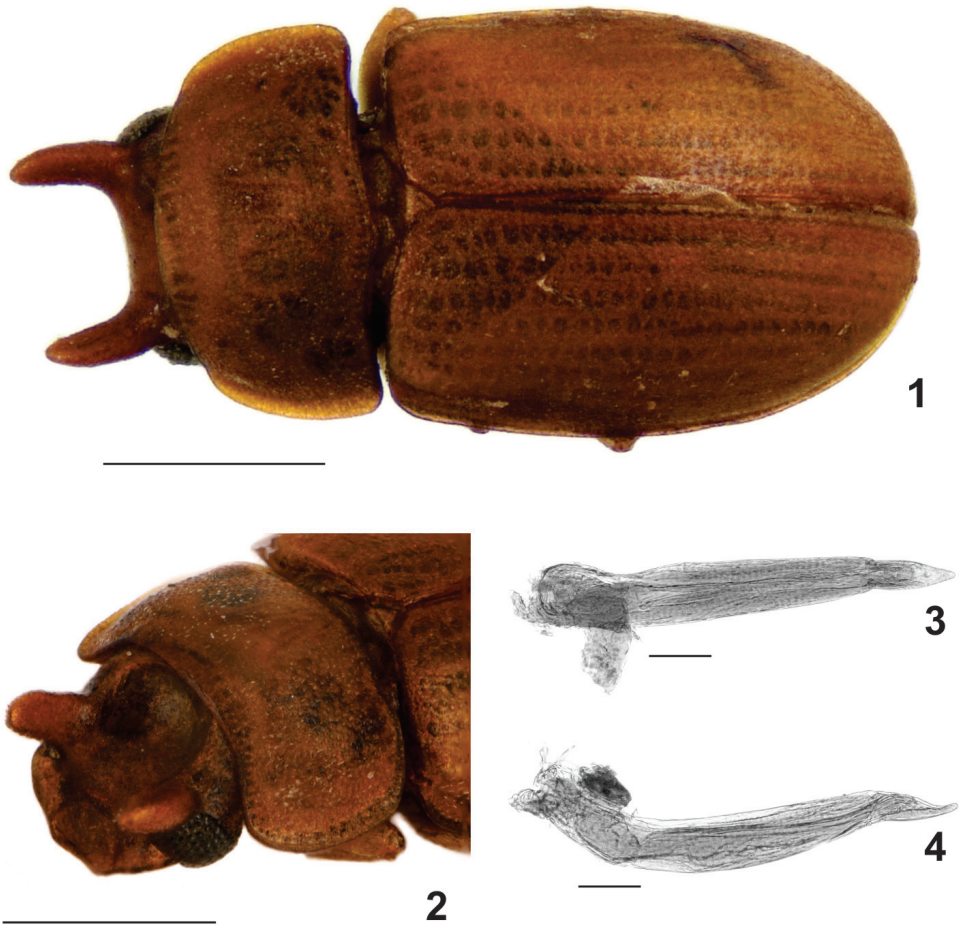
Taxonomy

Neomida diminuta sp. n.

<http://zoobank.org/74A4E927-BEA1-4763-857E-20A3899F26B1>

Figs 1–4

Diagnosis. *Neomida diminuta* sp. n. differs from all other *Neomida* by its minute size (TL 1.74 mm), while other species in the genus are at least 1.85 mm long. It differs



Figures 1–4. *Neomida diminuta* sp. n. male holotype. **1** Dorsal view **2** Diagonal view of head **3** Ventral view of aedeagus **4** Lateral view of aedeagus. Scales bar: 0.5 mm (Figs 1–2), 0.1 mm (Figs 3–4).

from *N. suilla* and *N. picea* in the possession of two clypeal tubercles instead of one, from *N. cioides* in the subcylindrical and straight frontal horns, and from *N. inermis* by its subtle clypeal sinuosity instead of conspicuous and cylindrical tubercles. *Neomida diminuta* sp. n. males have eyes, body shape and cephalic horns similar to those of *N. occidentalis*, but the latter are twice as long. In *N. diminuta* sp. n., the epipleura extends from base to apex of elytra, a feature observed only in other six species of *Neomida*: *N. cioides* (Champion), *N. deltocera* Triplehorn, *N. occidentalis*, *N. pentaphyllodes* (Champion), *N. picea* (Laporte and Brullé) and *N. suilla*.

Etymology. The name “diminuta” means small, referring to its minute size.

Description. Male. Body moderately convex, opaque, glabrous; length 1.74 mm; elytra, pronotum and head reddish-brown; antennae and legs golden-yellow. **Head** with vertex deeply concave; frons armed with a pair of long, subcylindrical, subparallel narrow horns, each rising close to an eye; clypeus with two small sinuosities contiguous

to antennal insertions. **Eyes** with anterior portion emarginated by antennal insertion, forming a lower lobe approx. four times as large as upper lobe. **Antennae** with antennomeres 5–11 expanded forming a club. **Pronotum** strongly transverse, approx. twice as wide as long, widest and longest at middle, sides subparallel and narrowed anteriorly; lateral edges explanate, visible for their entire lengths from above; anterior edge truncate. **Elytra** approx. twice as long as pronotum, widest at middle and narrowing to apex, epipleura extending to apex. **Hind wings** developed, apparently functional. **Ventral surface** slightly darker than dorsum, punctation sparser; prosternal process subparallel. **Protibiae** with outer edge serrate; apex bearing a row of spines; inner apical angle with two long spines. **Hind tarsi** with basal tarsomere approx. as long as the following three together. **Aedeagus** with basale approx. three and a half times as long as apicale, curved at base, sides subparallel, a bit wider in the second third; apicale with sides subparallel, narrowing near middle to apex; penis about as long as basale, cylindrical, expanded at apex, with struts converging and fusing at basal one-fifth; internal sac not observed (possibly lost during dissection). **Female** unknown.

Measurements. Male holotype (in mm): TL 1.74, PL 0.49, PW 0.89, EL 1.17, EW 0.98, GD 0.69; ratios: PL/PW 0.55, EL/EW 1.19, EL/PL 2.39, GD/EW 1.70, TL/EW 2.46.

Type specimen. Male holotype (MNHN) labeled: “Dup Colomb 41 [sic] {circular green label}\ ♂ {small green label}\ *Neomida diminuta*, HOLOTYPUS, Aloquio & Lopes-Andrade {handwritten in red label}”.

Comments. *Neomida diminuta* sp. n. was collected in 1841 and remained unrecognized as a tenebrionid beetle in the Muséum national d’Histoire naturelle of Paris, France, until recently. It was found among specimens identified as *Cis* Latreille (Ciidae), possibly confounded due to its small size and head bearing horns. The great age certainly affected important morphological features, such as body vestiture, pronotal and elytral punctation and integrity of membranous structures as the internal sac of aedeagus. Information on host fungus was not available. The extension of exposed epipleura and other conspicuous characters need to be more carefully observed, because they can be important for proposing species-groups or even subgenera for *Neomida*, in order to facilitate the work with such a speciose genus.

