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A new *Synersaga* species from Cambodia (Lepidoptera, Lecithoceridae), with a world catalogue of the genus

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Abstract

A new species of the genus *Synersaga* Gozmány, *S. mondulkiriensis* **sp. n.**, is described from Cambodia. The genus is diagnosed, and a global catalogue for the genus is provided.

Keywords

Lepidoptera, Lecithoceridae, *Synersaga*, new species, Cambodia, taxonomy

Introduction

The family Lecithoceridae (Lepidoptera, Gelechioidea) is characterized by the very long antenna, usually longer than the forewing, and the male genitalia with gnathos bent downwards or absent. These characters are useful to differentiate from other gelechioid-moths. With respect to Lecithoceridae biology, larvae are known to feed on dead plant materials. A few Australian species have been reported to be reared on leaf litters of eucalypt (Common 1996). Recently, Komai et al. (2011) reported that two species of Lecithocerinae (*Homaloxestis myeloxesta* Meyrick, 1932 and *Lecithocera*

thiodora (Meyrick, 1914)) and three species of Torodorinae (*Athymoris martialis* Meyrick, 1935, *Deltoplastis apostatis* (Meyrick, 1932), and *Halolaguna sublaxata* Gozmány, 1978) were reared from dead leaves of several unknown broadleaved trees in Japan. The family is mostly distributed in the Oriental and Australian Regions, around 1,200 described species (van Nieukerken et al. 2011).

Synersaga Gozmány, 1978 is a small genus belonging to the subfamily Lecithocerinae that comprises six species only in the Oriental Region: the type species, *S. pseudocathara* (Diakonoff, 1952) described from Myanmar, and five more species from East and Southeast Asia (Gozmány 1978; Park 2007, 2009; Park et al. 2007). Herein a new species, *S. mondulkiriensis* sp. nov., is described from Cambodia. Moths have usually unicolorous forewing with yellowish-brown to dark-fuscous ground color.

The genus is allied to *Lecithocera* Herrich-Schäffer, 1853 and is defined by the combination of following characters: vein R_3 on the forewing is separate or connate and the male genitalia have the cucullus fairly elongated and usually expanded distally, and well- developed caudal processes of the juxta. On the other hand, for several species of *Lecithocera* known from Sri Lanka, which have male genitalia resembling *Synersaga*, e.g. *L. capnaula* Meyrick, 1911, *L. haemylopsis* (Meyrick, 1911), *L. nubigena* (Meyrick, 1911), *L. paroena* (Meyrick, 1906), and *L. paroristis* (Meyrick, 1911), the generic placement should be reconsidered by examining the forewing venation.

Material and methods

The present study is based on recent material collected by the authors in Cambodia, from the result of an entomological expedition to Cambodia by the Environmental Ministry, Korea. The wingspan is measured from the left wing apex to the right wing apex, including fringe. The color standard for the description of adults follows Kornerup and Wanscher (1978). Types are deposited in the University of Incheon, Korea (UIK) on indefinite loan from Cambodia. Abbreviations for museums: HMNH= Hungarian Museum of natural History, Budapest, Hungary; KNA= Korea National Arboretum, Pocheon, Korea; UIK= University of Incheon, Korea; OPU= Osaka Prefectural University, Osaka, Japan; NRS= Naturhistoriska Riksmuseet, Stockholm, Denmark.

Taxonomic Accounts

Genus *Synersaga* Gozmány, 1978
http://species-id.net/wiki/Synersaga

Synersaga Gozmány, 1978: 141; Wu, 1997: 174; Park et al., 2007: 206; Park, 2009: 2.
Type species: *Lecithocera pseudocathra* Diakonoff, 1951: 76. Type locality: Myanmar
= *Anamimnesis* Gozmány, 1978:143. Type species: *Anamimnesis bleszynskii* Gozmany, 1978: 143 (synonimized by Park 2000).

Note. *Synersaga* is characterized by the forewing characters: forewing slightly broader distally with round apex, evenly colored, with yellowish brown or blackish ground color; venation with R_3 free or connate with R_{4+5}; M_3 and CuA_2 short-stalked or connate. However, the forewing color patterns of the known species are very similar to each other and they can be differentiated from one another by the shape of the uncus and the caudal processes of the juxta in the male genitalia. The abdominal tergites are densely spinose, and the seventh tergite is uniquely specialized, produced laterally with a sclerotized anterior margin.

World catalogue of *Synersaga*

bleszynskii (Gozmány, 1978: 143) — China
TL (Type locality): Chekiang, China. Type in HMNH.
Fig.: Gozmány (1978, Taf. 8, 37, Fig. 86; Park (2000, Figs 20, 20a)

caradjai (Gozmány, 1978: 143) — Taiwan
TL: Kosempo, Taiwan. Type in HNHM.
Fig.: Gozmány (1978, Taf. 8, 37, Fig. 85)

kuni Park, 2007: 206 — Vietnam
TL: Cuc Phoung, N. Vietnam. Type in KNA.
Fig.: Park et al. (2007, Figs 8, 17, 17a)

mondulkiriensis sp. n. — Cambodia
TL: Mondulkiri, Cambodia. Type in UIK.
Fig.: Park & Bae (2012, Figs 4–12)

nigriptera Park, 2007: 208 — Vietnam
TL: Babe, N. Vietnam. Type in KNA.
Fig.: Park et al. (2007, Figs 9, 18, 18a, 22)

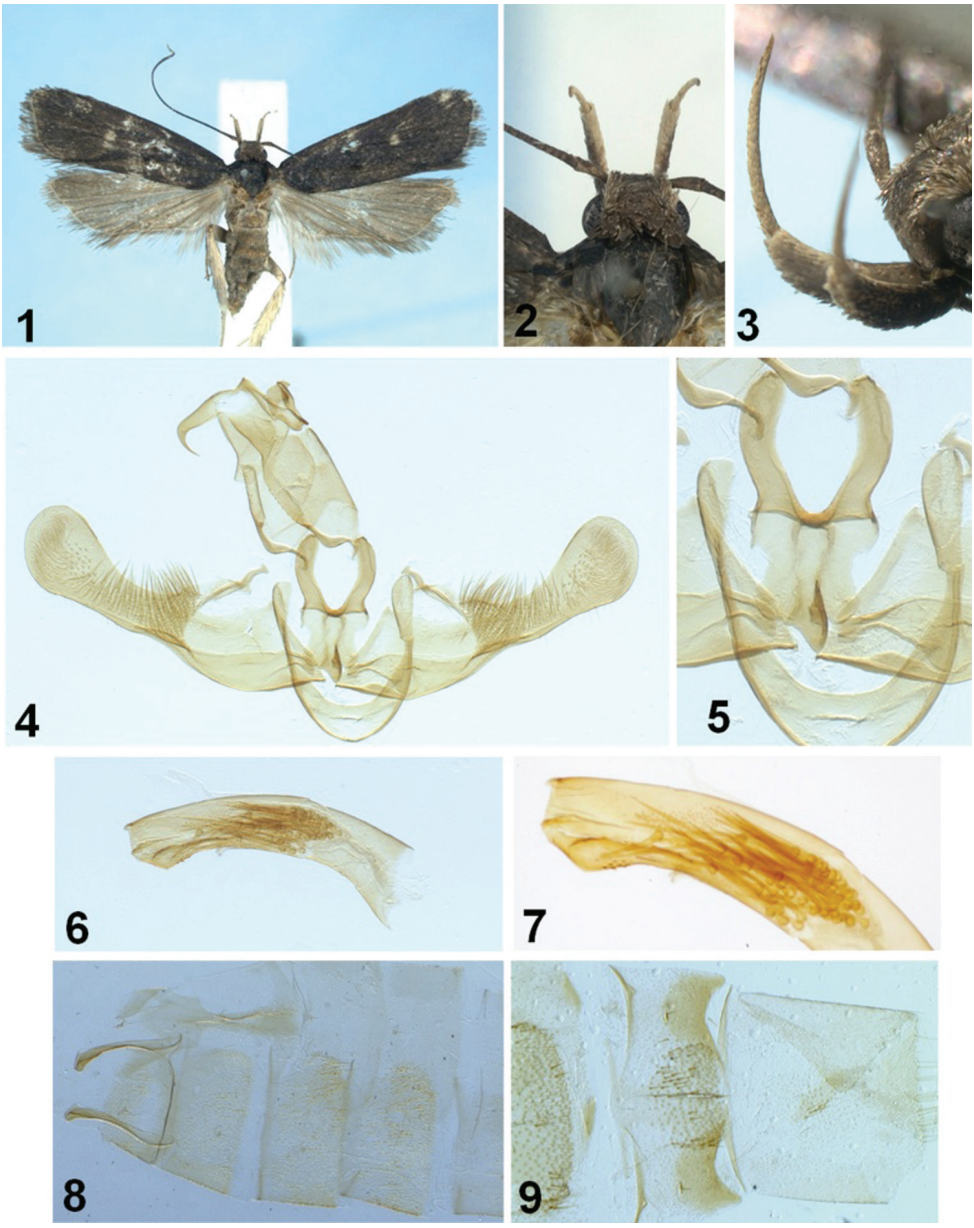
phuruaensis Park, 2009:2 — Thailand
TL: Loei, China. Type in OPU.
Fig.: Park (2009, Figs 4-6, 8, 8a, 10)

pseudocathra (Diakonoff, 1951: 76)* — Myanmar
Ark. Zool. 1951, 3: 76. TL: Kambaiti, Myanmar. Type in NRS.
Fig.: Diakonoff (1951, Figs 13 (male), 15 &16 (female))

***Synersaga mondulkiriensis* sp. n.**
urn:lsid:zoobank.org:act:839DA14C-9E99-4CEC-A7A0-24E0826F8454
http://species-id.net/wiki/Synersaga_mondulkiriensis
Figs 1–12

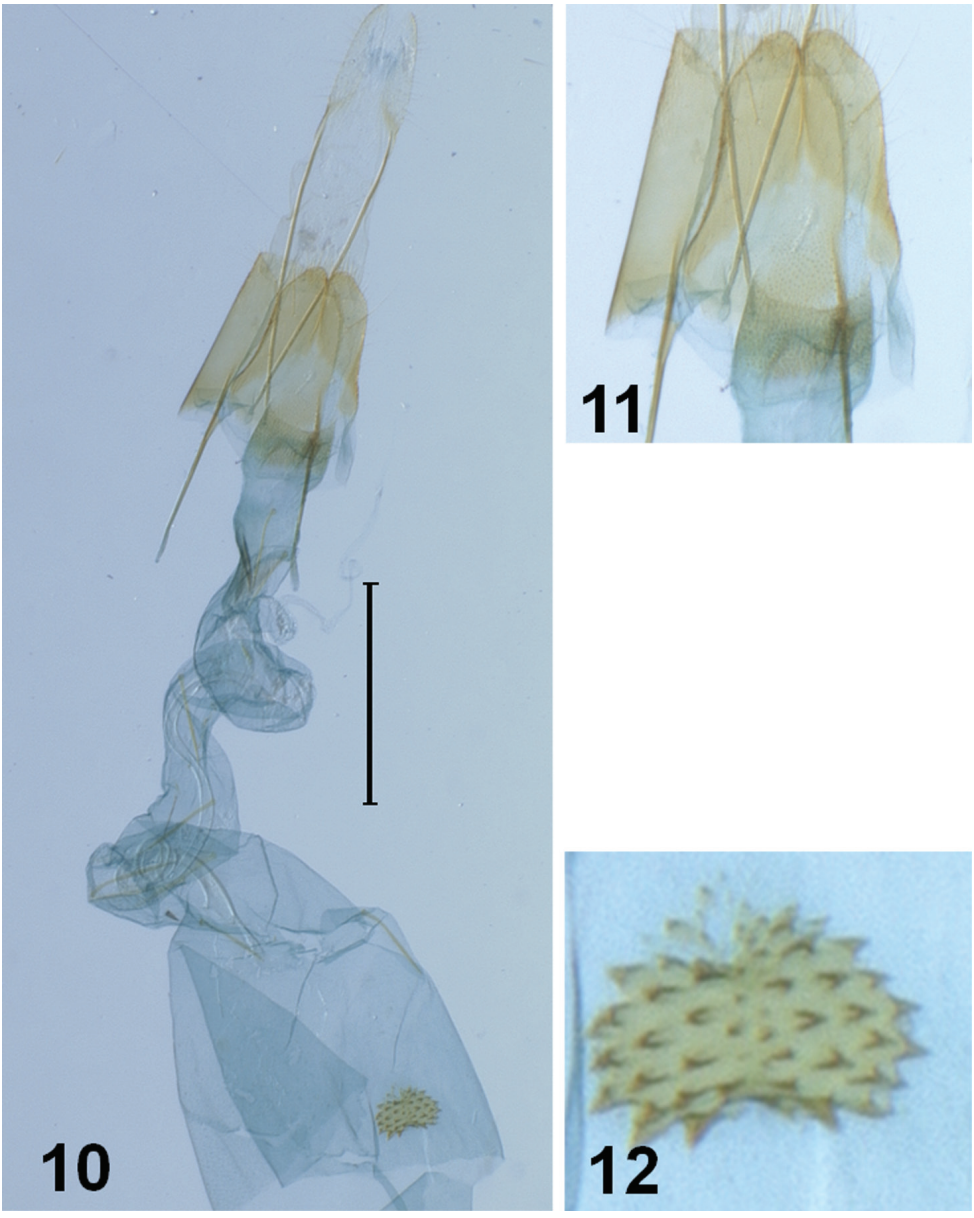
Type material. Holotype ♂ – Cambodia, Prov. Mondulkiri, Seima Biodiversity Conservation Area, 12°57'N, 107°10'E, 3–8 July 2009 (Bae & Chae), gen. slide no. CIS-6072/Park. Paratype – 3♂, 1♀, same locality, 7 Oct. 2010.

* Figure by Diakonoff (1951) was erroneously numbered: Fig. 14 is that of *L. pellax* Meyrick; and Gozmány (1978) cited erroneously "Daikonoff (1951)" as "Diakonoff (1952)".



Figures 1–9. *Synersaga mondulkiriensis* sp. n., holotype **1** adult, holotype **2** head in dorsal view **3** labial palpus **4** male genitalia **5** close-up of juxta **6** aedeagus **7** close-up of cornuti **8** 1st-4th abdominal segments **9** close-up of 6th–8th abdominal segments. Scale bar: 1 mm.

Diagnosis. This new species is similar to *S. pseudocathara* from Myanmar, and *S. kuni* and *S. nigriptera* from Vietnam in the external and male genitalic characters. It can be distinguished from them by the shape of cucullus and the caudal processes of the juxta in the male genitalia. The caudal processes of the juxta of the new species are



Figures 10–12. Female genitalia of *Synersaga mondulkiriensis* sp. n. **10** genitalia **11** 8th segment **12** genitalia. Scale bar: 1 mm.

similar to those of *S. nigriptera,* but longer and arched inwardly, and the distal portion of the cucullus is more or less clavate.

Description. Adult (Figures 1, 2, 3). Wingspan, 17–18 mm. Head and thorax dark fuscous dorsally. Antenna dark fuscous throughout, relatively thick. Second segment of labial palpus fairly thickened, dark fuscous on outer surface with orange white

apex, orange white on inner surface; 3rd segment slender, as long as 2nd segment, orange white all around. Forewing covered with dark fuscous scales throughout; two blackish discal spots well developed: one in middle, the other larger one at end of cell; apex rounded; termen slightly concave medially; venation with R_1 arising from middle of cell; R_2 nearer to R_3 than R_1 at base; R_3 free; R_4 and R_5 stalked for basal 3/5 length; R_5 reaching just beyond apex; M_3 arising from half between M_2 and CuA_{1+2} at base; CuA_1 and CuA_2 stalked for basal 1/5. Hindwing broader than forewing, pale brownish orange; apex more or less obtuse; termen sinuate; fringe concolorous, with narrow orange white basal line; venation with M_3 and CuA_1 short stalked. Hind tibia clothed with orange gray scales.

Male genitalia (Figures 4, 5, 6, 7). Uncus broad, short, obtuse, not exceeding basal stalk of gnathos, with small median lobe on caudal margin. Median process of gnathos strongly bent beyond middle, with acute apex. Valva broad basally, with triangular process near base on costa; costa gently concave; ventral margin gently arched outward in basal half; cucullus elongate, broadly expanded with round outer margin; dense long setae in basal half of cucullus, fairly setose beyond. Juxta with caudal processes long, gently arched inward, while the processes in *S. nigriptera* nearly straight, clavate. Aedeagus gently curved, shorter than valva+cucullus, with finely dentate along ventral and dorsal margins apically; cornuti consist of a series of numerous needle-like cornuti. Abdominal segments in Figures 8 and 9.

Female genitalia (Figures 10, 11, 12). Similar to those of *S. nigriptera*. Caudal margin of eighth abdominal sternite with deep Y-shaped medial emargination. Dorsal surface of ostial plate with dense spinules; caudal margin of ostium bursae concave. Antrum weakly sclerotized, cup-shaped. Ductus bursae coiled twice, slightly longer than corpus bursae, nearly same width throughout, with several needle-like spines internally. Corpus bursae elongate; signum a semiovate plate denticulate throughout.

Distribution. Cambodia (Mondulkiri).

Etymology. The species name is derived from the type locality.

Acknowledgements

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Two new species of *Pseudohadena* Alphéraky, 1889 from Kazakhstan (Lepidoptera, Noctuidae, Xyleninae)

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Abstract

Two new species of *Pseudohadena*, *P. anatine* **sp. n.** and *P. gorbunovi* **sp. n.** (Lepidoptera, Noctuidae) are described from Ustyurt, Kazakhstan. Illustrations of adults and the genitalia of both sexes are provided. Microstructures of vesicae are described and illustrated. A diagnostic comparison is made with *P. evanida psammoxantha* Ronkay, Varga & Fábián, 1995, *P. magnitudinis* Hacker & Ebert, 2002 and *P. pseudamoena* (Boursin, 1943).

Keywords

Lepidoptera, Noctuidae, *Pseudohadena*, *Jaxartia*, new species, Ustyurt, Kazakhstan

Introduction

Pseudohadena Alphéraky, 1889 is a Central Asian genus of the subfamily Xyleninae. It was re-described by Ronkay et al. in 1995 and divided into 3 subgenera, *Pseudohadena* Alphéraky, 1889, *Jaxartia* Püngeler, 1914 and *Pseudopseustis* Hampson, 1910.

Jaxartia was established at the beginning of last century by Püngeler in 1914 for the species *Jaxartia elinguis*, described by him in the same article. The second taxon in the genus, *Jaxartia striolata*, was discovered and described by Filipjev in 1949. At the

end of the 20th century, the genus *Pseudohadena* was revised by Ronkay et al. (1995) and *Jaxartia* was downgraded to a subgenus of *Pseudohadena*, comprising a further four species (*P. jordana* Staudinger, 1900, *P. evanida* Püngeler, 1914, *P. pseudamoena* Boursin, 1943 and *P. cymatodes* Boursin, 1954).

In 2007, Fibiger and Hacker listed 9 species belonging to the subgenus *Jaxartia* in Noctuidae Europaeae volume 9 and arranged them into 3 species-groups. The last known species was described in 2008 by Shirvani et al., thereby the subgenus comprises 10 species.

During a study of the Noctuidae material collected by Pavel Gorbunov on the plateau Ustyurt, Western Kazakhstan in 2010, two formerly unknown *Pseudohadena* species were recognised. Both new species are externally similar to *P.* (*J.*) *evanida* and six other representatives of the subgenus have clearly recognisable differences in their external and genital features.

Systematic part

***Pseudohadena* (*Jaxartia*) *anatine* Pekarsky, sp. n.**
urn:lsid:zoobank.org:act:031F6A87-1F52-4771-8328-3E451F6A58D2
http://species-id.net/wiki/Pseudohadena_anatine
Figs 1–4

Holotype. Male, S.W. KAZAKHSTAN, Ustyurt Res., Kendyrli (spring), 128 m, 42°57'N, 54°41'E, 3.x.2010, leg. P. Gorbunov; slide No.: OP1055m (coll. O. Pekarsky, deposited in the HNHM Budapest).

Paratypes. 4 males, with same data as holotype, slide No: OP1155m (male) (coll. O. Pekarsky); 1 male, with same data as holotype (coll. P. Gorbunov); 2 males , S.-W. KAZAKHSTAN, Ustyurt Nature Reserve, Kendyrli (spring), 128 m, 42°57'N, 54°41'E, 11.10.09 (coll. P. Gorbunov); 1 male & 1 female S.-W. KAZAKHSTAN, Ustyurt Nature Reserve, Oneri (cordon & spring), 42°36'N, 54°08'E, 12.10.09 (coll. P. Gorbunov); 2 males , S.-W. KAZAKHSTAN, Ustyurt Nature Reserve, Kendyrli (spring), 128 m, 42°57'N, 54°41'E, 28.09.10 (coll. P. Gorbunov); 1 male, Kazakhstan, Mangistauskaya, Karakiyanskyi, Ustyurt Plat., 9–15.10.2009, leg. V. Zurilina (coll. M. Dvořák), 1 female (coll. O. pekarsky); 2 males, SW Kazakhstan, Mangistau prov., Karakiya distr., Sand Tynyshtyk, 43°06'53"N, 054°11'39"E, 5.x.2010, leg. V. Zurilina (coll. O. Pekarsky); 1 female SW Kazakhstan, Ustyurt Res., Karynzharyk Sands, Saksorka, 42°42'N, 54°06'E, 7.v.2010 leg. P. Gorbunov, slide No: OP1193f (female) (coll. O. Pekarsky).

Diagnosis. *Pseudohadena anatine* is placed in the subgenus *Jaxartia* due to its widely bipectinate male antenna and the digging armature of the foreleg consisting of 4 large, curved spine-like setae outside on the basitarsus and an additional spinose seta inside at its distal end (Figs 53, 54). In addition, the vestiture of the head and the thorax is bifurcated hair-like scales (Fig. 52), which is a conspicuous apomorphic character

of the subgenus. It is a member of the *evanida* species-group, having a rather broad, less lanceolate fore wing with an indistinct noctuid pattern, strong valvae with subapical dilatation, large costal plate and semiglobular-ovoid corpus bursae.

The new species resembles *P.* (*J.*) *evanida evanida*, *P.* (*J.*) *evanida psammoxantha*, *P.* (*J.*) *pseudamoena* and *P.* (*J.*) *deserticola* by the beige-grey coloration of the fore wing with indistinct wing pattern; *P.* (*J.*) *magnitudinis* and *P.* (*J.*) *cymatodes* differ from *P.* (*J.*) *anatine* by their well-developed characteristic wing pattern; *P.* (*J.*) *leucochlora* can be distinguished from all mentioned congeners by its characteristic greenish fore wing ground colour. The broadly bipectinate male antenna of the new species is similar to those of *P. magnitudinis*, *P. cymatodes* and *P. evanida*. *Pseudohadena* (*J.*) *anatine* can be distinguished externally from the closely related *P.* (*J.*) *evanida* and *P.* (*J.*) *magnitudinis* by the shorter and broader fore wing with an almost straight costal margin and less acutely pointed apex. The wing pattern of the new species is regularly more obsolescent than in the two closest relatives; however, rather unicolorous, less distinctly-marked specimens can be found in both *P.* (*J.*) *evanida* and *P.* (*J.*) *magnitudinis*. The male genitalia of the new species differ from those of the above-mentioned two species in the shape of the clasper, the size and shape of the digitus, and the structure of the vesica. Also, all related species have clearly recognisable differences in the microstructure of the walls of vesica. The new species is distinguishable from its closest relatives, *P. evanida* and *P. magnitudinis*, by its fairly curved, medially thicker clasper, small, spiculiform distal process of the digitus, and small, conical distal diverticulum of the vesica, whereas *P. evanida* and *P. magnitudinis* have a shorter, evenly wide, ribbon-like, less curved clasper, a much larger tooth-like distal process of the digitus, and a larger, much longer distal diverticulum of the vesica. The distal diverticulum of *P. anatine* is covered by push-pin-like spinules with broad bases (Fig. 24), whereas the surface of the distal diverticulum is armed with elongated spinules with narrow bases in related species (Figs 35, 39).

The female genitalia of the new species differ from those of its relatives by the size of the entire organ, the shape and length of the ductus bursae, the shape of the corpus bursae and the shape of subgenital plate (8th abdominal segment). *Pseudohadena anatine* is easily separable from its closest relatives by the smaller size of the genitalia (total length 8 mm), the shorter and wider ductus bursae, and the acute edges of the subgenital plate. *P. evanida* has larger genitalia (total length 8.5–9 mm), longer and narrower ductus bursae, a narrower subgenital plate with quadrangular edges. *P. magnitudinis* is characterized by the even larger size of the female genitalia (total length 10 mm), longer ductus bursae and rather quadrangular edges of subgenital plate. In addition, the apophyses of the new species are as long as the ductus bursae, whereas the apophyses of related species are shorter than the ductus bursae.

Description. Male (Figs 1–3). Wingspan 39–40 mm, length of fore wing 17 mm. Head, thorax, abdomen and fore wing beige grey; latter irrorated by black scales. Thorax and head covered with bifurcated hair-like scales (Fig. 52) some of which have black tip. Usual hair-like scales on metathorax long, thin, directed across abdomen. Black hair-like scales around eyes long and dense. Palpi short, covered with black hair-like

scales on outer side and light-beige scales on inner side. Forewing broad and short with obtuse apex; costa straight; outer margin has almost straight termen. Wing pattern very indistinct, basal and subbasal lines marked as costal spots only; antemedial line represented by a few diffuse darker spots; medial line consists of a dark costal patch and shadow-like fascia; postmedial crossline traceable by black scales on veins; subterminal line variably strong, sinuous, marked by smaller or larger brown-grey arrowheads. Orbicular and reniform stigmata also less discernible, relatively large, roundish with light margins; claviform stigma diffuse or obsolete. Terminal line fine, continuous, grey brown; cilia long, narrow, variably strongly striated with dark brown. Hindwing pale, shining beige grey, transverse line present, discal spot pale but usually recognisable. Female (Fig. 4). As male but remarkably larger in size (wingspan 47 mm), with more obtuse apex of forewing.

Male genitalia (Figs 9–14, 21–29). Genital armature well sclerotized; uncus strong, hairy, with flattened and pointed tip; tegumen slender, moderately wide, 1.4 times shorter than vinculum; penicular lobes narrow, bearing long setae; juxta subdeltoidal with wide basal (ventral) plate and long triangular dorsal extension; vinculum sclerotized, rather V-shaped. Valvae symmetrical, massive, with widely parallel margins; cucullus triangular with pointed apex, corona weak; sacculus small with rounded, dorsal margin setose (clavus reduced); costa almost straight with small subapical salience; editum conspicuous, setose; clasper long, medially curved, thicker in middle and thinner at end, resembling head of a duck; costal plate large, digitus subapical, surpassing ventral margin of valva, small and spiculiform, very wide at base; ventral margin of valva and central area between sacculus and clasper weakly sclerotized. Aedeagus cylindrical, curved ventrally in distal part; carina with spinose field (Fig. 28). Vesica tubular, wider basally, everted forward, recurved laterally, scobinate with fine spinules (Fig. 22) except an area at base of proximal part (Fig. 29); partly membranous in proximal and medial parts; terminal end without scobination; medial diverticulum rather large, scobinate, scobinations granular (Fig. 23); membranous clear space at border between spinules on main corpus of vesica and granules on medial diverticulum (Fig. 25), whereas opposite side of vesica and medial diverticulum with same granulose character of scobination (Fig. 27); distal diverticulum conical with broad base and narrower upper part, with scobination consisting of push-pin-like spinules with broad bases (Fig. 24). Terminal cornutus straight, long, strong and narrow, with rounded tip; folded area near cornutus covered by fine spinules (Fig. 26). Eight abdominal segment with characteristic sclerotized structures on both sides (Fig. 46); tergite with two symmetrical, well-sclerotized curved bars, connected by a cross-section bar in the anterior and weakly-sclerotized band in posterior part; posterior margin slightly concave; middle section of the tergite unsclerotized and looks like a rectangular window with rounded lateral margins, straight anterior margin and convex posterior margin; sternite tapering with sclerotized curved anterior and straight posterior margins with unsclerotized narrow ”window” anteriorly.

Female genitalia (Fig. 61). Ovipositor short, broad, papillae anales densely hairy, setae on apical edges short, sparse. Apophyses anteriores slender, apophyses posteriores

thin with acute tips, as long as ductus bursae. Ostium bursae broad, short, ventral plate narrow. Ductus bursae short, broad, membranous with coarse wrinkles, its lateral sclerotization extending to appendix bursae and continuing ventrad. Appendix bursae small, rounded, well sclerotized, area near ductus bursae wrinkled and with large lateral sclerotized plate. Corpus bursae small, beveled ovoid, with three broad, short signa. Seventh abdominal segment heavily sclerotized; tergite a fully sclerotized pentagonal plate with parallel lateral sides and straight posterior margin; sternite narrow, strongly sclerotized with diffuse, almost straight anterior and concave posterior margins (Fig. 47).

Note. The study of a large number of *Pseudohadena* moths belonging to different subgenera and species groups showed a lot of variability of some parts in their genital structure. For instance, the terminal cornutus is sometimes doubled (Figs 13, 14), occurring rarely in larger series of moths with ordinary structure.

Etymology. The species name refers to the duck-like shape of the clasper.

Distribution. The species is known only from its type-locality, South-west Kazakhstan, Ustyurt plateau.

***Pseudohadena* (*Jaxartia*) *gorbunovi* Pekarsky, sp. n.**
urn:lsid:zoobank.org:act:420F7C70-8868-46C8-9141-44991C6A6FD9
http://species-id.net/wiki/Pseudohadena_gorbunovi
Figs 64–67

Holotype. Male, SW KAZAKHSTAN, Ustyurt Res., 4 km S of Kokesem cordon, 316 m, 43°08'N, 54°54'E, 1–2.x.2010, leg. P. Gorbunov; slide No.: OP0976m (coll. O. Pekarsky, deposited in the HNHM Budapest).

Paratypes. 23 males, with same data as holotype (coll. O. Pekarsky); 3 males, 2 females, SW KAZAKHSTAN, Ustyurt Plat., 30km S Sai-Utes, Syndy, 223 m, 44°00'N, 53°25'E 19.ix.2010 leg. P. Gorbunov, (coll. O. Pekarsky); 4 males, 1 female, SW Kazakhstan, Mangistau Prov., Ustyurt Nat. Res., Cordon Kokesem, 43°10'10"N, 54°53'16"E, 1.10.2010 leg. V. Zurilina (coll. O. Pekarsky); 56 males, 3 females, from same locality, 2.x.2010, leg. V. Zurilina (coll. O. Pekarsky); 1 male, Kazakhstan, Mangistau Prov., Cordon Kokesem, Ustyurt nat. reserv., 12.10.2010, (coll. M. Dvořák), 1 male, Kazakhstan, Mangistauskaya, Karakiyanskyi, Ustyurt Plat., 9–15.10.2009, leg. V. Zurilina (coll. M. Dvořák), 6 males, SW Kazakhstan, Mangistau prov., Ustyurt Nat. Res., Cordon Kenderly, 42°57'28"N, 54°41'34"E, 3.x.2010, leg. V. Zurilina (coll. O. Pekarsky); 11 males, SW KAZAKHSTAN, Ustyurt Nat. Res., Kendyrli (spring), 128 m, 42°57'N, 54°41'E, 29.ix.2010, leg. P. Gorbunov, (coll. O. Pekarsky); 29 males, from same locality, 3.x.2010, slide Nos: OP1056m, OP1057m (males), 2 females, 10.x.2010, leg. P. Gorbunov, slide Nos: OP1153f, OP1154f (female) (coll. O. Pekarsky); 20 males, SW Kazakhstan, Mangistau prov., Karakiya distr., Sand Tynyshtyk, 43°06'53"N, 54°11'39"E, 5.x.2010, leg. V. Zurilina (coll. O. Pekarsky); 6 males, from same locality, 4.x.2010, V. Zurilina (coll. O. Pekarsky); 7 males, 1 female, SW KAZAKHSTAN, Ustyurt Plateau, 19 km N of Beineu, 45°30'N,

55°15'E, 120 m 8.x.2010, leg. P. Gorbunov, slide Nos: OP1059m, OP1060m (males), OP0977f (female) (coll. O. Pekarsky); 10 males, SW KAZAKHSTAN, Ustyurt Res., Tynyshtyk Boget at Karashek Mt., 43°06N, 54°11E 4.x.2010, leg. P. Gorbunov, slide No.: OP1058m (male) (coll. O. Pekarsky); 1 male, SW KAZAKHSTAN, Beket-Ata 20 km S, 268 m, 43°29'35.2"N, 54°01'37.5"E, 7.10.2010, leg. K. Nupponen, slide No.: OP1067m (male) (coll. O. Pekarsky); 1 female, Kazakhstan, Mangistauskaya, Karakiyanskyi, Ustyurt Plat., 9-15.10.09, leg. V. Zurilina, (coll. O. Pekarsky); 4 males, SW Kazakhstan, Mangistau Prov., Ustyurt Nat. Res., Cordon Kokesem, 43°10'10"N, 54°53'16"E, 2.10.2010, leg. V. Zurilina (coll. O. Pekarsky, deposited in ZISP, St. Petersburg).

Diagnosis. *Pseudohadena* (*Jaxartia*) *gorbunovi* possesses all diagnostic external characters of the subgenus *Jaxartia* (wide bipectinate antenna of males, five curved spine-like setae on basitarsus of fore leg, bifurcated hair-like scales on thorax and head). It resembles *P. evanida*, *P. leucochlora* and *P. pseudamoena*. The genitalia structure of both sexes, especially the coiled type of vesica, the long ductus bursae, and the size of corpus bursae and appendix bursae indicates the close relationship with *P. cymatodes* and *P. pseudamoena*. Despite of the conspicuous differences in the habitus of *P. gorbunovi* and *P. cymatodes*, the latter species is the closest relative of *P. gorbunovi*.

The external features of *P. gorbunoviare* compared below with those of *P. pseudamoena* due to the striking external differences between it and *P. cymatodes*. The main distinguishing external features of *P. gorbunoviare* smaller size, the almost straight antemedial line, the more elongated fore wing with acute apex and oblique outer margin, and the narrower hind wing; *P. pseudamoena* has a zigzagged antemedial line, much wider fore wings with less oblique outer margin and obtuse apex and the hind wing is also wider, more rounded. The two species also differ in the structure of bifurcated hair-like scales (Figs 101, 104).

The diagnostic features of the male genitalia are in the shape of the cucullus, the costal process (digitus), the clasper, and the structure of vesica; those of the female genitalia are the shapes of the corpus bursae and appendix bursae. The new species differs from related species by its elongated, uniform clasper, fine, attenuated distal process of the digitus, relatively short cucullus, and the dorso-ventral direction of the twist of the vesica. In comparison with *P. gorbunovi*, *P. pseudamoena* has a larger, medially dilated, “butter knife”-shaped clasper with acute tip, somewhat shorter, wider distal process of the digitus, a much longer cucullus, and the vesica is twisted in a ventro-dorsal direction.