Neomida suilla (Champion, 1896)

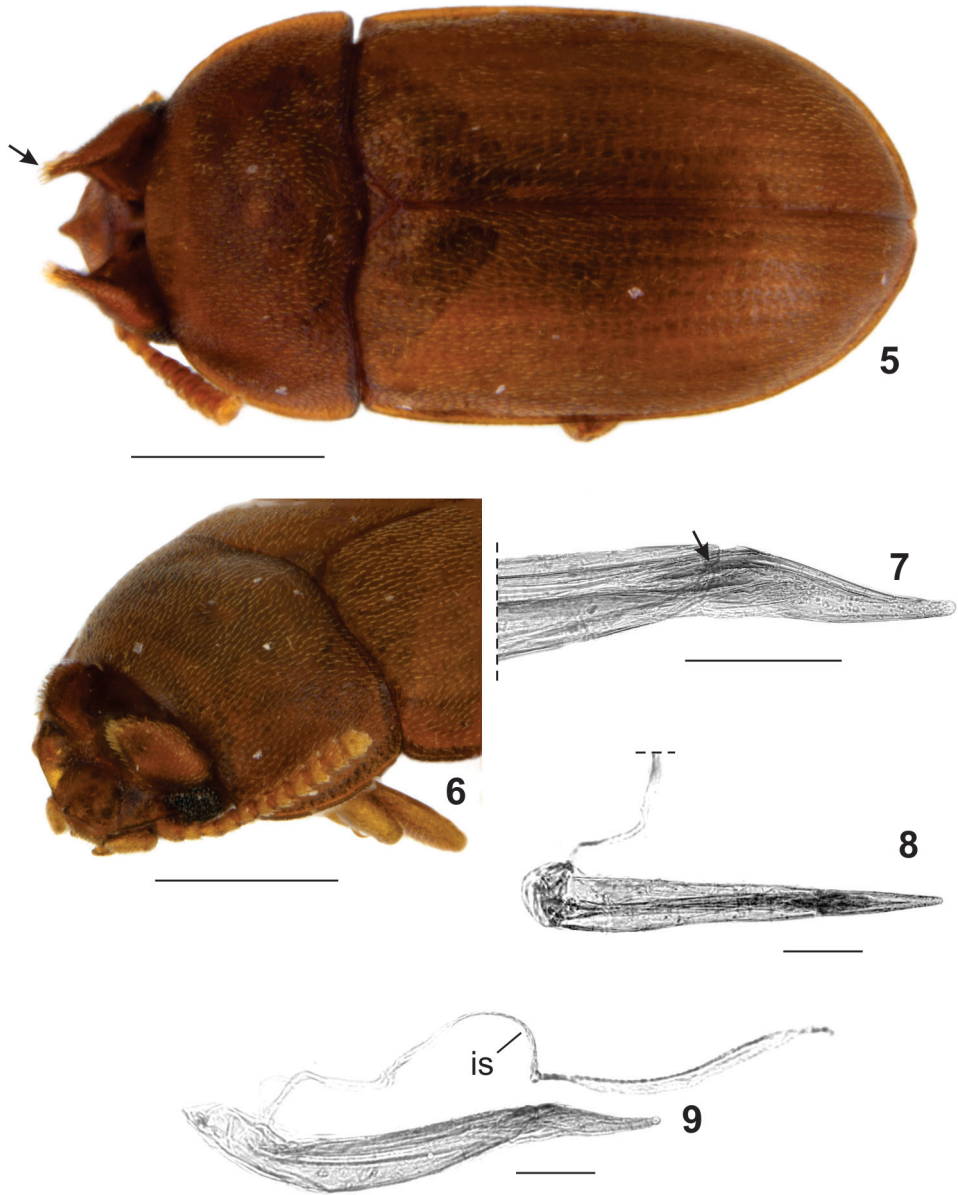
Figs 5–12

Arrhenoplita suilla Champion 1896: 11

Hoplocephala suilla (Champion): Blackwelder 1945: 527

Neomida suilla (Champion): Triplehorn 1965: 375; Marcuzzi 1984: 87; Triplehorn 2006: 313

Diagnosis. Males of *N. suilla* differ from males of all other described New World *Neomida*, except *N. picea* (Laporte and Brullé), in having a single prominent median clypeal tubercle



Figures 5–9. *Neomida suilla* male. **5** Dorsal view, tuft of bristles on horn tip (arrow) **6** diagonal view of head **7** Detail of aedeagus apicale showing the ala (arrow) **8** Ventral view of aedeagus **9** Lateral view of aedeagus. **is** – internal sac. Scale bars: 0.5 mm (Figs 5–6), 0.1 mm (Figs 7–9).

(Triplehorn 2006). *Neomida suilla* differs from *N. picea* by its shorter length, and males in having triangular-shaped cephalic horns with a tuft of bristles at their tips (Fig. 5, arrow).

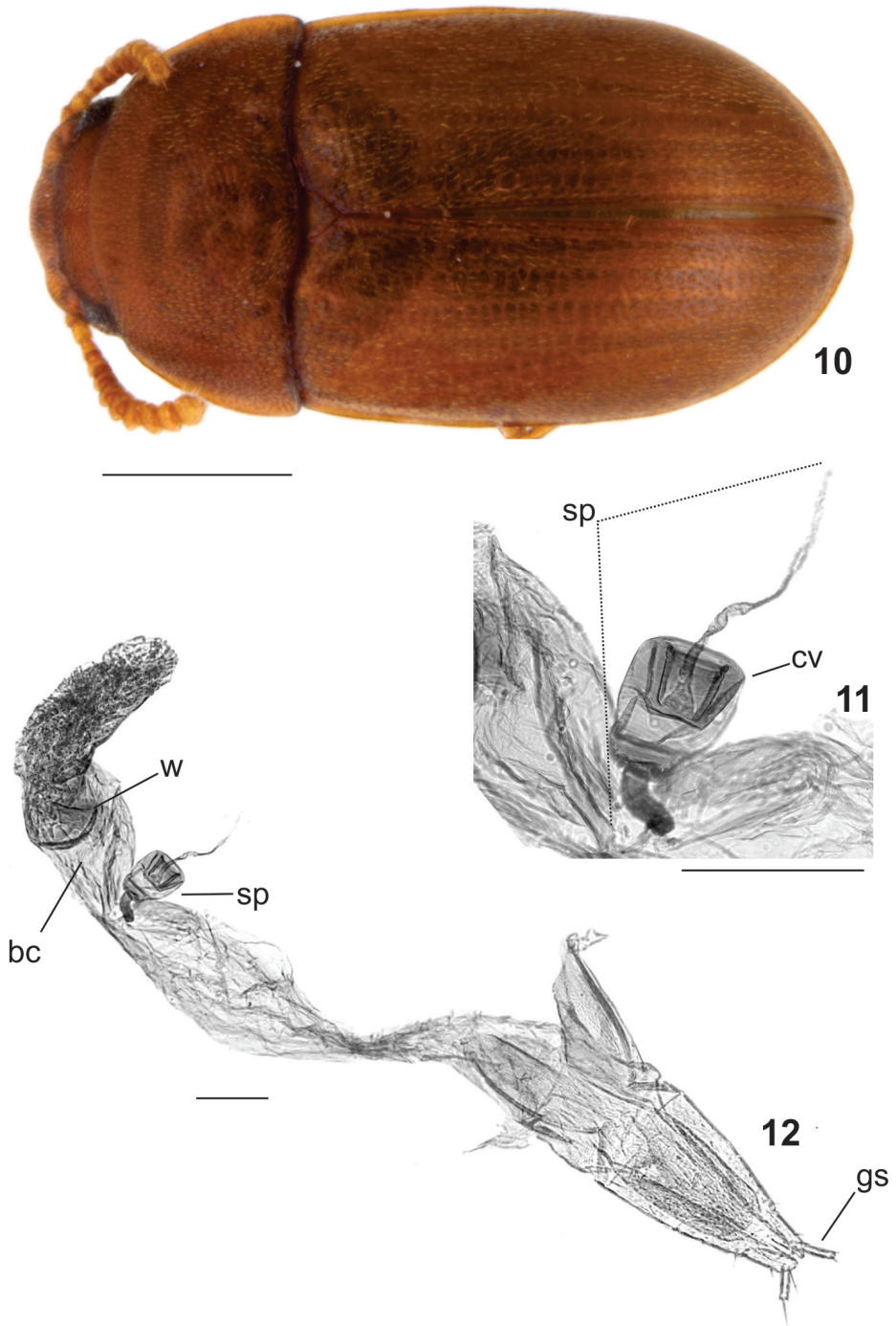
Supplementary description. Male. Body moderately convex, opaque, with vestiture of small seta; length 1.85–2.25 mm; elytra, pronotum and head reddish-brown;

antennae, legs and mouthparts golden-yellow. **Head** with clypeus bearing a single prominent tubercle near the middle of anterior edge; frons armed with a pair of long, flattened, subtriangular, broad horns, each rising close to an eye and directed upward; horns with a row of bristles extending from about the middle of anterior edge to apex (Fig. 5, arrow); vertex deeply concave; **Eyes** with anterior portion emarginate by antennal insertion, forming a lower lobe about three times larger than upper lobe. **Antennae** with antennomeres 5–11 expanded forming a club; antennomeres 6–11 bearing multi-pronged sensilla (sensillifers) at the upper portion. **Pronotum** strongly transverse, twice as wide as long, widest posteriorly and longest at middle; lateral edges explanate, visible for their entire lengths from above; anterior edge slightly curved outward. **Elytra** approx. two and a half times as long as pronotum; sides subparallel at basal half, then narrowing to apex, epipleura extending to apex. **Hind wings** developed, apparently functional. **Ventral surface** slightly darker than dorsum, punctation sparser; prosternal process subparallel, narrowest at apex. **Protibiae** with outer edge serrate; apex bearing a row of spines; inner apical angle with two long spines. **Aedeagus** with basale about three times as long as apicale; basale most expanded near its base; apicale strongly narrowed at apex and with two lateral projections (ala) directed anteriorly and fitting the basale (Fig. 7, arrow); penis about as long as basale, cylindrical, expanded at apex, with struts converging and fusing at basal one-seventh of the length; internal sac narrow, elongated, about twice as long as penis. **Females** similar to males except for the following features: head without clypeal tubercle and frontal horns, and vertex devoid of concavity; eyes with lower lobe twice as long as upper one. **Female abdominal terminalia** with bursa copulatrix approx. one and a half time as long as gonocoxites together; common oviduct approx. as long as window of bursa; window of bursa about four times as long as spermatheca; spermatheca (Fig. 11) with check valve small, oval, bearing an invagination from upper portion to about middle; paraprocts about as long as gonocoxites together; baculi of basal gonocoxites perpendicular in relation to baculi of paraprocts; gonocoxites transversely divided into three parts; gonostyli inserted at top of apical gonocoxites.

Variation. Males ($n = 30$), measurements (in mm): TL 1.90–2.20 (2.10 ± 0.09), PL 0.45–0.60 (0.56 ± 0.04), PW 0.90–1.05 (1.00 ± 0.04), EL 1.00–1.40 (1.28 ± 0.08), EW 0.95–1.10 (1.05 ± 0.04), GD 0.70–0.80 (0.74 ± 0.03); ratios: PL/PW 0.50–0.60, EL/EW 1.00–1.35, EL/PL 2.00–2.67, GD/EW 0.64–0.75, TL/EW 1.82–2.15. Females ($n = 10$), measurements (in mm): TL 1.85–2.20 (2.08 ± 0.10), PL 0.45–0.60 (0.56 ± 0.05), PW 0.90–1.05 (1.00 ± 0.04), EL 1.25–1.40 (1.32 ± 0.05), EW 0.95–1.10 (1.06 ± 0.05), GD 0.70–0.75 (0.74 ± 0.02); ratios: PL/PW 0.50–0.60, EL/EW 1.18–1.35, EL/PL 2.17–2.78, GD/EW 0.68–0.74, TL/EW 1.91–2.10.

Material examined. 15 males and five females (1♂ and 1♀ ANIC, 13♂ and 3♀ CELC, 1♂ and 1♀ OSUC) labeled: “BRASIL: MG, Rio Doce, Lago da Candonga; área de mata, 16.ix.2009, leg. E.F. Barbosa”. 15 males and five females (1♂ and 1♀ ANIC, 13♂ and 3♀ CELC, 1♂ and 1♀ OSUC) labeled: “BRASIL: ES, Linhares, Mata do Lago, 16.vii.2010, leg. S.Z. Aloquio Jr.”.

Comments. All specimens of *N. suilla* were found in basidiomes of *Ganoderma* sp., which is the primary host fungus record for the species. *Neomida suilla* was col-



Figures 10–12. *Neomida suilla* female. **10** Dorsal view **11** Spermatheca **12** Abdominal terminalia. **bc** – bursa copulatrix, **cv** – check valve, **gs** – gonostylus, **sp** – spermatheca, **w** – window of bursa. Scale bars: 0.5 mm (Fig. 10), 0.1 mm (Figs 11–12).



Figure 13. Distribution map for *Neomida diminuta* sp. n., represented by an interrogation symbol (?), without specific locality, and *Neomida suilla*, represented by a triangle (▲).

lected in two localities of the Brazilian Atlantic Forest (Fig. 13) separated by approx. 500 linear km, each at an extreme of the Doce River. These two localities are the most southern records for the species, which was known from only two localities in the Lesser Antilles (St. Vincent and Guadeloupe) and one in Recife (in the state of Pernambuco, Brazil). Its occurrence in the Lesser Antilles and in distant localities of the Brazilian Atlantic Forest suggests a wide distribution throughout the east coast of tropical South America.

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New data on the subgenus *Harpopaederus* of the genus *Paederus* (Coleoptera, Staphylinidae, Paederinae) of mainland China

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Abstract

Paederus (*Harpopaederus*) *xui* Peng & Li, **sp. n.** (Sichuan: Micang Shan) is described. Additional records of five *Harpopaederus* species are reported. All of these species are illustrated.