The female genitalia of *P. gorbunovi* are distinguishable from those of *P. pseudamoena* by the almost equally sized and similarly shaped corpus bursae and appendix bursae, whhereas in *P. pseudamoena* the corpus bursae is smaller than the appendix bursae.

The detailed characterisation of the genitalia of *P. cymatodes* will be presented in a separate paper (Pekarsky, in prep.).

Description. Male (Figs 64, 66). Wingspan 31–40 mm, length of fore wing 15–17mm. Head, thorax, abdomen and fore wing beige; fore wing irrorated with a few blackish-brown scales, thorax and head mixed sparsely with black-tipped hair-like

scales. Scales on thorax and head bifurcated except on metathorax, which is covered by unforked hair-like scales directed across abdomen. Eye surrounded by black hair-like scales. Palpus short, wide, densely covered by long black hair-like scales on outer side and light-beige scales on inner side. Forewing narrow, with acute apex; costa straight; outer margin oblique. Wing pattern indistinct: basal, subbasal and medial lines recognisable only on most strongly patterned specimens; antemedial line represented by some darker spots; medial line most often represented only by dark costal patch; postmedial line curved and dentate; subterminal line curved, composed by blackish-brown scales; orbicular stigma with darker patch in centre; reniform stigma narrow, lunulate; claviform stigma diffuse, with small darker basal patch; terminal line present, cilia striated with dark brown. Hind wing pale, shining beige grey; transverse line present; discal spot hardly discernible.

Female (Figs 65, 67). Wingspan 36 mm, length of fore wing 15–17 mm. External characters as for male but with more rounded fore wing; wings and abdomen somewhat darker in colouration.

Male genitalia (Figs 70–72, 76–84). Genital armature well sclerotized; uncus strong, flattened with obtuse flattened dorsal-ventral apex; tegumen ribbon-like, 0.67 times length of vinculum; penicular lobes small, bearing long setae; juxta shield-like with rounded basal (ventral) side and elongated (dorsal) extension; vinculum V-shaped. Valvae symmetrical, massive, wide, with parallel sides; sacculus short, triangular with dorsal setose sector; costa straight from base to cucullus, with big salience subapically; editum granule-shaped, setose; clasper strong, wide, flattened, medially curved; central area of the valva between sacculus and costal process weakly sclerotized; costal process large, its extension thin, acute, spiculiform, situated subapically; corona weak. Aedeagus cylindrical, distal part curved ventrally; ventral part sclerotized; carina heavily sclerotized, without spines. Vesica tubular, everted forward and recurved ventrally producing a full coil and continued in opposite direction from carina in a subconical tube; basal tube and medial part thick walled; medial third with long subconical diverticulum; distal third with somewhat shorter diverticulum and with long, robust, pointed terminal cornutus; basal part of vesica with membranous area with clear surface (Fig. 83); lateral and dorsal surfaces of vesica covered by fine spinules from basal area towards medial diverticulum (Fig. 77); medial diverticulum covered with granule-like formations with acute tips (Fig. 78); vesica with a strict border between two different types of scobination on main tube of vesica (spinules) and medial diverticulum (granulous formations with acute tips) on both sides (Figs 80, 81); scobination of distal diverticulum consists of spinules with broad bases (Fig. 79); terminal end of vesica covered by small spinules (Fig. 82). Eighth abdominal segment with characteristic sclerotized structures on both sides (Figs 97, 98); tergite with two symmetrical, well-sclerotized, anteriorly curved bars, connected by a cross-bar anteriorly and by weakly sclerotized band posteriorly; posterior margin slightly concave; middle section of tergite has no sclerotization and looks like a rectangular window with rounded lateral margins and straight posterior and anterior margins; sternite rather oval with wide sclerotization posteriorly and straight anterior and posterior margins, with unsclerotized "window" anteriorly.

Female genitalia (Figs 107, 108).

Ovipositor short; papillae anales densely hairy. Apophyses anteriores thin with small spatulate tips; apophyses posteriores somewhat longer than apophyses anteriores. Ostium bursae broad, ventral plate sclerotized, quadrangular with rounded lower corners, its walls scobinate. Ductus bursae long, tubular, sinusoid, a sclerotized crest running laterally from ostium bursae to apical part of corpus bursae. Appendix bursae as large as corpus bursae, most parts sclerotized; corpus bursae elliptical-semiglobular with three unequal signa: first signum long, tapering towards its tip; second signum medium-long, ribbon-like, equally wide throughout; third signum similar to second one but somewhat shorter. Seventh abdominal segment heavily sclerotized; tergite a fully sclerotized plate with parallel lateral sides and convex posterior and anterior sides; sternite smaller having a narrow, strongly sclerotized posterior part with rounded posterolateral corners, concave centrally; anterior part lightly sclerotized (Fig. 98).

Etymology. The new species is dedicated to the famous Russian entomologist, Mr. Pavel Gorbunov, who collected both of the new species of *Pseudohadena* described herein.

Distribution. The species is known only from its type-locality, South-west Kazakhstan, Ustyurt plateau.

Acknowledgements

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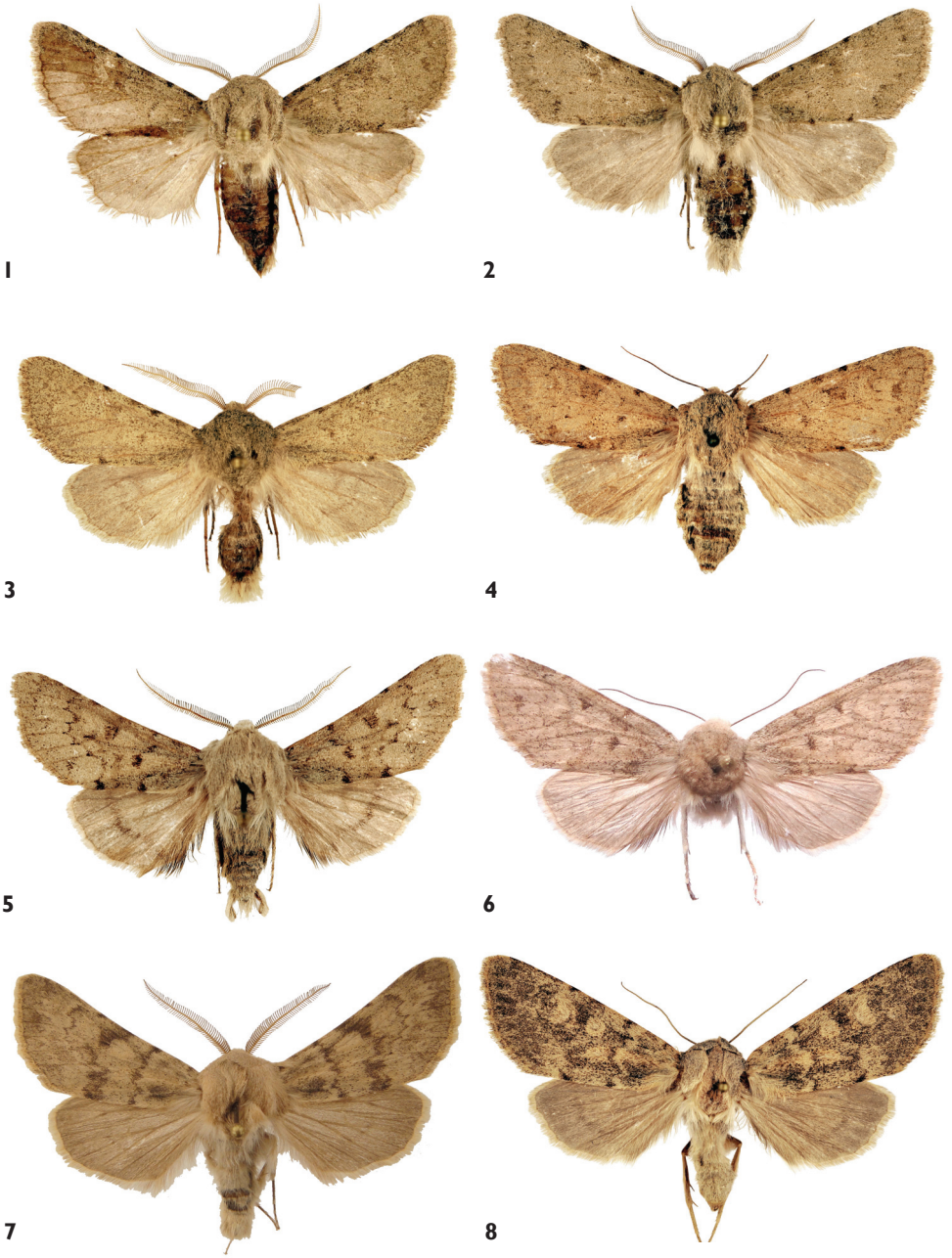
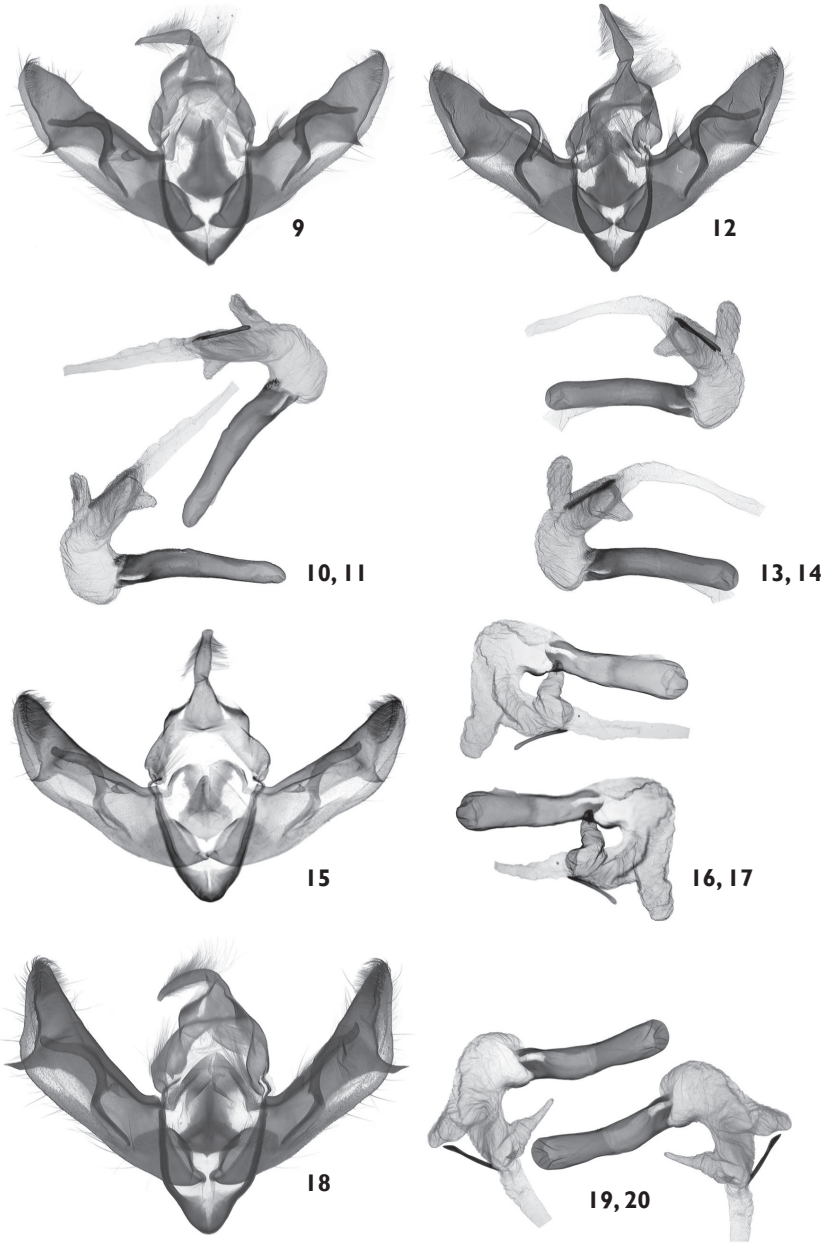
Figures



Figures 1–8. Adults. **1–4** *Pseudohadena* (*Jaxartia*) *anatine* sp. n. **1** holotype male, Kazakhstan **2** paratype male, Kazakhstan **3** paratype male, Kazakhstan **4** paratype female, Kazakhstan **5–6** *P.* (*J.*) *evanida psammoxantha* **5** paratype male, Kazakhstan **6** holotype female, Kazakhstan. **7–8** *P.* (*J.*) *magnitudinis* **7** male, Iran **8** female, Iran.



Figures 9–20. Male genitalia. **9–11** *Pseudohadena* (*Jaxartia*) *anatine* sp. n., male genitalia, holotype, Kazakhstan, slide No. OP1055m **9** clasping apparatus **10** aedeagus (ventral view) **11** aedeagus (ventral view, opposite side). **12–14** *Pseudohadena* (*J.*) *anatine* sp. n., male genitalia, paratype, Kazakhstan, slide No. OP1155m **12** clasping apparatus **13** aedeagus (ventral view) **14** aedeagus (ventral view, opposite side). **15–17** *Pseudohadena* (*J.*) *evanida psammoxantha*, male genitalia, paratype, Kazakhstan, slide No. RL4982m **15** clasping apparatus **16** aedeagus (ventral view) **17** aedeagus (ventral view, opposite side). **18–20** *Pseudohadena* (*J.*) *magnitudinis*, male genitalia, Iran, slide No. OP1071m **18** clasping apparatus **19** aedeagus (ventral view) **20** aedeagus (ventral view opposite side).

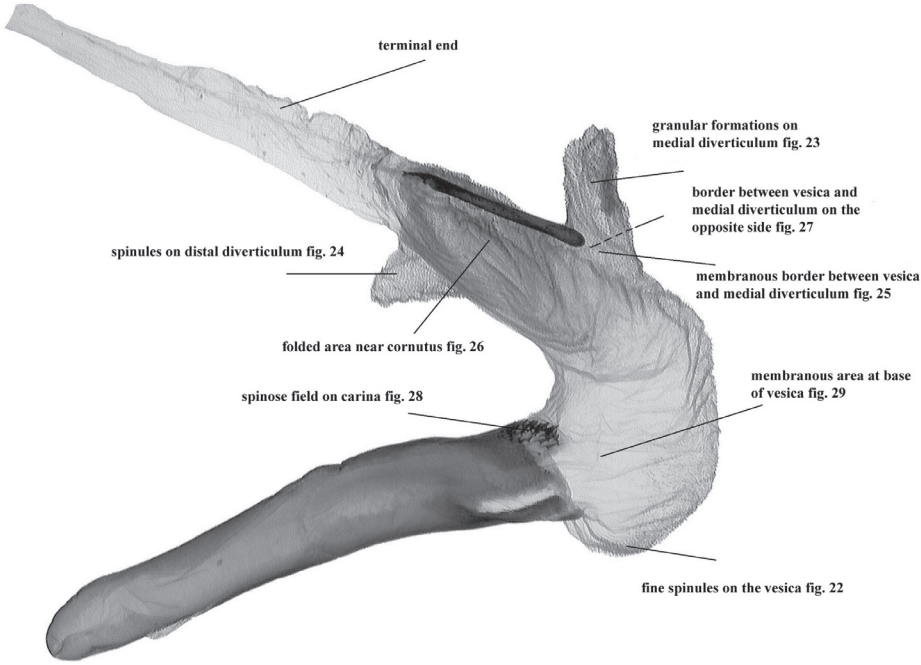
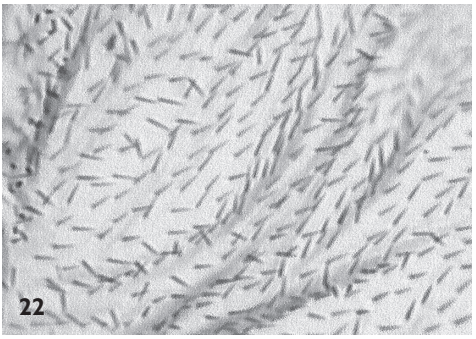
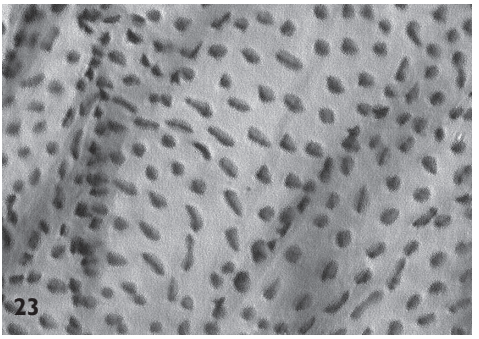
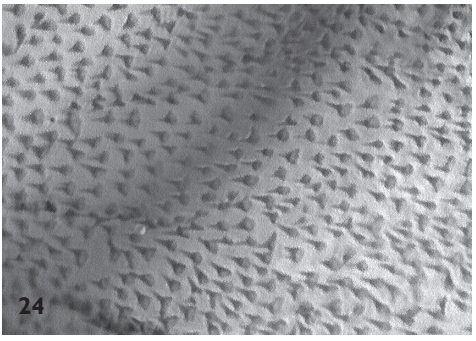
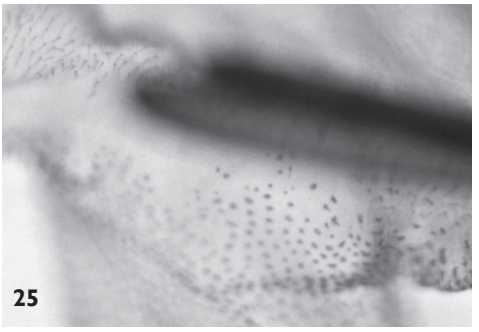


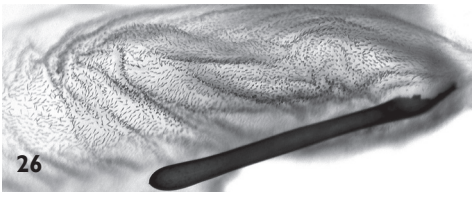
Figure 21. Vesica characteristics of *Pseudohadena* (*Jaxartia*) *anatine* sp. n., Kazakhstan.