Keywords

Coleoptera, Staphylinidae, *Paederus*, *Harpopaederus*, new species, new records, mainland China

Introduction

The widely distributed genus *Paederus* Fabricius, 1775 was previously represented in China by 39 species (Li et al. 2014; Peng et al. 2014), ten of which were placed in the subgenus *Harpopaederus* Scheerpeltz, 1957 (type species: *Paederus schoenherri* Czwalina, 1889): *P. antennocinctus* Willers, 2001 (Sichuan, Gansu), *P. gottschei* Kolbe, 1886 (Heilongjiang, Jilin; North Korea; South Korea; Russia), *P. konfuzius* Willers, 2001 (Shaanxi, Gansu, Sichuan), *P. pseudobaudii* Aleksandrov, 1934 (Heilongjiang), *P. apfelsinicus* Willers, 2001 (Hubei, Shaanxi), *P. gracilacutus* Li & Zhou, 2007 (Shaanxi, Gansu), *P. lineodenticulatus* Li & Zhou, 2007 (Sichuan), *P. dangchangensis* Li & Zhou, 2007 (Gansu), *P. brevior* Li, Solodovnikov & Zhou, 2014 (Shaanxi) and

P. multidenticulatus Li, Solodovnikov & Zhou, 2014 (Hubei) (Li and Zhou 2007; Li et al. 2014; Smetana 2004; Willers 2001a, b).

In recent years numerous *Harpopaederus* specimens were collected during several field trips. Six species were identified, one of which is described for the first time.

Material and methods

The material treated in this study is deposited in the following collections:

SNUC Insect Collection of Shanghai Normal University, Shanghai
cAss private collection Volker Assing, Hannover
cSch private collection Michael Schülke, Berlin

The following abbreviations are used in the text, with all measurements in millimeters:

Body length (BL) from the anterior margin of the labrum to the abdominal apex; forebody length (FL) from the anterior margin of the labrum to the posterior margin of the elytra; head length (HL) from the anterior clypeal margin to the occipital constriction; head width (HW): maximum width of head; length of antenna (AnL); length of pronotum (PL) along midline; maximum width of pronotum (PW); elytral length (EL) at the suture from the apex of the scutellum to the posterior margin of the elytra (at the sutural angles); maximum width of the elytra (EW); maximum width of abdomen (AW); length of aedeagus (AL) from the apex of the dorsal plate to the base of the aedeagal capsule.

Results

Paederus (Harpopaederus) apfelsinicus Willers, 2001

Figs 1A, 2A, G–J

Material studied. China: Hubei: 1 ♀, Shennongjia, Xiaolongtan, 05.VIII.2002, Li & Tang leg. (SNUC).

Comment. The above specimen was collected near the type locality of this species. The female external and sexual characters are illustrated in Figs 1A, 2A, 2G–J. For illustrations of the male sexual characters see Willers (2001a).

Paederus (Harpopaederus) brevior Li, Solodovnikov & Zhou, 2014

Figs 1B, 2B, 3

Material studied. China: Shaanxi: 4 ♂♂, 2 ♀♀, Ningshan Hsien, Huoditang, 33°26'N, 108°26'E, 1724 m, 24–25.V.2008, Huang & Xu leg. (SNUC); 1 ♂, 1 ♀, Zhouzhi Hsien,

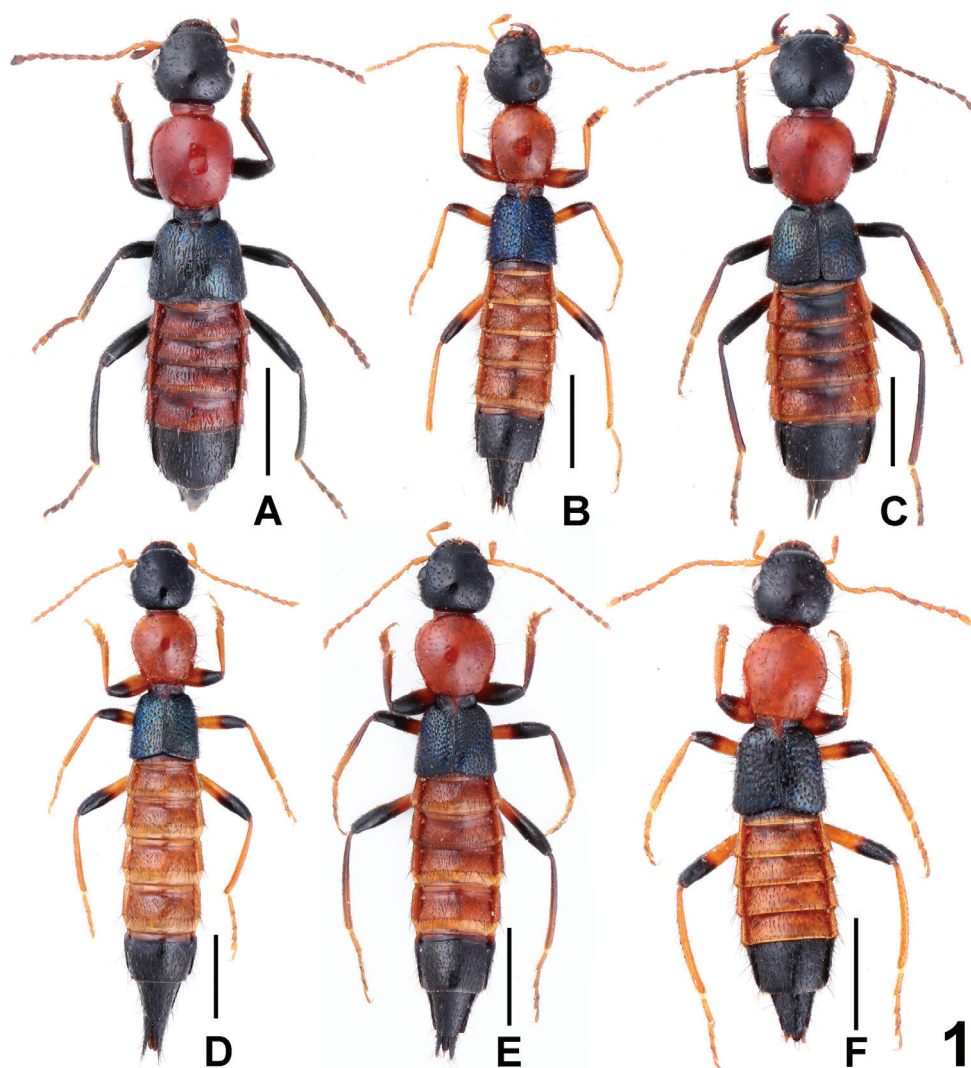


Figure 1. Habitus, **A** *P. (Harpopaederus) apfelsinicus* **B** *P. (H.) brevior* **C** *P. (H.) gottschei* **D** *P. (H.) gracilacutus* **E** *P. (H.) konfuzius* **F** *P. (H.) xui*. Scale bars: 2.0 mm.

Houzhenzi, 33°51'N, 107°50'E, 1260 m, 05.V.2008, Huang & Xu leg. (SNUC); 1 ♂, 1 ♀, Ningshan Hsien, Huoditang, 33°26'N, 108°27'E, 1500–1700 m, 12.VII.2012, Yu-Hong Pan leg. (SNUC); 7 ♂♂, 3 ♀♀, Foping Hsien, Foping Nature Reserve, 33°38'N, 107°58'E, 1250–1400 m, 18.VII.2004, Hu, Tang & Zhu leg. (SNUC).

Comment. The original description of *P. brevior* is based on five type specimens from “Qinling Shan 6 km, E Xunyangba 1000–1300 m” (Li et al. 2014). The illustrations of the aedeagus provided in the original description leave no doubt that the above specimens are conspecific with the types. The external and sexual characters are illustrated in Figs 1B, 2B, 3.

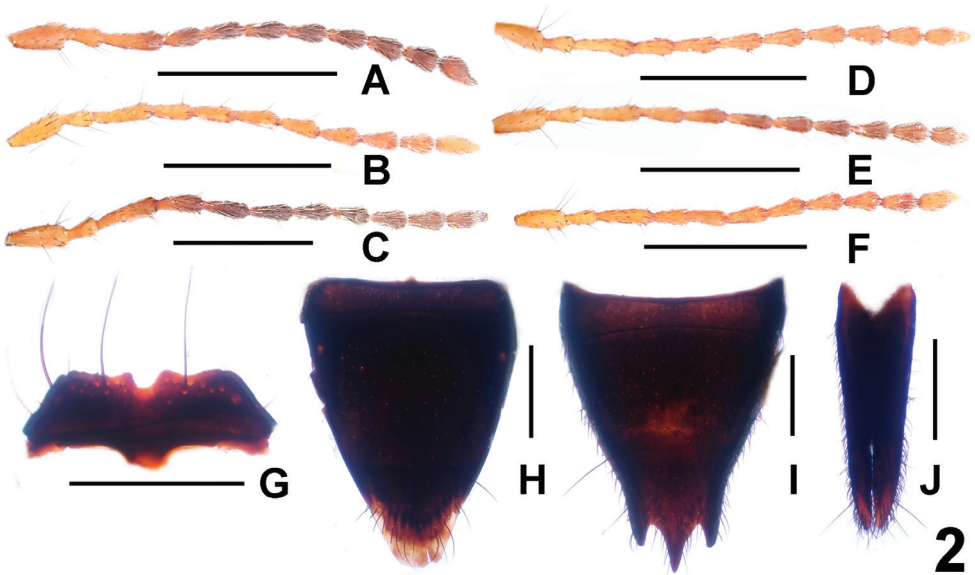


Figure 2. Antenna (**A–F**) and *Paederus apfelsinicus* (**G–J**), **A** *P. apfelsinicus* **B** *P. brevior* **C** *P. gottschei* **D** *P. gracilacutus* **E** *P. konfuzius* **F** *P. xui*; **G** female labrum **H** female tergite VIII **I** female sternite VIII **J** female tergite IX. Scale bars: **A–F** 1.0 mm; **G–J** 0.5 mm.

Paederus (Harpopaederus) gottschei Kolbe, 1886

Figs 1C, 2C, 4

Material studied. China: Jilin: 1 ♂, 2 ♀♀, Changbai Shan, 25.VII.2004, Li-Zhen Li leg. (SNUC).

Comment. The currently known distribution ranges from the Russian Far East and northern China (Heilongjiang, Jilin) to North and South Korea. The external and sexual characters are illustrated in Figs 1C, 2C, 4.

Paederus (Harpopaederus) gracilacutus Li & Zhou, 2007

Figs 1D, 2D, 5

Material studied. China: Shaanxi: 5 ♂♂, 1 ♀, Nanzheng Hsien, Liping National Forest Park, 35°50'N, 106°36'E, 1400–1600 m, 15.VII.2012, Chen, Li, Ma & Zhao leg. (SNUC); 4 ♂♂, 1 ♀, Zhouzhi Hsien, Houzhenzi, Sangongli Gou, 33°51'N, 107°49'E, 1336 m, 17–19.V.2008, Huang & Xu leg. (SNUC).

Comment. Although the original description is based exclusively on type specimens from Gansu, Li and Zhou (2007), who repeatedly state that the distribution also includes Shaanxi. The above material, whose identification is based on the illustrations provided in the original description, represents the first confirmed records from Shaanxi.

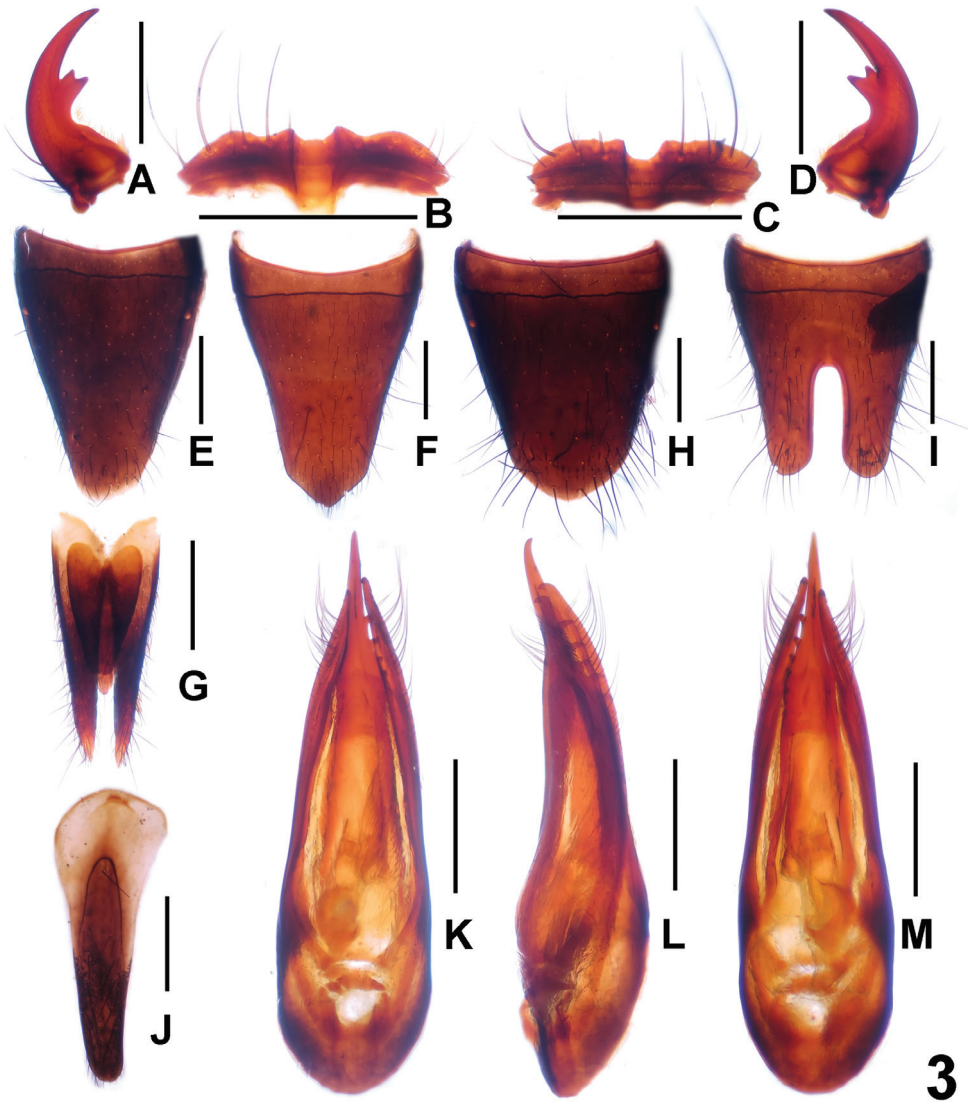


Figure 3. *Paederus brevior*. **A** male left mandible **B** male labrum **C** female labrum **D** male right mandible **E** female tergite VIII **F** female sternite VIII **G** female tergite IX **H** male tergite VIII **I** male sternite VIII **J** male sternite IX **K** aedeagus in ventral view **L** aedeagus in lateral view **M** aedeagus in dorsal view. Scale bars: 0.5 mm.