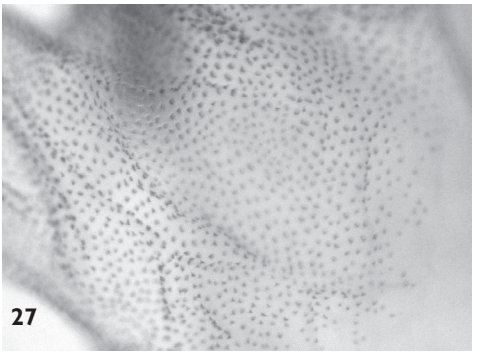


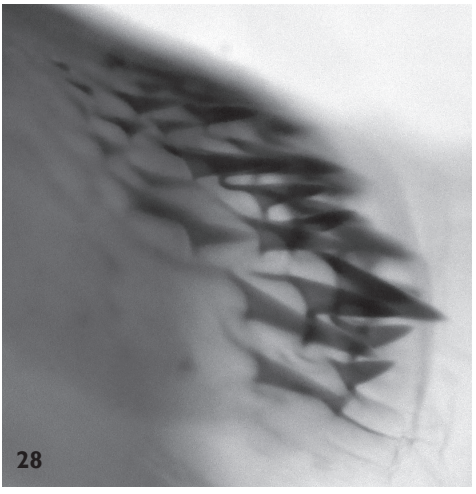












Figures 22–29. Vesica microstructure of *Pseudohadena* (*Jaxartia*) *anatine* sp. n. **22** fine spinules on the vesica **23** granular formations on medial diverticulum **24** spinules on distal diverticulum **25** membranous border between vesica and medial diverticulum **26** folded area near cornutus **27** border between vesica and medial diverticulum on opposite side **28** spinose field on carina **29** membranous area at base of vesica.

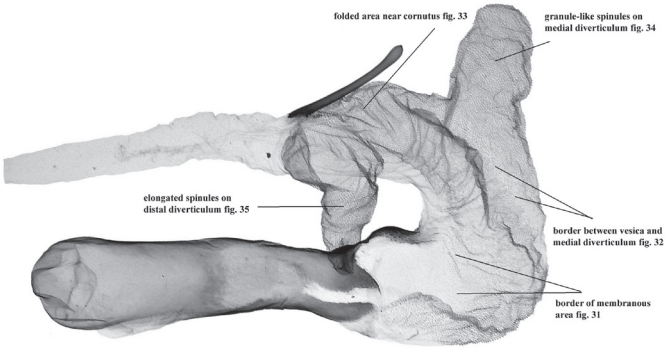
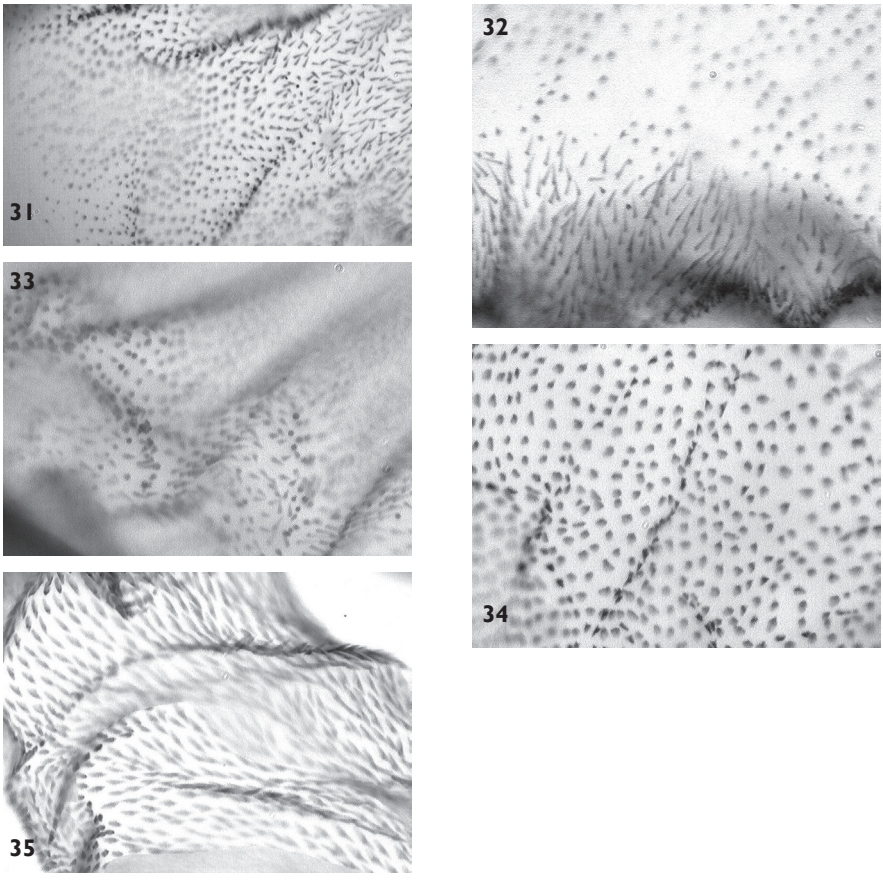


Figure 30. Vesica characteristics of *P.* (*J.*) *evanida psammoxantha*, paratype, Kazakhstan, slide No. RL4982m



Figures 31–35. Vesica microstructure of *Pseudohadena* (*Jaxartia*) *evanida psammoxantha*, paratype, Kazakhstan, slide No. RL4982m **31** border of membranous area **32** border between vesica and medial diverticulum **33** folded area near cornutus **34** granule-like spinules on medial diverticulum **35** elongated spinules on distal diverticulum.

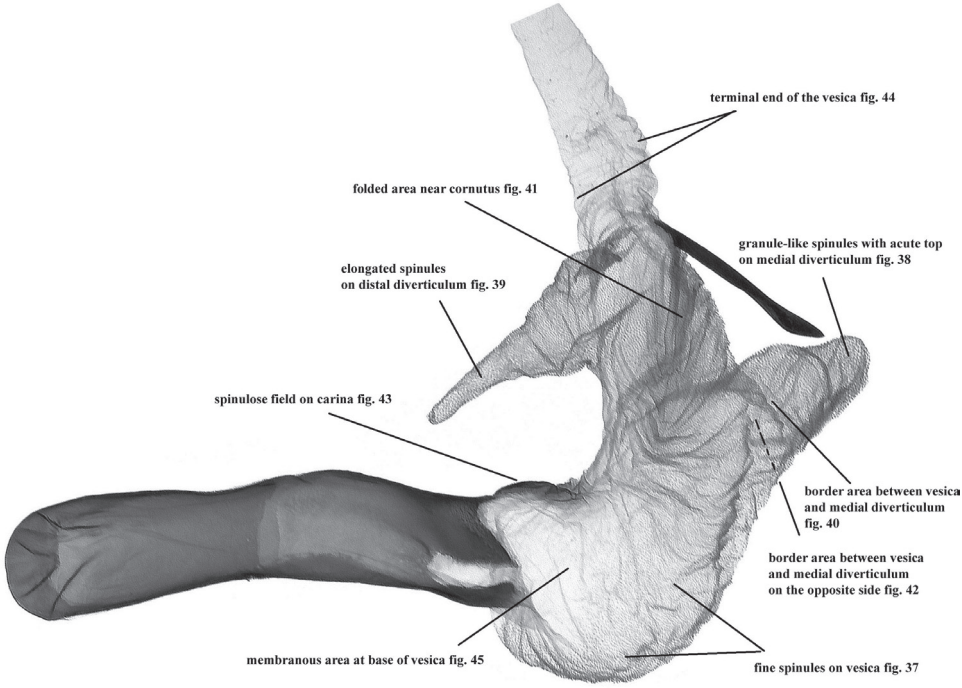


Figure 36. Vesica characteristics of *P.* (*J.*) *magnitudinis*, Iran, slide No. OP1071m

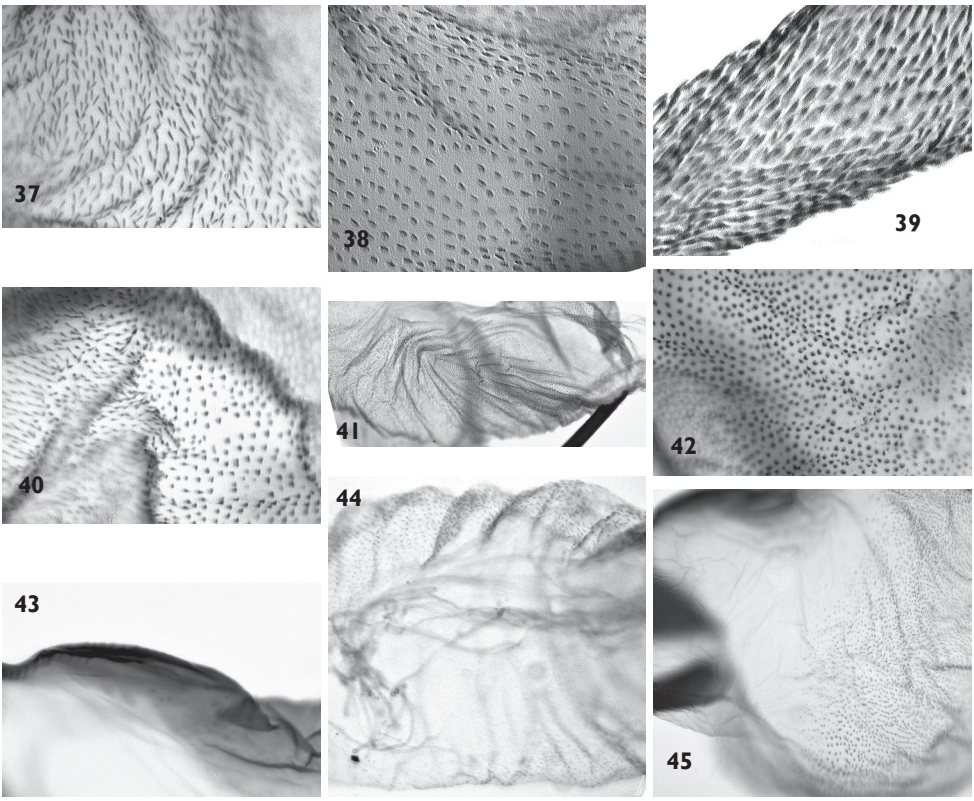
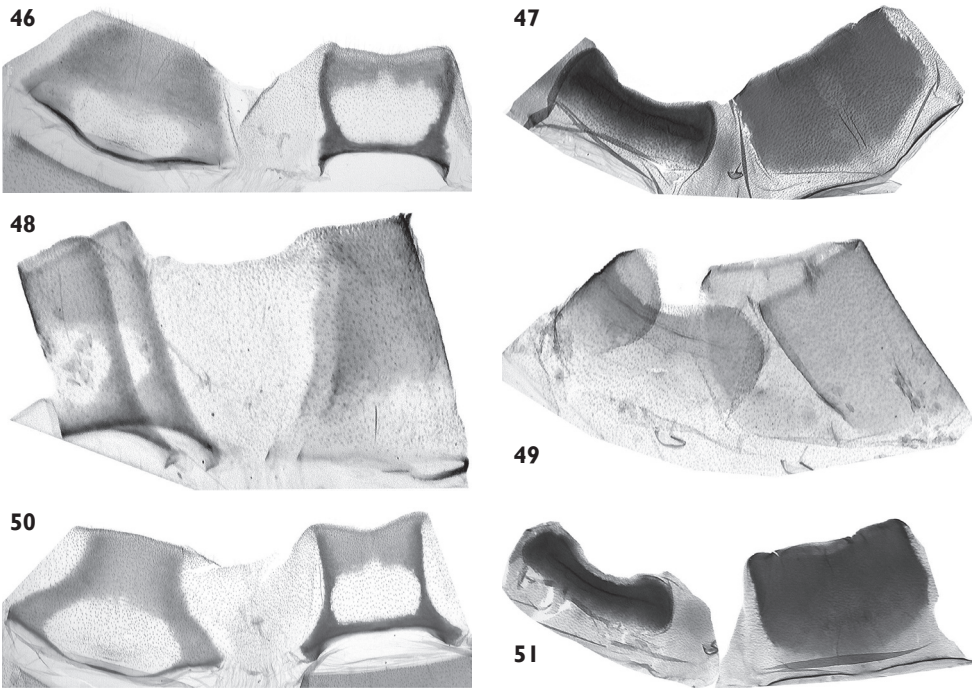
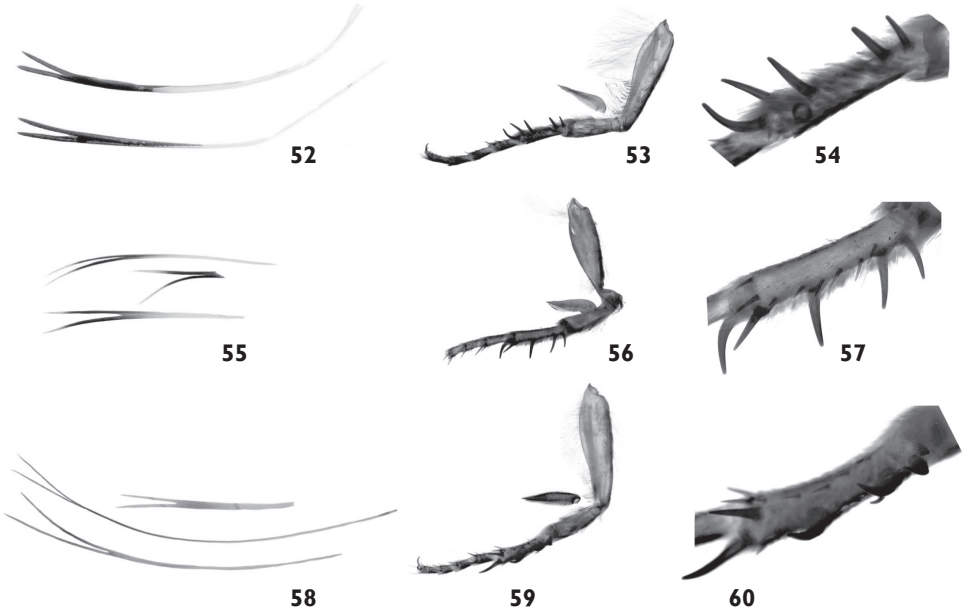


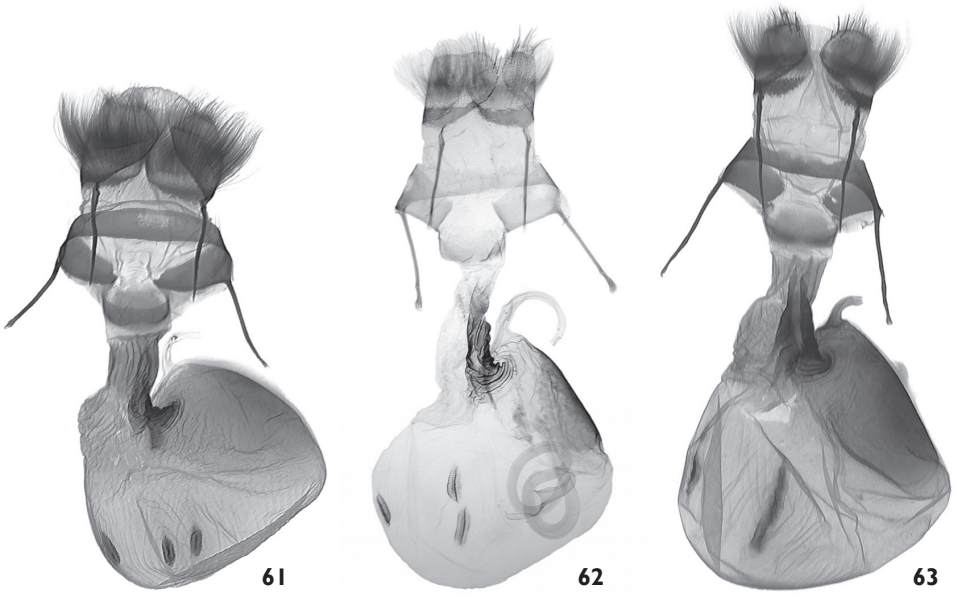
Figure 37–45. Vesica microstructure of *Pseudohadena* (*J.*) *magnitudinis*, Iran, slide No. OP1071m **37** fine spinules on vesica **38** granule-like spinules with acute tips on medial diverticulum **39** elongated spinules on distal diverticulum **40** border between vesica and medial diverticulum **41** folded area near cornutus **42** border area between vesica and medial diverticulum on opposite side **43** spinulose field on carina **44** terminal end of the vesica 45 membranous area at base of vesica.