***Paederus (Harpopaederus) konfuzius* Willers, 2001**

Figs 1E, 2E, 6

Material studied. China: Shaanxi: 6 ♂♂, Ningshaan Hsien, Pingheliang, 33°28'N, 108°29'E, 2100 m, 13.VII.2012, Chen, Li, Ma & Zhao leg. (SNUC); 1 ♂, 4 ♀♀,

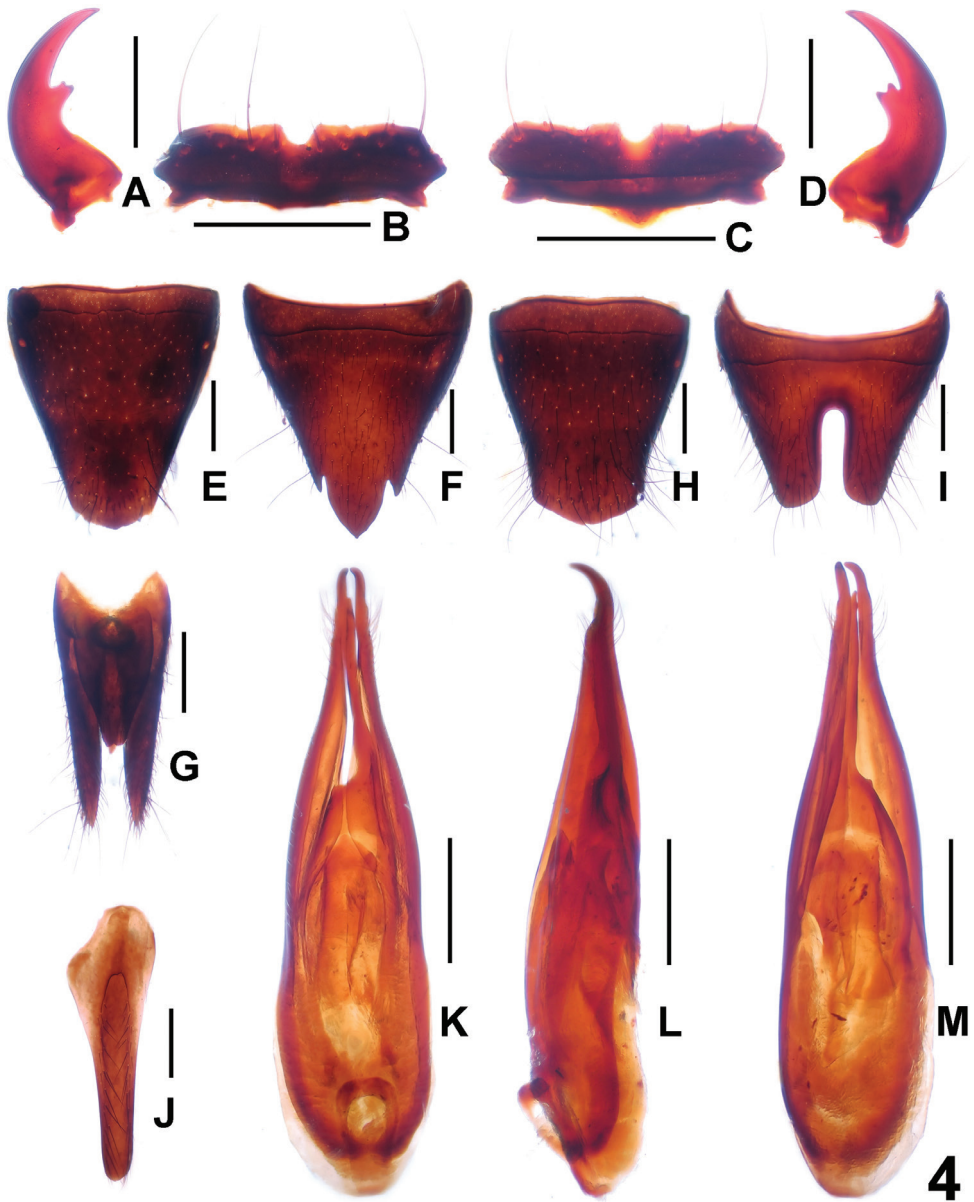


Figure 4. *Paederus gottschei*. **A** male left mandible **B** male labrum **C** female labrum **D** male right mandible **E** female tergite VIII **F** female sternite VIII **G** female tergite IX **H** male tergite VIII **I** male sternite VIII **J** male sternite IX **K** aedeagus in ventral view **L** aedeagus in lateral view **M** aedeagus in dorsal view. Scale bars: 0.5 mm.