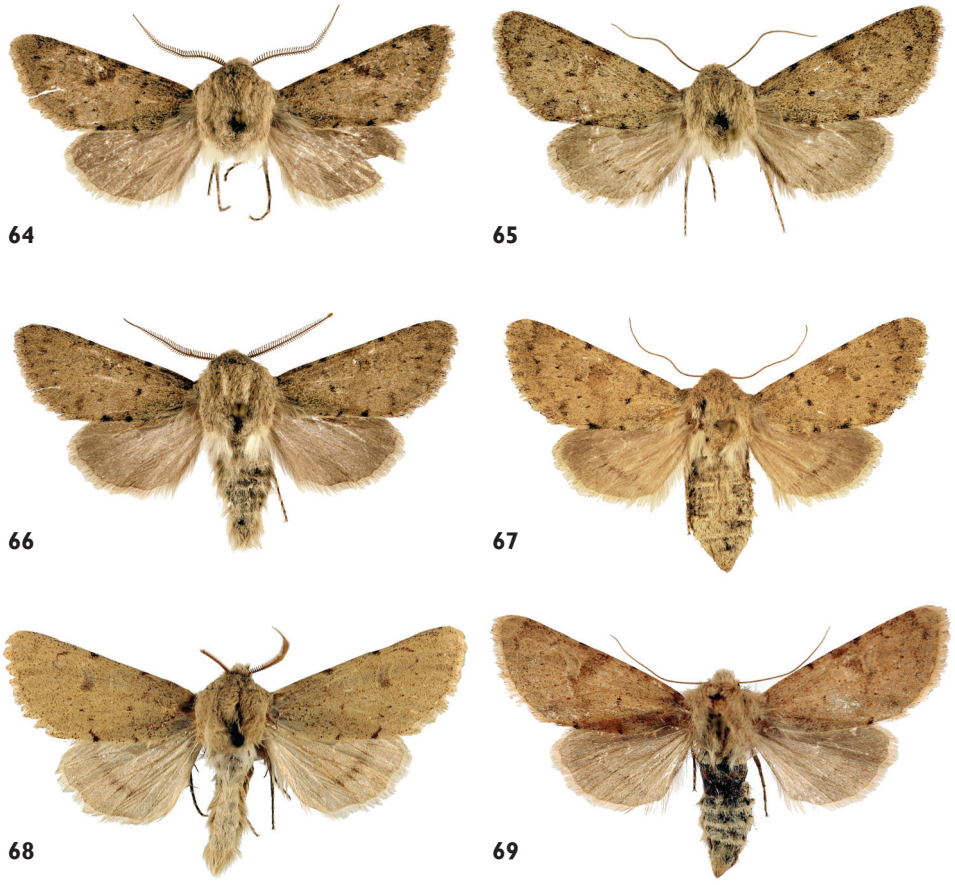
Figures 46–51. Abdominal segments. **46** *Pseudohadena* (*Jaxartia*) *anatine* sp. n., Kazakhstan, 8th abdominal segment of the male **47** 7th abdominal segment of female **48** *Pseudohadena* (*Jaxartia*) *evanida psammoxantha,* 8th abdominal segment of male **49** 7th abdominal segment of female **50** *Pseudohadena* (*J.*) *magnitudinis*, 8th abdominal segment of the male **51** 7th abdominal segment of the female.



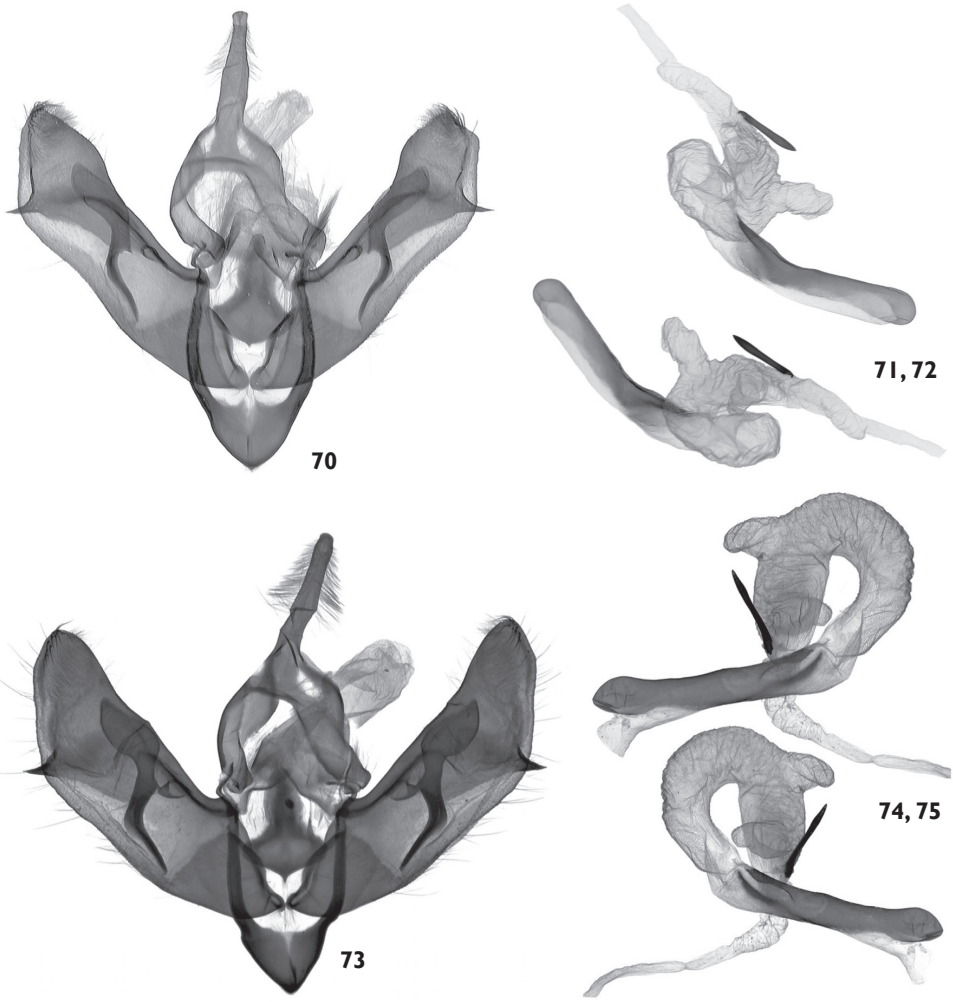
Figures 52–60. 52 Bifurcated hair-like scales from head and thorax of *Pseudohadena* (*Jaxartia*) *anatine* sp. n., Kazakhstan **53** right fore leg with separated epiphysis **54** basitarsus of fore leg **55** bifurcated hair-like scales from head and thorax of *Pseudohadena* (*Jaxartia*) *evanida psammoxantha* **56** right fore leg with separated epiphysis **57** basitarsus of fore leg **58** bifurcated hair-like scales from head and thorax of *Pseudohadena* (*J.*) *magnitudinis* **59** right fore leg with separated epiphysis **60** basitarsus of fore leg.



Figures 61–63. Female genitalia. **61** *Pseudohadena* (*J.*) *anatine* sp. n., female genitalia, paratype, Kazakhstan, slide No. OP1193f **62** *P.* (*J.*) *evanida psammoxantha*, female genitalia, holotype, Kazakhstan, slide No. RL5182 **63** *P.* (*J.*) *magnitudinis,* female, Iran slide No. OP1096f.



Figures 64–69. Adults. **64–67** *Pseudohadena* (*Jaxartia*) *gorbunovi* sp. n. **64** holotype male, Kazakhstan **65** paratype female **66** paratype male **67** paratype female. **68–69** *P.* (*J.*) *pseudamoena.* **68** paratype male, Armenia **69** female, Iran.



Figures 70–75. Male genitalia. **70–72** *Pseudohadena* (*Jaxartia*) *gorbunovi* sp. n., male genitalia, holotype, Kazakhstan, slide No. OP0976m **70** clasping apparatus **71** aedeagus (ventral view) **72** aedeagus (ventral view, opposite side) 73–75 *Pseudohadena* (*J.*) *pseudamoena*, male genitalia, paratype, Armenia, slide No. OP1198m **73** clasping apparatus **74** aedeagus (ventral view) **75** aedeagus (ventral view, opposite side).

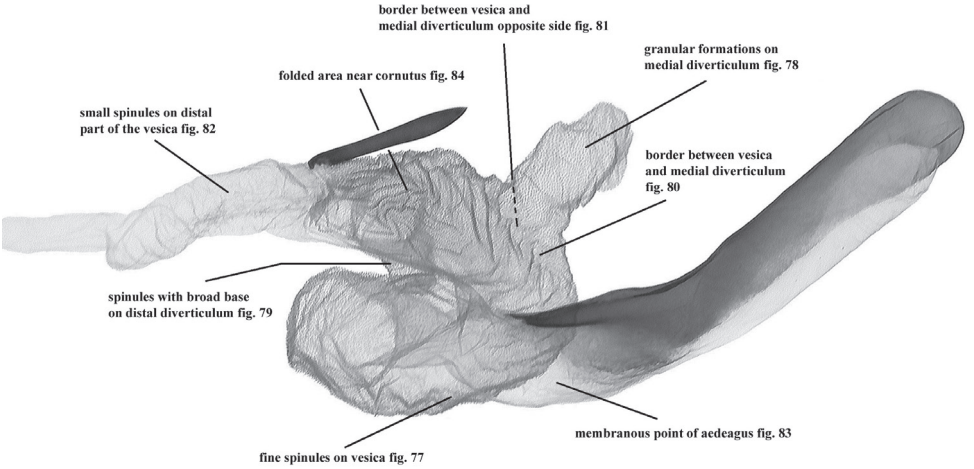
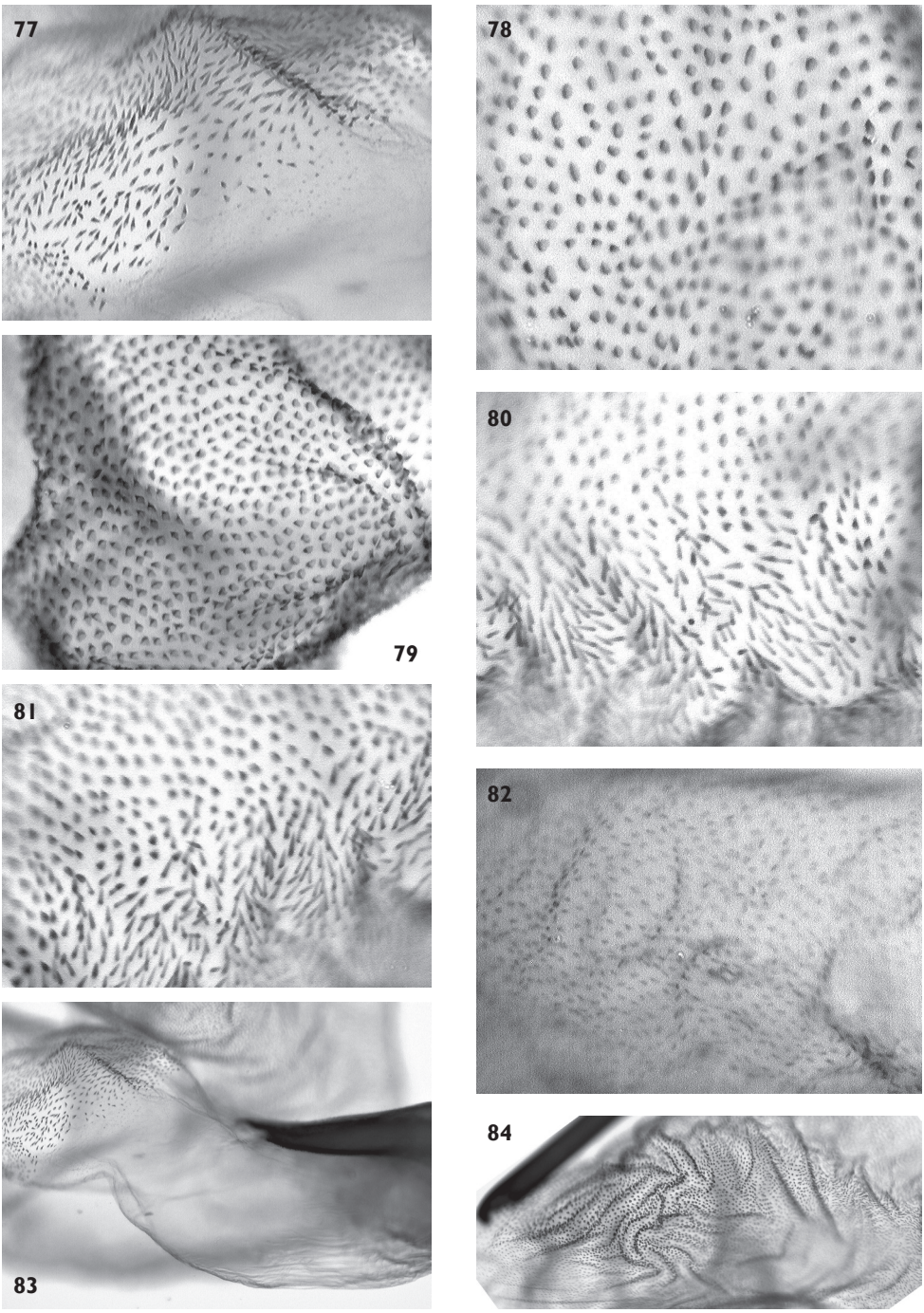


Figure 76. Vesica characteristics of *P.* (*J.*) *gorbunovi* sp. n., holotype, Kazakhstan, Slide No. OP0976m.



Figures 77–84. Vesica microstructure of *P.* (*Jaxartia*) *gorbunovi* sp. n. **77** fine spinules on vesica **78** granular formations on medial diverticulum **79** spinules with broad bases on distal diverticulum **80** border between vesica and medial diverticulum **81** border between vesica and medial diverticulum on opposite side **82** small spinules on distal part of vesica **83** membranous point of aedeagus **84** folded area near cornutus.

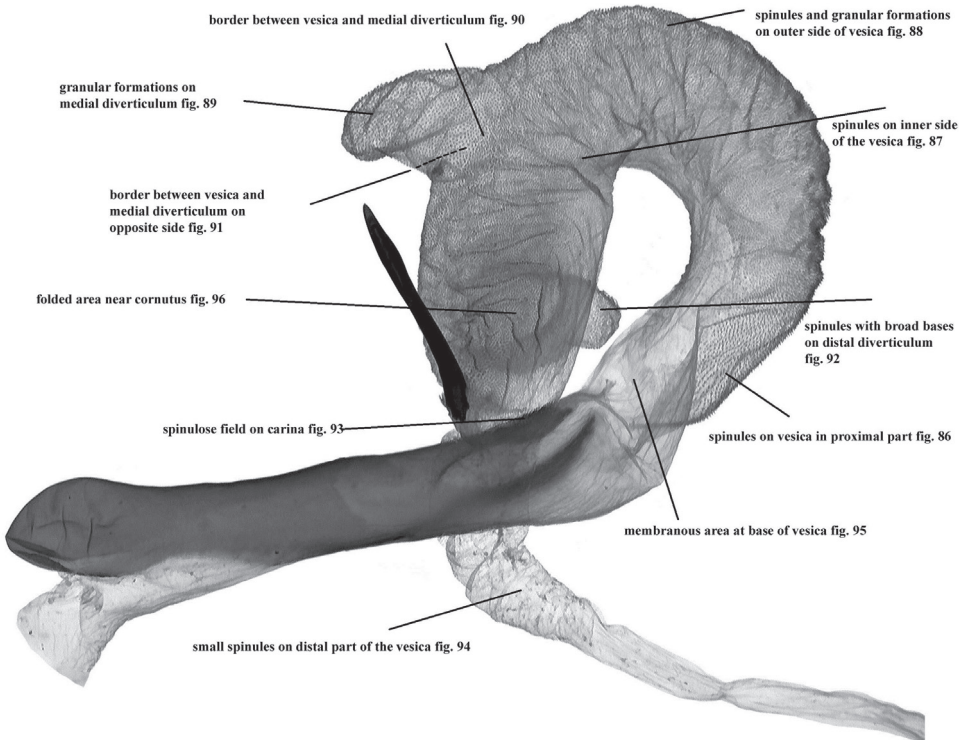
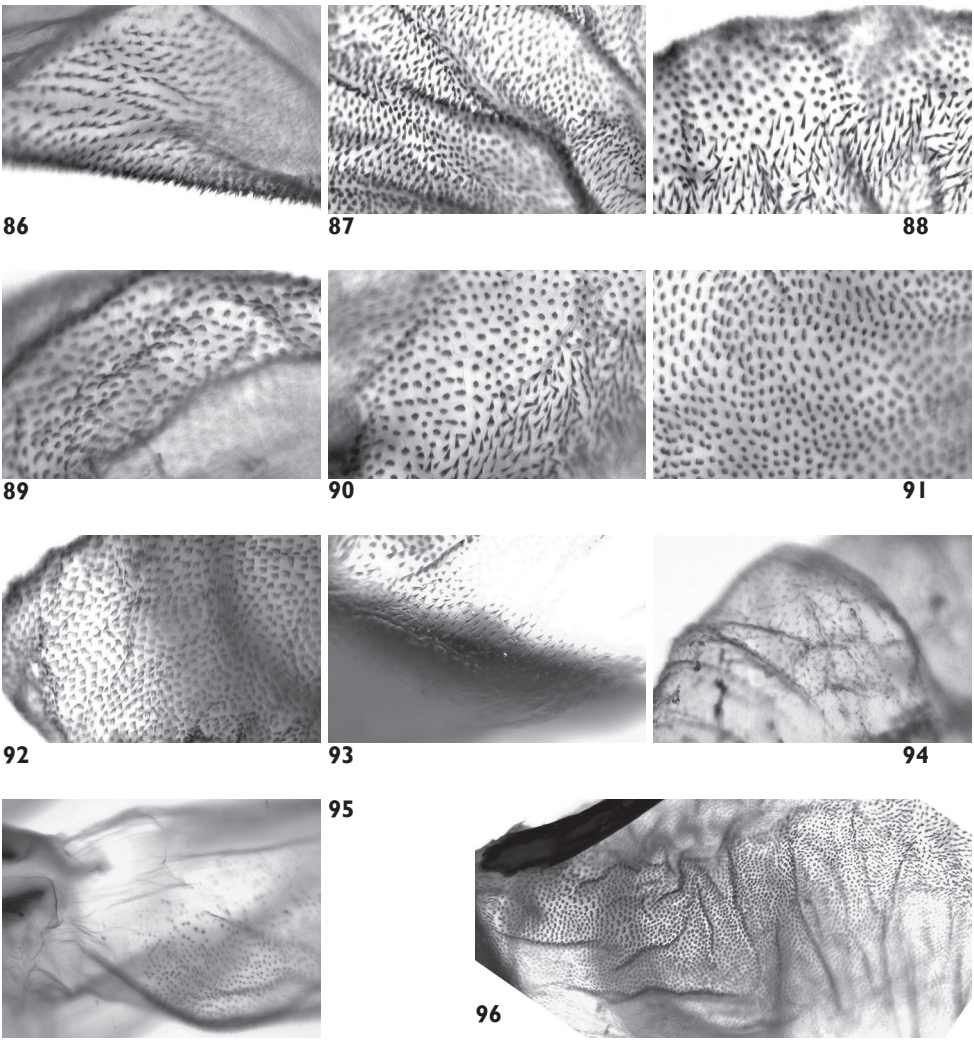
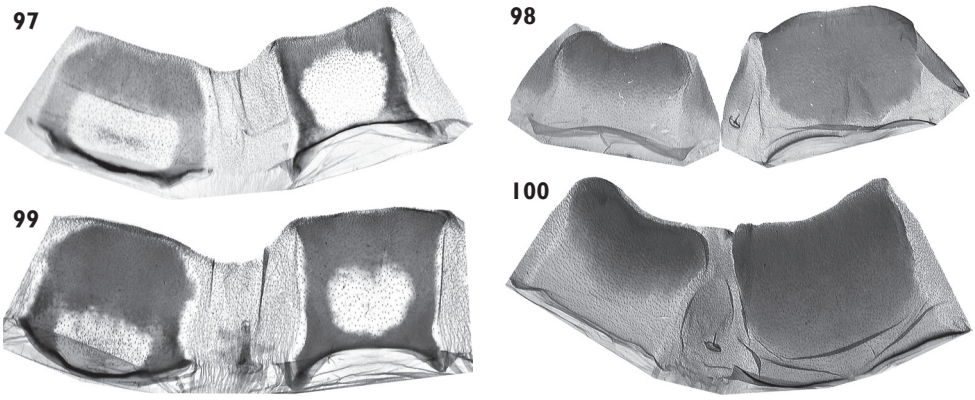


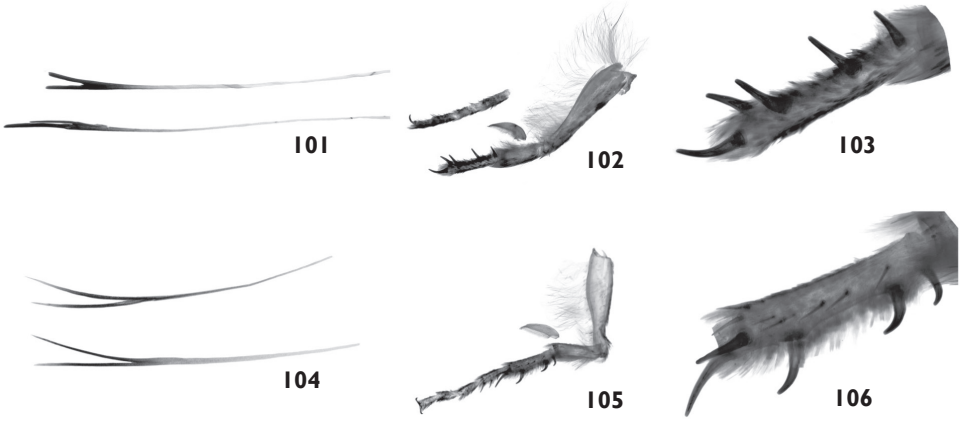
Figure 85. Vesica characteristics of *P.* (*J.*) *pseudamoena*, paratype, Armenia, slide No. OP1198m



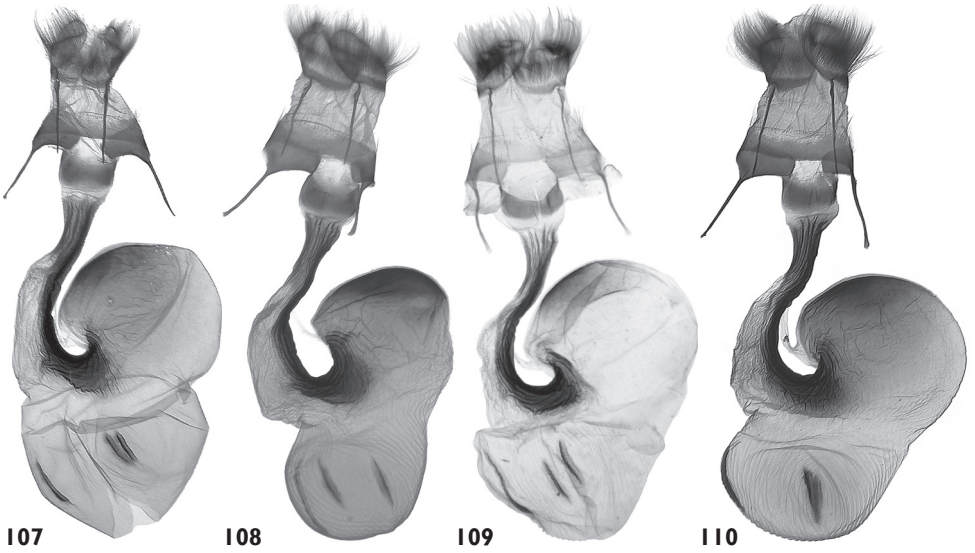
Figures 86–96. Vesica microstructure of *P.* (*Jaxartia*) *pseudamoena*. **86** spinules on vesica in proximal part **87** spinules on inner side of vesica **88** spinules and granular formations on outer side of vesica **89** granular formations on medial diverticulum **90** border between vesica and medial diverticulum **91** border between vesica and medial diverticulum on opposite side **92** spinules with broad bases on distal diverticulum **93** spinulose field on carina **94** small spinules on distal part of vesica **95** membranous area at base of vesica **96** folded area near cornutus.



Figures 97–100. Abdominal segments. **97** *P.* (*J.*) *gorbunovi* sp. n., 8th abdominal segment of male **98** 7th abdominal segment of female **99** *P.* (*J.*) *pseudamoena,* 8th abdominal segment of male **100** 7th abdominal segment of female.



Figures 101–106. 101 Bifurcated hair-like scales from head and thorax of *Pseudohadena* (*Jaxartia*) *gorbunovi* sp. n., Kazakhstan **102** right fore leg **103** basitarsus of fore leg **104** bifurcated hair-like scales from head and thorax of *Pseudohadena* (*Jaxartia*) *pseudamoena,* Iran **105** right fore leg **106** basitarsus of fore leg.



Figures 107–110. Female genitalia. **107** *Pseudohadena* (*J.*) *gorbunovi* sp. n., female genitalia, paratype, Kazakhstan, slide No. OP0977f **108** *P.* (*J.*) *gorbunovi* sp. n., female genitalia, paratype, Kazakhstan, slide No. OP1163f **109** *P.* (*J.*) *pseudamoena*, female genitalia, Iran, Elburs, slide No. RL8103f **110** *P.* (*J.*) *pseudamoena,* female, Iran, slide No. OP1126f.

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First record of the leafhopper genus *Sweta* Viraktamath & Dietrich (Hemiptera, Cicadellidae, Typhlocybinae) from China, with description of one new species feeding on bamboo

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Abstract

Sweta bambusana **sp. n.** (Hemiptera: Cicadellidae: Typhlocybinae: Dikraneurini), a new bamboo-feeding species, is described and illustrated from Guizhou and Guangdong of China. This represents the first record of the genus *Sweta* Viraktamath & Dietrich from China and the second known species of the genus. The new taxon extends the range of the genus *Sweta*, previously known only from northeast India and Thailand, considerably eastwards. A key for separation of the species of *Sweta* is given.

Keywords

Cicadomorpha, distribution, Oriental region, taxonomy

Introduction

The leafhopper genus *Sweta* was established by Viraktamath and Dietrich (2011) based on the type species *Sweta hallucinata* Viraktamath & Dietrich, 2011, from northeast India and Thailand. This dikraneurine genus is remarkable because it shares features with another leafhopper subfamily, Signoretiinae, restricted to the Old World tropics (Viraktamath and Dietrich 2011).

During the course of studying species biodiversity of the bamboo-feeding leafhoppers in China (see Discussion), several specimens belonging to an undescribed species of the genus *Sweta* were found. The new species represents the first record of *Sweta* in China, and its discovery has broadened our knowledge of host plant and biogeography of the genus.

Materials and methods

Terminology used in this work follows Dietrich (2005). Dry specimens were used for the description and illustration. External morphology was observed under a stereoscopic microscope and characters were measured with an ocular micrometer. Measurements are given in millimeters; body length is measured from the apex of the head to the apex of the forewing in repose. The genital segments of the examined specimens were macerated in 10% KOH, washed in water and transferred to glycerine. Illustrations of the specimens were made with a Leica MZ 12.5 stereomicroscope. Photographs of the types were taken with a Leica D-lux 3 digital camera. The digital images were then imported into Adobe Photoshop 8.0 for labeling and plate composition. Nomenclature of leg setae follows Li et al. (2011). The type specimens are deposited in the Institute of Entomology, Guizhou University, Guiyang, China (IEGU), and the Natural History Museum, London (BMNH).

Taxonomy

Sweta Viraktamath & Dietrich, 2011

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

Sweta Viraktamath & Dietrich, 2011: 1.

Type species. *Sweta hallucinata* Viraktamath & Dietrich, 2011, by original designation.

Diagnosis. Small size. Crown of the head strongly elevated above the anterior margin of the pronotum. Ocelli vestigial. Pronotum enlarged, strongly convex, and extended to the scutellar suture. Forewing broad, tectiform, with elongate, sinuate distal segments of veins R and M, closed preapical cells absent. Hind wing with the

submarginal vein complete and veins RP and MA confluent. First hind tarsomere acuminate. Aedeagus fused to the connective. Female second valvulae asymmetrical.

Distribution. Oriental region (Fig. 19).

Remarks. This dikraneurine genus is remarkable because it has a feature unknown in other typhlocybinae but present in another leafhopper subfamily (Signoretiinae), i.e. the elongate pronotum. A full description of the genus was given by Viraktamath and Dietrich (2011).

Key to species of *Sweta* Viraktamath & Dietrich (male)

1 Aedeagus with lower preapical processes distinctly longer than more distal processes; male abdomen with 3S apodemes extended to midlength of segment IV ..... ***S. hallucinata***

– Aedeagus with lower preapical processes slightly shorter than more distal processes (Figs 9–11); male abdomen with 3S apodemes extended to midlength of segment V (Fig. 5) ..... ***S. bambusana* sp. n.**

***Sweta bambusana* sp. n.**

urn:lsid:zoobank.org:act:E0CB16F2-4D98-4080-8981-9D69A313A2CF

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

Figs 1–16

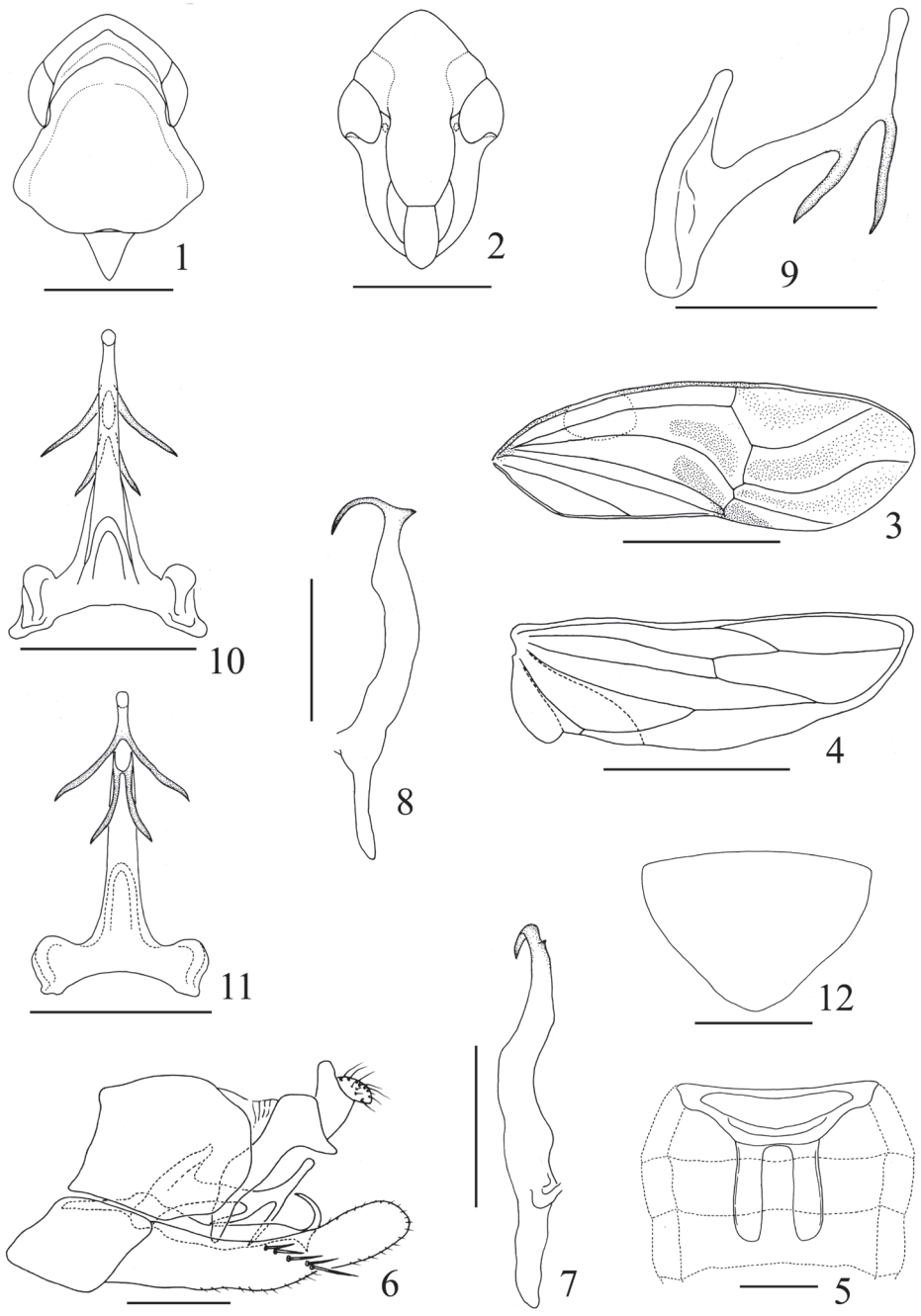
Type material. Holotype: ♂, **China:** Guizhou, Huishui, Yantang (26°08'N, 106°39'E), collected from bamboo (*Dendrocalamus affinis*), 31 May 2008, X.-S. Chen and L. Yang (IEGU); paratypes: 3 ♀♀, same data as holotype (IEGU); 3 ♂♂, 4♀♀, Guizhou, Changshun, Weiyuan (26°02'N, 106°27'E), collected from bamboo (*Dendrocalamus affinis*), 30 Sept. 1997, X.-S. Chen and L. Yang (IEGU), one male and female deposited in BMNH; 3 ♀♀, Guangdong, Guangzhou, Baiyunshan (23°10'N, 113°18'E), collected from bamboo, 21 Nove. 2006, X.-S. Chen (IEGU).

Etymology. The new species is named after the host plant bamboo (Bambusoideae).

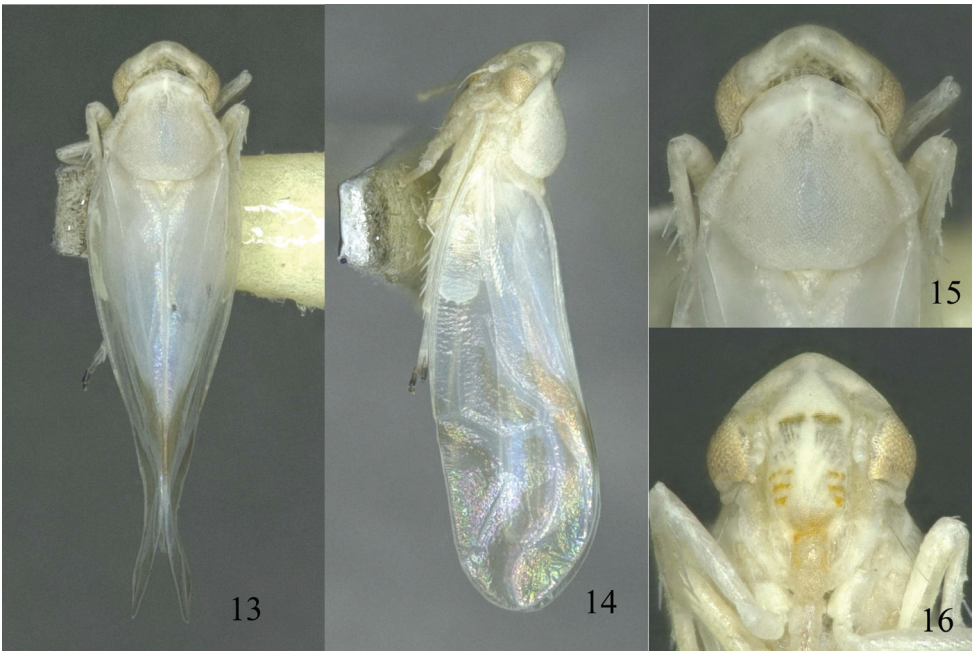
Description. Body length (from apex of vertex to tip of forewings): male 4.03–4.15 mm (N = 5); female 3.75–4.22 mm (N = 10); forewing length: male 3.25–3.30 mm (N = 5); female 3.05–3.31 mm (N = 10).