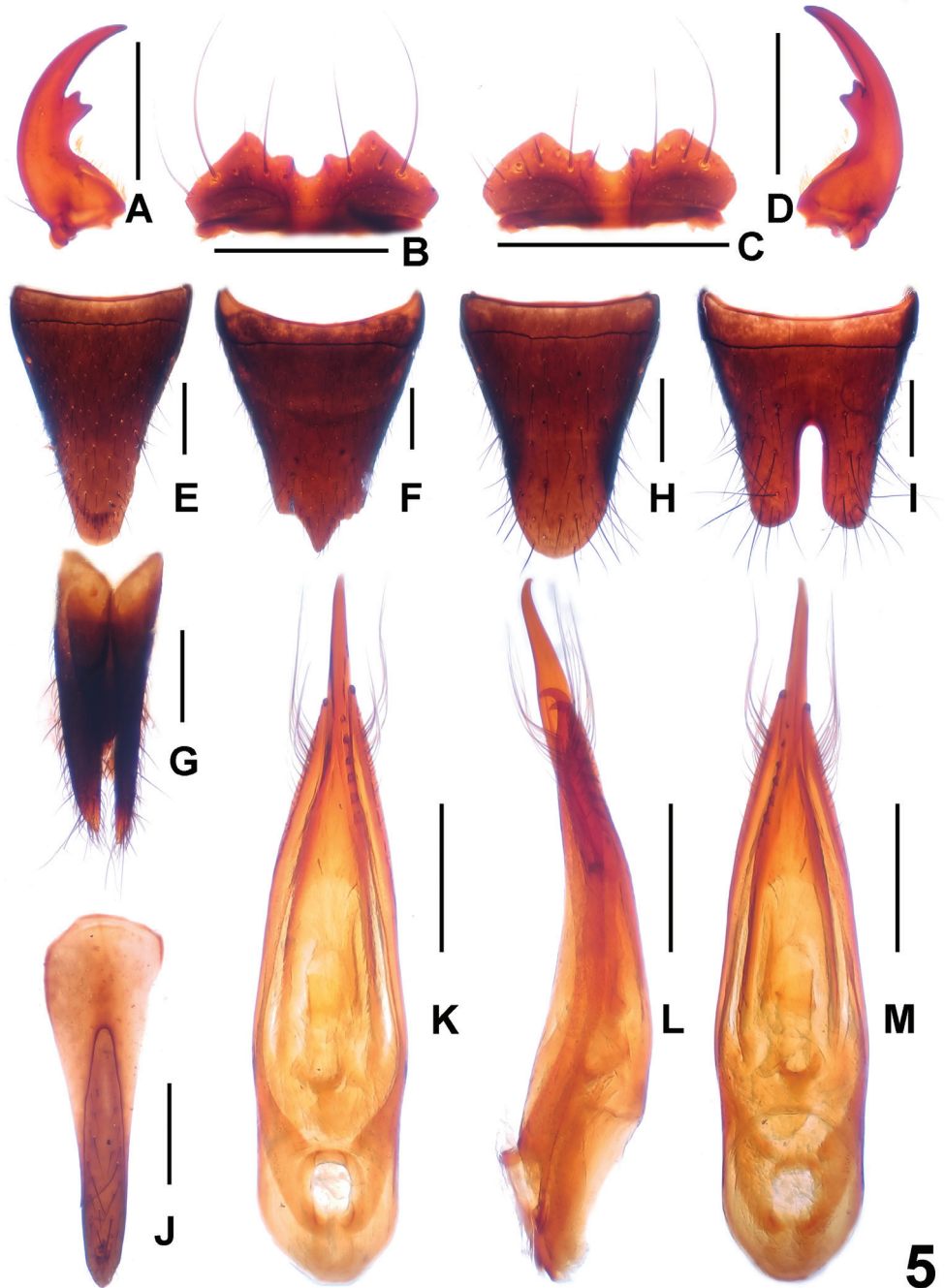


Figure 5. *Paederus gracilacutus*. **A** male left mandible **B** male labrum **C** female labrum **D** male right mandible **E** female tergite VIII **F** female sternite VIII **G** female tergite IX **H** male tergite VIII **I** male sternite VIII **J** male sternite IX **K** aedeagus in ventral view **L** aedeagus in lateral view **M** aedeagus in dorsal view. Scale bars: 0.5 mm.

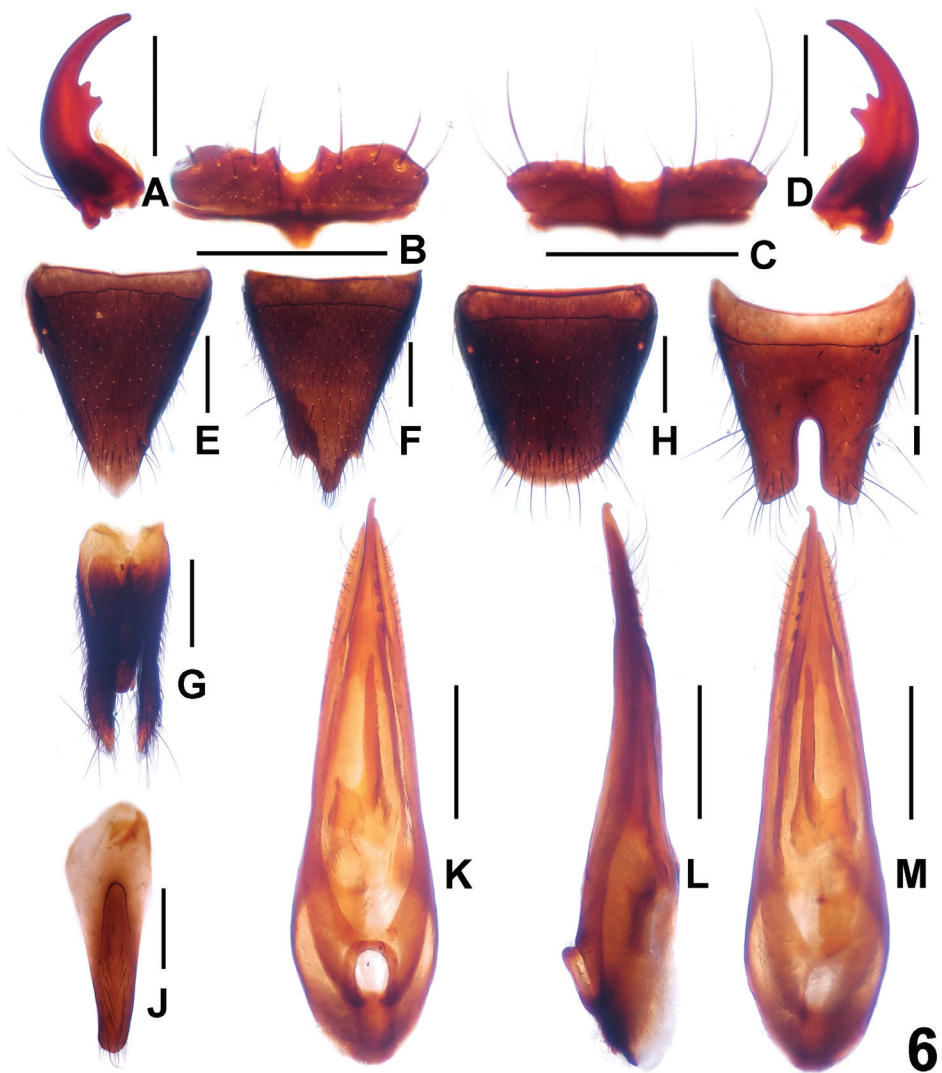


Figure 6. *Paederus konfuzius*. **A** male left mandible **B** male labrum **C** female labrum **D** male right mandible **E** female tergite VIII **F** female sternite VIII **G** female tergite IX **H** male tergite VIII **I** male sternite VIII **J** male sternite IX **K** aedeagus in ventral view **L** aedeagus in lateral view **M** aedeagus in dorsal view. Scale bars: 0.5 mm.

Zhouzhi Hsien, Daoban, 33°44'N, 107°58'E, 1900 m, 04.V.2008, Huang & Xu leg. (SNUC); 1 ♂, 1 ♀, Zhouzhi Hsien, Houzhenzi, Qinlingliangxia, 33°49'N, 107°44'E, 1820 m, 18.V.2008, Huang & Xu leg. (SNUC); 3 ♀♀, Mei Hsien, Taibai Shan, 34°01'N, 107°51'E, 1853 m, 22–23.V.2008, Huang & Xu leg. (SNUC).

Comment. The original description is based on 13 type specimens from the Qinling Shan, Shaanxi (Willers 2001b). Li and Zhou (2007) recorded this species from Gansu and Sichuan, but did not specify the localities.

Paederus (Harpopaederus) xui Peng & Li, sp. n.

<http://zoobank.org/8171DF85-E235-4FA7-8671-01492B9D8DC4>

Figs 1F, 2F, 7

Type material. HOLOTYPE: ♂, labelled 'China: Sichuan Province, Nanjiang Hsien, Micang Shan, Daba, 32°40'N, 107°02'E, 1800 m, 27.IV.2008, Huang & Xu leg.' (SNUC). PARATYPES: 2 ♂♂, 3 ♀♀, same label data as holotype (SNUC); 1 ♀ [teneral]: 'CHINA (S.Shaanxi) Micang Shan, 33 km S Hanzhong, 32°44'44"N, 106°52'46"E 1360 m (stream valley, forest margin with tall herbaceous vegetation, pitfall traps, vinegar) 15.-16.VIII.2012 D.W. Wrase [30A]' (cSch); 2 ♀♀: 'CHINA: S-Shaanxi [CH12-31], Micang Shan, 40 km SW Hanzhong, 32°52'25"N, 106°37'11"E, 1530 m, N-slope, mixed secondary forest, litter and moss sifted, 16.VIII.2012, leg. M. Schülke' (cSch, cAss).