Coloration. Milky white to pale yellow (Figs 13-16). Forewing cells rather clouded with faint pale brown; distal portions of tarsi dark brown (Figs 3, 13, 14).

Head and thorax. External features as in diagnosis. Crown shorter medially than width between eyes (0.14:1). Pronotum shorter medially than width at widest part (0.55:1), longer medially than crown (4.0:1). Scutellum shorter medially than pronotum (0.31: 1). Forewing longer medially than width at widest part (2.95:1). Hindwing longer medially than width at widest part (3.65:1).



Figures 1–12. *Sweta bambusana* sp. n. **1** Head and thorax, dorsal view **2** Head, anteroventral view **3** Forewing **4** Hindwing **5** Base of abdomen, ventral view **6** Male genital capsule, lateral view **7** Style, ventral view **8** Style, lateral view **9** Aedeagus, lateral view **10** Aedeagus, dorsal view **11** Aedeagus, ventral view **12** Female abdominal sternite VII, ventral veiw. Scale bars: = 1 mm (Figs 3, 4), 0.5 mm (Figs 1, 2), 0.2 (Figs 5–12)



Figures 13–16. *Sweta bambusana* sp. n. **13** Dorsal habitus, holotype from Huishui **14** Lateral habitus, holotype from Huishui **15** Head and thorax, dorsal view **16** Head, anteroventral view.

Abdomen. Male abdomen with 3S apodemes subparallel, extended to midlength of segment V (Fig. 5).

Male genitalia. Aedeagus with both pair of preapical processes curved laterally, lower pair slightly shorter than more dorsal pair (Figs 9, 10, 11); shaft apex blunt and rounded. Other features as in generic diagnosis.

Female genitalia. Seventh sternite (Fig. 12) broad basally, triangularly produced posteriorly with rather rounded apex.

Host plant. Bamboo (*Dendrocalamus affinis* (Rendle) Mcclure) (Figs 17, 18).

Distribution. Southern China (Guizhou and Guangdong) (Fig. 19).

Remarks. This new species is very closely related to *S. hallucinata* Viraktamath & Dietrich, 2011 from Thailand and India, but can be distinguished by the aedeagus with apex blunt and rounded (tapering in *hallucinata*); the lower pair of subapical processes slightly shorter than more dorsal pair (in *hallucinata*, the lower pair are distinctly longer than the more upper pair); male abdomen with the 3S apodemes extended to midlength of the segment V (extended to midlength of the segment IV in *hallucinata*); the female abdominal sternite VII more or less triangular (relatively rounded in *hallucinata*).

Figures 17–18. Host plant of *Sweta bambusana* sp. n. **17** View of the area where the types of *S. bambusana* were captured, in Changshun (Guizhou, China) with *Dendrocalamus affinis* **18** View of the plant.

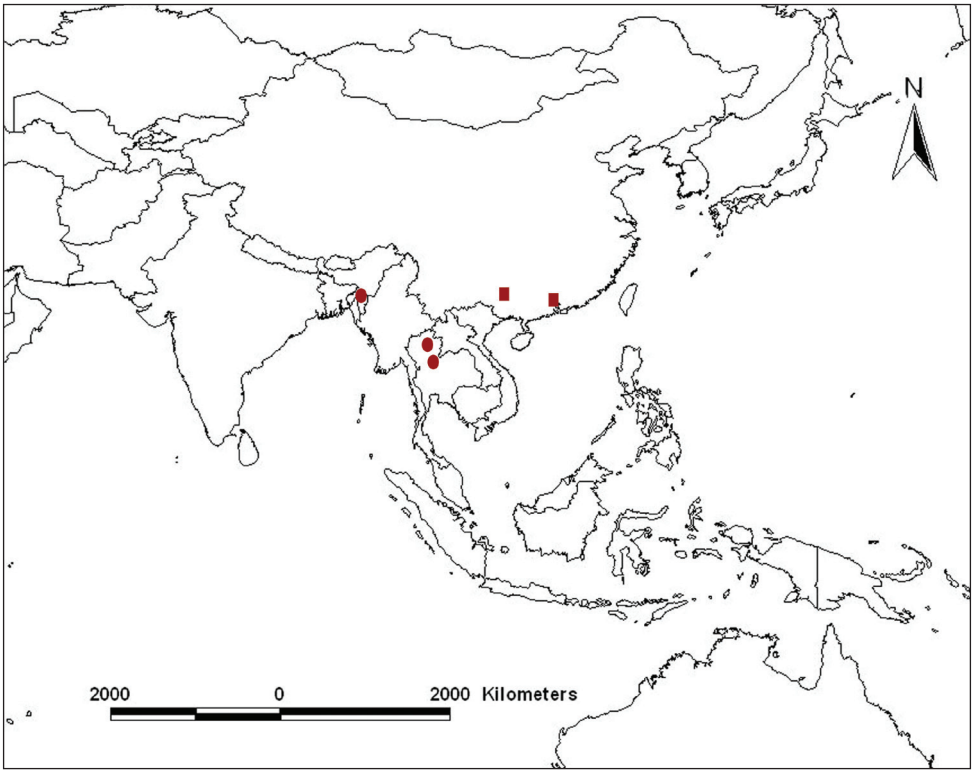


Figure 19. Geographic distribution of *Sweta* species: *S. hallucinata* (●); *S. bambusana* sp. n. (■).

Discussion

Diversity of bamboo-feeding leafhoppers. The present authors have paid particular attention to the species of bamboo-feeding leafhoppers in their field research and collected large numbers of specimens in the past 15 years from China including a number of new taxa and new records (Chen and Li 1997; Li and Chen 1999; Chen et al. 2007, 2008, 2009; Yang et al. 2007; Li et al. 2007, 2011; Yang and Chen 2011). Yang et al. (1999) recorded 13 species within 9 genera from China and Yang et al. (2011) increased the number to 33 genera and 55 species (in 9 subfamilies), of which, 4 species belonged to Typhlocybinae. Clearly, throughout China, the species diversity of bamboo-feeding leafhoppers is very great with more than 87 species feeding exclusively on Bambusoideae (Chen et al. in press).

Host plant of new species. *S. bambusana* was found feeding exclusively on one species of native bamboo, *Dendrocalamus affinis* (Rendle) McClure (Figs 17, 18). No other information on biology of *Sweta* species, nor host plant damage caused, is available.

Distribution of *Sweta* species. Although both species of *Sweta* appear to be widespread in Southeast Asia (Fig. 19) they are very rare. The new species extends the range of the genus eastwards from northeast India and Thailand to China.

Acknowledgements

We are grateful to Prof. Guang-Qian Gou (College of Life Sciences, Guizhou University, China) for identifying the host plant bamboo. This research was supported by the National Natural Science Foundation of China (No. 31160163) and the International Science and Technology Cooperation Program of Guizhou (20107005).

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RESEARCH ARTICLE

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Three species of *Amphicorina* (Annelida, Sabellida, Sabellidae) from Japan, with descriptions of two new species

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Abstract

We describe two new species and redescribe one in the polychaete genus *Amphicorina* Claparède, 1864 (Sabellidae) from Hokkaido, Japan. *Amphicorina ascidicola* **sp. n.** differs from its 38 congeners chiefly in the reduction of the collar, but also in having three pairs of radioles, one pair of ventral radiolar appendages, a bifurcate ventral lobe on the anterior peristomial ring, six abdominal chaetigers, and a large anterior tooth on the abdominal uncini. *Amphicorina ezoensis* **sp. n.** has a crenulated collar, three pairs of radioles, and more than eight (12) abdominal chaetigers; *A. ezoensis* **sp. n.** shares these character states with *A. anneae* (Rouse, 1994), *A. eimeri* (Langerhans, 1880), and *A. persinosa* (Ben-Eliahu, 1975), but differs from them in having two pairs of ventral radiolar appendages and a non-oblique collar. *Amphicorina mobilis* (Rouse, 1990) was previously known only from the type locality (New South Wales, Australia), but we identify our Japanese material as conspecific on the basis of morphological and molecular similarity.

Keywords

Taxonomy, morphology, polychaete, scanning electron microscopy, 18S rRNA, 28S rRNA

Introduction

Sabellid polychaetes in the genus *Amphicorina* Claparède, 1864 are distributed nearly worldwide; most are small (up to 6 mm in body length) and live in shallow marine environments. Since Giangrande et al.'s (1999) revision of the genus, four species have been added to *Amphicorina* by López and Tena (1999), Nogueira and Amaral (2000), and Capa and López (2004), increasing the number of species in the genus to 38. To date, however, no polychaete species has been reported from Japanese waters under the name of *Amphicorina*.

In a faunal survey around Hokkaido, northern Japan, we found three species of *Amphicorina*; we identified one as *A. mobilis* (Rouse, 1990), previously known only from Australia, whereas the other two proved to be undescribed species. Here we describe these two species as new to science and provide morphological data for *A. mobilis*; we also provide partial sequences of the 18S and 28S rRNA genes for *A. mobilis* and one of the two new species.

Material and methods

Unless otherwise mentioned, the specimens used in this study were collected by the first author from several intertidal sites in Hokkaido, northern Japan (Akkeshi, Higashi-shizunai, Mukawa, and Muroran on the Pacific side; Okushiri-Island, Setana, and Oshoro in the Sea of Japan). For morphological observation, specimens were fixed in 10% seawater formalin and later transferred to 70% ethanol after rinsing in deionized water. For DNA extraction, most specimens were preserved in 99% ethanol, though a few living specimens were directly frozen at –10°C. Observations were made with a stereoscopic microscope, compound light microscope, and scanning electron microscope (SEM). Some intact specimens were mounted whole on glass slides, embedded in Entellan New (Merck) under a cover slip. One specimen of *Amphicorina ascidicola* sp. n. was dehydrated in an ethanol series, cleared in xylene, embedded in paraffin (m.p. 56–57°C), sectioned sagittally at 8 μm thickness, and stained using Mallory's trichrome method (Gibson 1994). For SEM observation, specimens were dehydrated in an ethanol series, critical-point dried with CO_2, and coated with gold. All voucher specimens have been deposited in the Hokkaido University Museum, Sapporo, Japan, catalogued under the acronym ZIHU, representing the former Zoological Institute, Hokkaido University.

DNA was extracted from either frozen or ethanol-preserved specimens using a DNeasy Tissue Kit (Qiagen, Tokyo, Japan) according to the manufacturer's protocol. Primers used for PCR amplification of gene fragments are listed in Table 1.

Hot-start PCRs were performed using a thermal cycler (iCycler, Bio-Rad), in 10-μl reaction volumes containing 1 μl of total DNA template (approximately 10–100 ng), 1 μl Ex *Taq* buffer (TaKaRa Bio), 25 mM each dNTP, 10 μM each primer, and 2.5 U TaKaRa Ex*Taq* DNA polymerase (5 U/μl, TaKaRa Bio) in deionized water.

Table 1. Primers used in this study for initial PCR amplification and/or sequencing.

	Gene fragment	Primer set	Source
Amplification	18S	1F (5'- TAC CTG GTT GAT CCT GCC AGT AG -3')	Giribet et al. (1996)
		9R (5'- GAT CCT TCC GCA GGT YTC ACC TAC -3')	
	28S-D1	F (5'- AAC CSC TGA AYT TAA GCA T -3')	Brown et al. (1999)
		R (5'- AAC TCT CTC MTT CAR AGT TC -3')	
	28S-D3–D7	01F (5' -GAC TAC CCC CTG AAT TTA AGC AT -3')	Kim et al. (2000)
		3KR (5'- CCA ATC CTT TTC CCG AA -3')	Hiruta (unpubl.)
Sequencing	18S	1F (see above)	—
		3F (5'- GTT CGA TTC CGG AGA GGG A -3')	Giribet et al. (1996)
		4R (5'- GAA TTA CCG CGG CTG CTG G -3')	
		9R (see above)	—
		18Sbi (5'- ATG GTT GCA AAG CTG AAA C -3')	Whiting et al. (1997)
		18Sa2.0 (5'- GAG TCT CGT TCG TTA TCG GA -3')	
	28S-D1	F, R (see above)	—
	28S-D3–D7	01F (see above)	—
		1KR (5'- GAC TCC TTG GTC CGY GTT TCA AG -3')	Kim et al. (2000)
		14F (5'- TGG GAC CCG AAA GAT GGT G -3')	Luan et al. (2005)
		15R (5'- CGA TTA GTC TTT CGC CCC TA -3')	Hiruta (unpubl.)
		3KR (see above)	—

Thermal cycling conditions were 95°C for 1 min; 35 cycles of 95°C for 30 sec, 45°C for 1.5 min, and 72°C for 3 min (18S and 28S-D3–D7) or 1 min (28S-D1); and 72°C for 7 min. PCR products were purified according to the method of Boom et al. (1990) with some modifications (Kobayashi et al. 2009). Terminator reactions were done with a BigDye Terminator v3.1 Cycle Sequencing Kit (Life Technologies) following the manufacturer's protocol; sequencing primers are listed in Table 1. Sequencing was performed with an Applied Biosystems 3130 DNA Analyzer (Life Technologies). Base-calling and assembling were carried out using ATGC ver. 4.0.6 (GENETYX). Gene sequences were aligned and compared by using MEGA ver. 5 (Tamura et al. 2011).

Systematics

Genus *Amphicorina* Claparède, 1864

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

Type species. *Fabricia* (*Amphicorina*) *armandi* Claparède, 1864 by monotypy.

Nomenclatural remarks. The genus name was initially referred to in French as "L'*Amphicorine*" (Quatrefages 1850) for a sabellid occurring in Bréhat, France. It was later latinized as *Amphicorina* by Leuckart (1854); however, neither Quatrefages

(1850) nor Leuckart (1854) combined it with any available specific name(s), and thus their usage of the name does not satisfy Article 12.2.5 of the International Code of Zoological Nomenclature (ICZN 1999). Claparède (1864) made the genus-group name available, originally as a subgenus that included only *Fabricia* (*Amphicorina*) *armandi* Claparède, 1864. Therefore, the authority of the name should be ascribed to Claparède (1864), not to Quatrefages (1850) as some authors have erroneously indicated (e.g., Nogueira and Amaral 2000; WoRMS 2010).

***Amphicorina ascidicola* sp. n.**
urn:lsid:zoobank.org:act:39CC8B25-D1E9-46F4-8463-20AD2AC36E69
http://species-id.net/wiki/Amphicorina_ascidicola
Figs 1, 2

Material examined. Morphology. Holotype: ZIHU 3926, intact specimen, fixed in 10% seawater formalin, preserved in 70% ethanol, among botryllid ascidian colonies, 42°16'N, 142°27'E, Higashi-shizunai, Hokkaido, Japan, 10 June 2010. **Paratypes:** ZIHU 3927, among botryllid ascidian colonies, 42°18'N, 140°59'E, Muroran, Hokkaido, Japan, 16 April 2010; ZIHU 3928, 3929, among laminarian holdfasts, 42°33'N, 141°55'E, Mukawa, Hokkaido, Japan, 9 June 2010; ZIHU 3930, 3931, among botryllid ascidian colonies, 43°01'N, 144°50'E, Akkeshi, Hokkaido, Japan, 23 June 2009; ZIHU 3932, 3933, same data as for holotype; ZIHU 3934–3937, among laminarian holdfasts, 42°33'N, 141°55'E, Mukawa, Hokkaido, Japan, 9 June 2010 [ZIHU 3927, 3933–3937, intact specimens, fixed in 10% seawater formalin, preserved in 70% ethanol; ZIHU 3928, dissected, with half of branchial crown removed; ZIHU 3929, 3930, whole mounts on slides; ZIHU 3931, serial sagittal sections on slide; ZIHU 3932, mounted on SEM stub].

DNA analysis. One specimen, among algae, 42°18'N, 140°59'E, Muroran, Hokkaido, Japan, 19 April 2011.