Description. Measurements (in mm) and ratios: BL: 8.67–9.34; FL: 4.72–4.95; HL: 0.93–0.98; HW: 1.07–1.11; AnL: 2.72–2.95; PL: 1.23–1.26; PW: 1.10–1.13; EL: 0.87–0.94; EW: 1.13–1.20; AW: 1.74–1.77; AL: 1.38–1.41; HL/HW: 0.84–0.87; HW/PW: 0.96–0.98; HL/PL: 0.76–0.78; PL/PW: 1.10–1.13; EL/PL: 0.71–0.75; diameter of eye: 0.34–0.36.

Habitus as in Fig. 1F. Coloration: head, labrum and apical segments black, labial palpi and antennae yellowish brown; pronotum brownish red; elytra blackish blue with metallic luster; first four abdominal segments reddish brown; legs yellowish brown, with apical halves of femora black.

Head wider than long, widest across eyes; punctation coarse and sparse; interstices glossy. Mandibles without distinct sexual dimorphism. Eyes distinctly convex. Antenna as in Fig. 2F.

Pronotum nearly oviform, strongly convex in cross-section; punctures somewhat sparser and shallower than those of head.

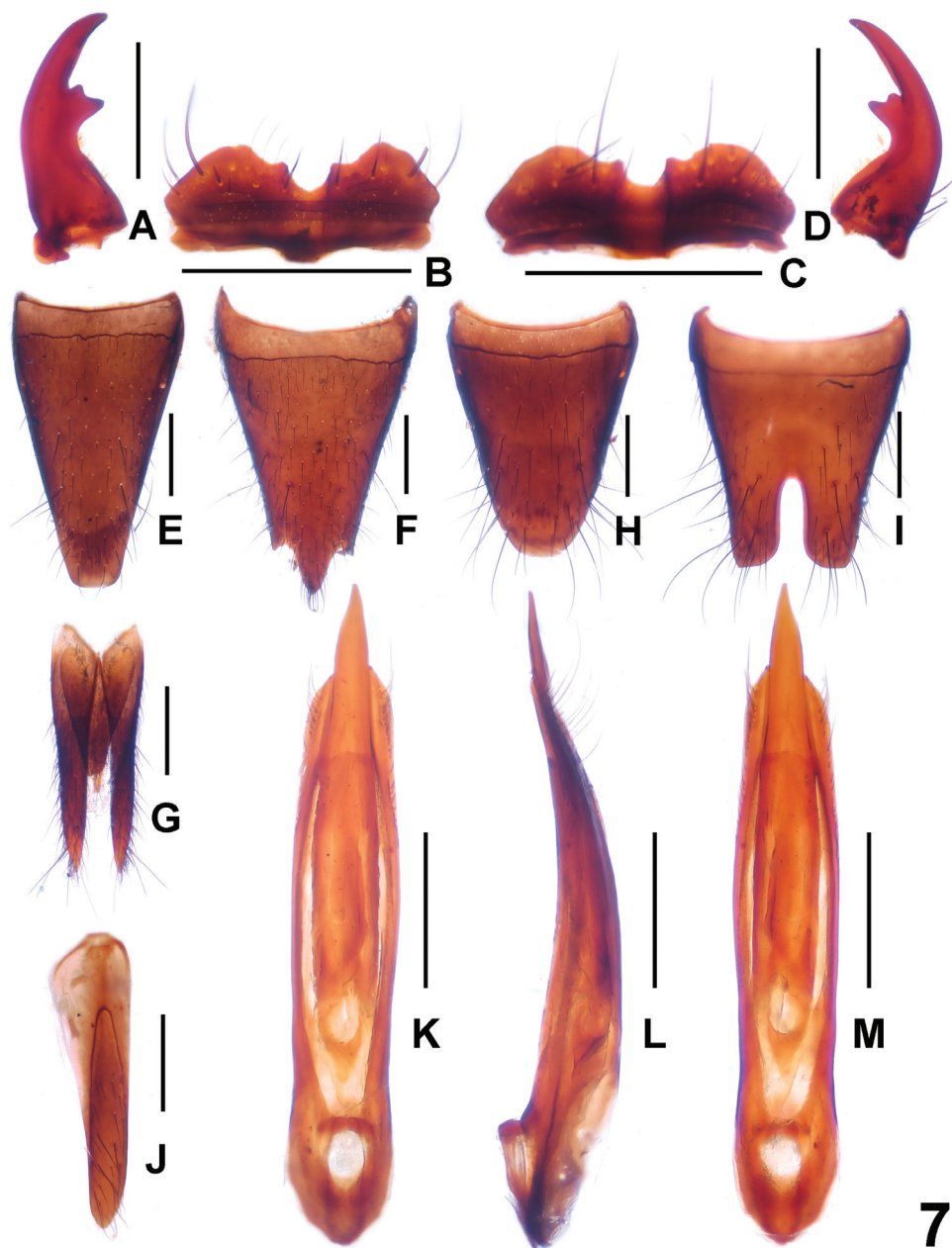
Elytra trapeziform; punctation coarse, defined and dense. Hind wings reduced. Metatarsomere I as long as combined length of metatarsomeres II and III.

Abdomen distinctly broader than elytra; punctation coarse; interstices with very shallow microsculpture; posterior margin of tergite VII without palisade fringe.

Male. Anterior margin of labrum (Fig. 7B) distinctly sinuate; each mandible (Fig. 7A, D) with single bicuspidate tooth. Posterior margin of tergite VIII (Fig. 7H) convex; sternite VII unmodified; sternite VIII (Fig. 7I) with deep posterior incision, this incision approximately 0.4 times as long as sternite VIII; sternite IX as in Fig. 7J; aedeagus as in Fig. 7K–M; dorsal plate of median lobe nearly symmetric, long and slender; parameres very slender and curved apically; internal sac without sclerotized spines.

Female. Labrum as in Fig. 7C. Posterior margin of tergite VIII (Fig. 7E) truncate; posterior margin of sternite VIII (Fig. 7F) with narrowly triangular median process; tergites IX and X as in Fig. 7G.

Distribution and natural history. The type locality is situated in the Micang Shan to the north of Nanjiang, northern Sichuan. The specimens were sifted from leaf litter in a mixed deciduous forest at an altitude of 1,800 m.



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Figure 7. *Paederus xui*. **A** male left mandible **B** male labrum **C** female labrum **D** male right mandible **E** female tergite VIII **F** female sternite VIII **G** female tergite IX **H** male tergite VIII **I** male sternite VIII **J** male sternite IX **K** aedeagus in ventral view **L** aedeagus in lateral view **M** aedeagus in dorsal view. Scale bars: 0.5 mm.

Etymology. The species is dedicated to Wang Xu, who collected some of the type specimens.

Comparative notes. As can be inferred from the highly similar sexual characters, the new species is allied to the geographically close *P. antennocinctus* Willers, 2001 (Sichuan: Jiuzhaigou; Gansu: Qiujia Dam), from which it differs by the coloration of legs, the somewhat smaller size, the shape of the labrum, the longer dorsal plate of the aedeagus and the nearly trifurcate posterior margin of the female sternite VIII.

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