Description. Body with eight thoracic and six abdominal chaetigers (Fig. 1A). Total length 2.8 mm, crown length 0.7 mm, maximum body width 0.3 mm. Three pairs of radioles, with lateral flanges; proximal 1/7 of radioles connected by palmate membrane; each radiole with six pairs of pinnules ending with terminal pinnule; all pinnules ending at same height as terminal pinnule (Fig. 1A). Each radiole with two longitudinal internal cellular supporting axes; each pinnule with one internal cellular supporting axis. One pair of ventral radiolar appendages present, with one internal cellular supporting axis, nearly 1/2 radiole length (Fig. 1A). One pair of elongate dorsal lips present, with neither pinnular nor radiolar appendages; one pair of triangular ventral lips present (Fig. 1B). Distal end of ventral lobe on anterior peristomial ring bifurcate (Fig. 2B). Posterior peristomial ring collar absent; border between anterior and posterior peristomial ring obscure (Figs 1B, 2A, 2B). Small ciliated patch on posterior peristomial ring (Figs 1B, 2A, 2B). One pair

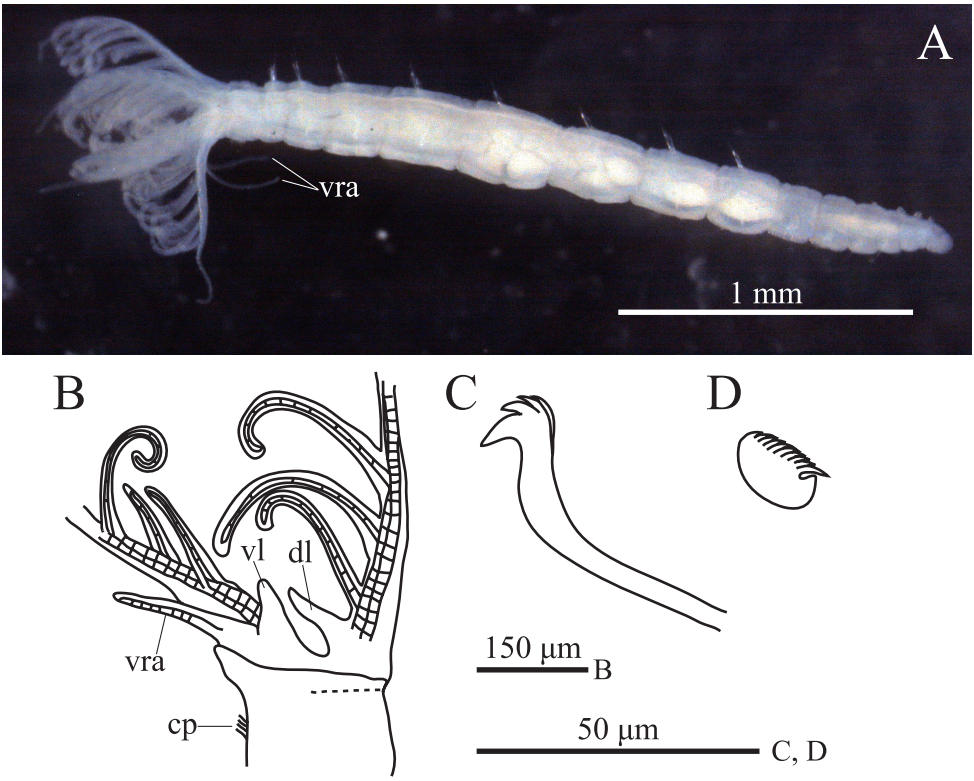

Figure 1. *Amphicorina ascidicola* sp. n. **A** holotype, ZIHU 3926, lateral view **B** paratype, ZIHU 3928, lateral view of inner surface of branchial crown **C** paratype, ZIHU 3930, thoracic uncinus **D** paratype, ZIHU 3931, abdominal uncinus. Abbreviations: **cp** ciliated patch **dl** dorsal lip **vl** ventral lip **vra** ventral radiolar appendage.

of red eyes present on peristomium (not visible in preserved specimens). Glandular ridge absent.

Superior thoracic notochaetae elongate, narrowly hooded, 3–5 per fascicle (Fig. 2C). Inferior thoracic notochaetae bayonet type, five per fascicle in first thoracic chaetiger; second to eighth thoracic chaetigers with 3–4 narrowly hooded and 5 bayonet-type inferior thoracic notochaetae (Fig. 2C). Thoracic acicular uncini 5–7 per torus; each uncinus with three rows of irregular-sized teeth above main fang (Figs 1C, 2D). Abdominal uncini quadrangular, with eight rows of teeth above large basal tooth (Figs 1D, 2E), 5–15 uncini per torus. Abdominal neurochaetae needle-like capillaries in form, three per fascicle (Fig. 2F).

Pygidium rounded, with one pair of red eyes; color of eyes faded in preserved specimens.

One pair of statocysts in first thoracic chaetiger evident in living state. Oocytes found in sixth to eighth thoracic chaetigers.

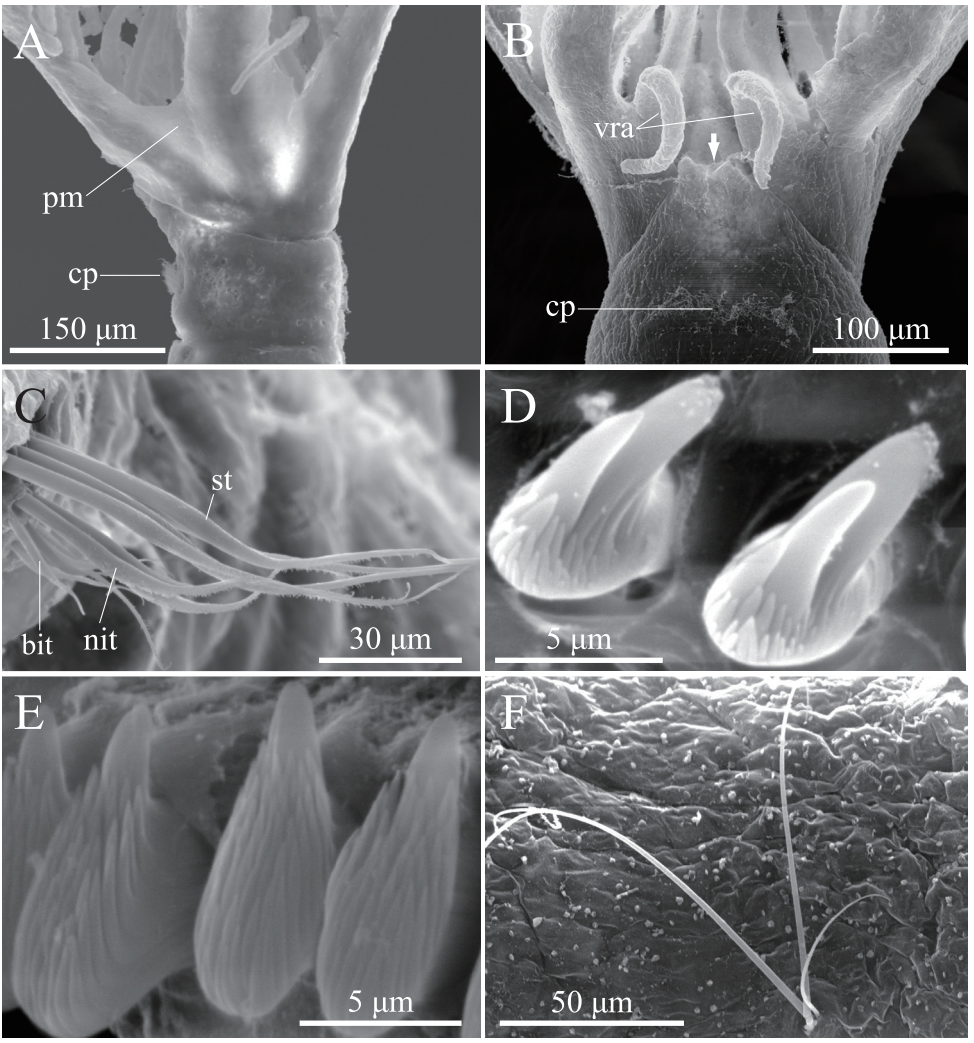

Figure 2. *Amphicorina ascidicola* sp. n., paratype, ZIHU 3932, SEM images. **A** basal part of radioles, lateral view **B** basal part of radioles, ventral view (arrow indicates bifurcate ventral lobe on anterior peristomial ring) **C** thoracic notochaetae on the 5th chaetiger **D** thoracic uncini **E** abdominal uncini **F** abdominal chaetae. Abbreviations: **bit** bayonet inferior thoracic notochaetae **cp** ciliated patch **nit** narrowly hooded inferior thoracic notochaetae **pm** palmate membrane **st** superior thoracic notochaetae **vra** ventral radiolar appendage.

DNA analysis. We obtained sequences for two of the three target gene fragments for this species (GenBank accession numbers AB646764, 18S, 1677 bp; AB646765, 28S-D1, 377 bp); we were unable to sequence 28S-D3–D7. Both strands were sequenced for 28S-D1; part of the 18S sequence is based on only one strand. Among species of *Amphicorina*, DNA sequence data were available only for *A. mobilis* (Rousset et al. 2004; Kupriyanova and Rouse 2008). In a 1687 bp alignment of 18S sequences, *A. ascidicola* sp. n. differed in sequence from the Australian (GenBank accession num-

ber EF116206, Kupriyanova and Rouse 2008) and Japanese specimens (AB646764) of *A. mobilis* by 15 indels and 17 substitutions in each case. In a 321 bp alignment of the 28S-D1 region, *A. ascidicola* sp. n. differed in sequence from the Australian (EF116217, Kupriyanova and Rouse 2008) and Japanese (AB646765) specimens of *A. mobilis* by five substitutions and one indel in each case.

Etymology. The specific name, a noun, is a combination of *ascidia* (sea squirt) and *-cola* (dweller), referring to the fact that the species was frequently found among botryllid ascidian colonies.

Remarks. Among the 38 congeners, the following eight species have been reported to exhibit a reduction in the collar [= absence of posterior peristomial ring collar] as in *A. ascidicola*: *A. alata* (Ehlers, 1897), *A. brevicollaris* (Rouse, 1990), *A. gracilis* (Hartman, 1969), *A. grahamensis* Giangrande, Montanaro & Castelli, 1999, *A. minuta* (Berkeley & Berkeley, 1932), *A. neglecta* (Banse, 1957), *A. pectinata* (Banse, 1957), and *A. triangulata* López & Tena, 1999. However, the present new species can be distinguished from those by the combination of characters and their states summarized in Table 2.

Table 2. Comparison of characters in species of *Amphicorina* with a reduced collar.

Taxa	Characters					Source
	Number of pairs of radioles	Number of pairs of ventral radiolar appendages	Ventral lobe on anterior peristomial ring	Number of abdominal chaetigers	Inferior tooth of abdominal uncini	
A. alata (Ehlers, 1897)	4	1	absent	6	small	Ehlers (1897), Giangrande et al. (1999), López and Tena (1999)
A. brevicollaris (Rouse, 1990)	4	2	bifurcate	7	small	Rouse (1990), Giangrande et al. (1999), López and Tena (1999)
A. gracilis (Hartman, 1969)	3	0	absent	8	small	Hartman (1969), Giangrande et al. (1999), López and Tena (1999)
A. grahamensis Giangrande, Montanaro & Castelli, 1999	3	1	absent	5	large	Giangrande et al. (1999), López and Tena (1999)
A. minuta (Berkeley & Berkeley, 1932)	2	?	absent	5	large	Berkeley and Berkeley (1932), Giangrande et al. (1999), López and Tena (1999)
A. neglecta (Banse, 1957)	4	1	absent	6	large	Banse (1957), Giangrande et al. (1999), López and Tena (1999)
A. pectinata (Banse, 1957)	4	2	bifurcate	6	large	Banse (1957), Giangrande et al. (1999), López and Tena (1999)
A. triangulata López & Tena, 1999	4	1	bifurcate	6	large	López and Tena (1999)
A. ascidicola sp. n	3	1	bifurcate	6	large	Present study

***Amphicorina ezoensis* sp. n.**
urn:lsid:zoobank.org:act:3B810496-A96D-4D12-904F-B3C695EA48FD
http://species-id.net/wiki/Amphicorina_ezoensis
Figs 3, 4

Material examined. Holotype: ZIHU 4255, fixed in 10% seawater formalin, preserved in 70% ethanol, among algae, 42°33'N, 139°50'E, Setana, Hokkaido, Japan, 10 May 2010. **Paratypes:** ZIHU 4254, mounted on SEM stub, same data as for holotype; ZIHU 4270, fixed in 10% seawater formalin, preserved in 70% ethanol, same data as for holotype.

Description. Eight thoracic and 12 abdominal chaetigers (Fig. 3A). Total length 3.1 mm, crown length 0.6 mm, maximum body width 0.3 mm. Three pairs of radioles, with lateral flanges; proximal 1/2 of radioles connected by palmate membrane. Each radiole with two longitudinal internal cellular supporting axes; each pinnule with one internal cellular supporting axis. Ventral-most radiole with two appendages on each side (Fig. 4A); these appendages (arranged dorsally and ventrally) being almost 1/2 radiole length, and only dorsal one having one internal cellular supporting axis. Distal end of ventral lobe on anterior peristomial ring bifurcate, extending slightly beyond collar margin (Figs 3C, 4A). Posterior peristomial ring collar crenulate (Figs 3A, 3B, 3C, 4A, 4B), with dorsal gap (Fig. 4B). Ciliated patch absent on posterior peristomail ring (Figs 3C, 4A). Glandular ridge on second chaetiger present.

Superior thoracic notochaetae elongate, narrowly hooded, 4–5 per fascicle (Fig. 3D). Inferior thoracic notochaetae bayonet type, four per fascicle; no elongate, narrowly hooded chaetae (Fig. 3D). Thoracic acicular uncini 4–5 per torus; each uncinus having four rows of teeth above main fang (Figs 3E, 4C). Abdominal uncini quadrangular, with eight rows of teeth above large basal tooth (Figs 3F, 4D), 2–9 uncini per fascicle; number of uncini decreasing posteriorly, with eight uncini on first and second abdominal chaetigers, nine on third. Abdominal neurochaetae 2–4 per fascicle, needle-like capillaries in form (Fig. 3G). Pygidium rounded. Peristomial and pygidial eyes and statocysts not visible in preserved specimens. Oocytes found in fourth and fifth thoracic chaetigers.

Etymology. The specific epithet is an adjective derived from *Ezo*, the old place name for Hokkaido, in combination with the Latin suffix *-ensis*.

Remarks. *Amphicorina ezoensis* is similar to *A. anneae* (Rouse, 1994), *A. eimeri* (Langerhans, 1880), and *A. persinosa* (Ben-Eliahu, 1975) in having a crenulate collar, three pairs of radioles, and more than eight abdominal chaetigers. *Amphicorina ezoensis* differs from *A. persinosa* in the shape of the collar. In *A. ezoensis*, the anterior edge of the collar is perpendicular to the anterior-posterior body axis, and the collar completely covers the anterior peristomium so that the latter is not visible laterally, while in *A. persinosa* the collar is oblique in lateral view so that

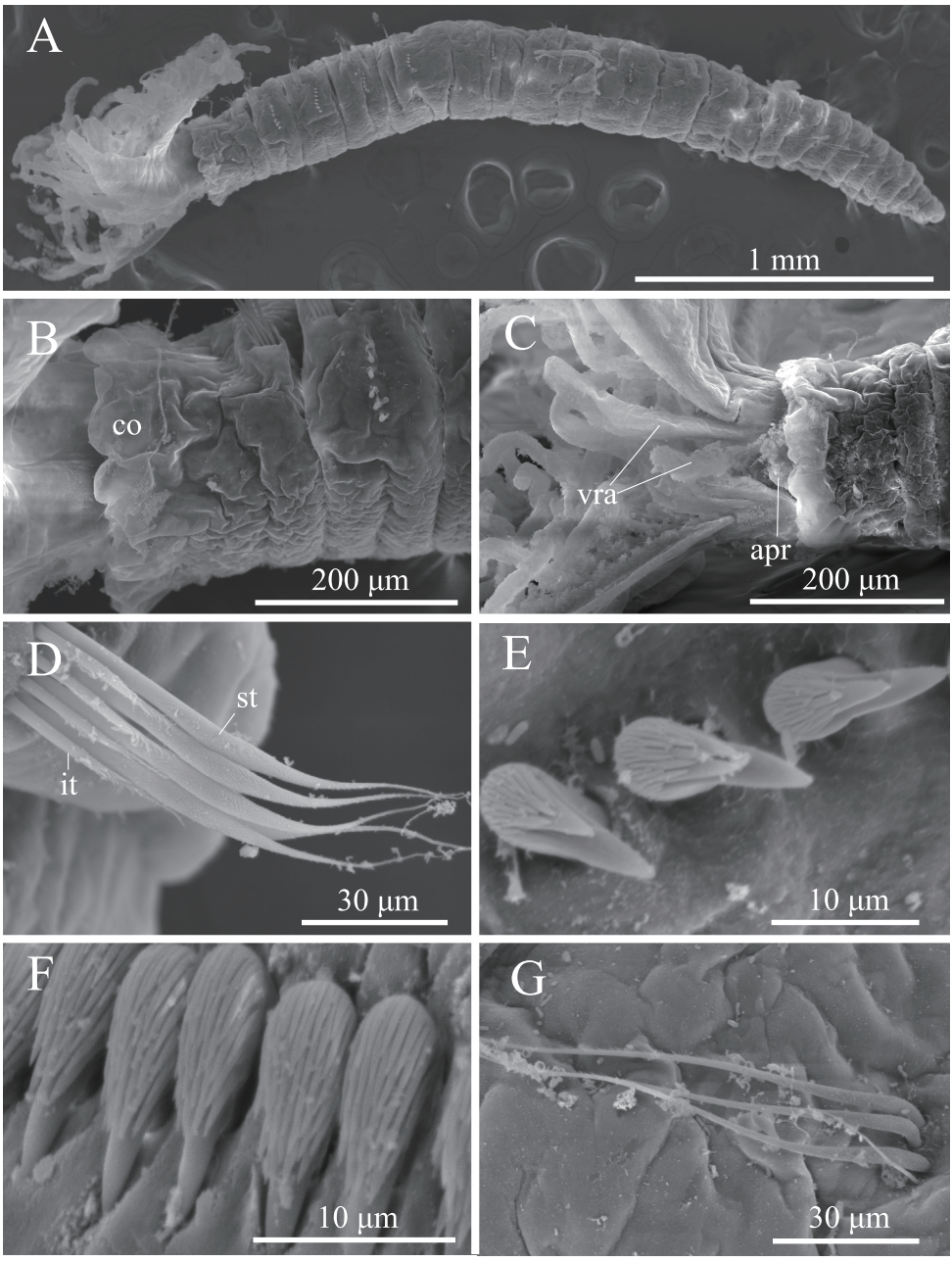

Figure 3. *Amphicorina ezoensis* sp. n., paratype, ZIHU 4254, SEM images. **A** entire worm, lateral view **B** collar and first thoracic segment, lateral view **C** basal part of radioles, ventral view **D** thoracic notochaetae on the 4th chaetiger **E** thoracic uncini **F** abdominal uncini **G** abdominal chaetae. Abbreviations: **apr** anterior peristomial ring **co** collar **it** inferior thoracic notochaetae **st** superior thoracic notochaetae **vra** ventral radiolar appendage.

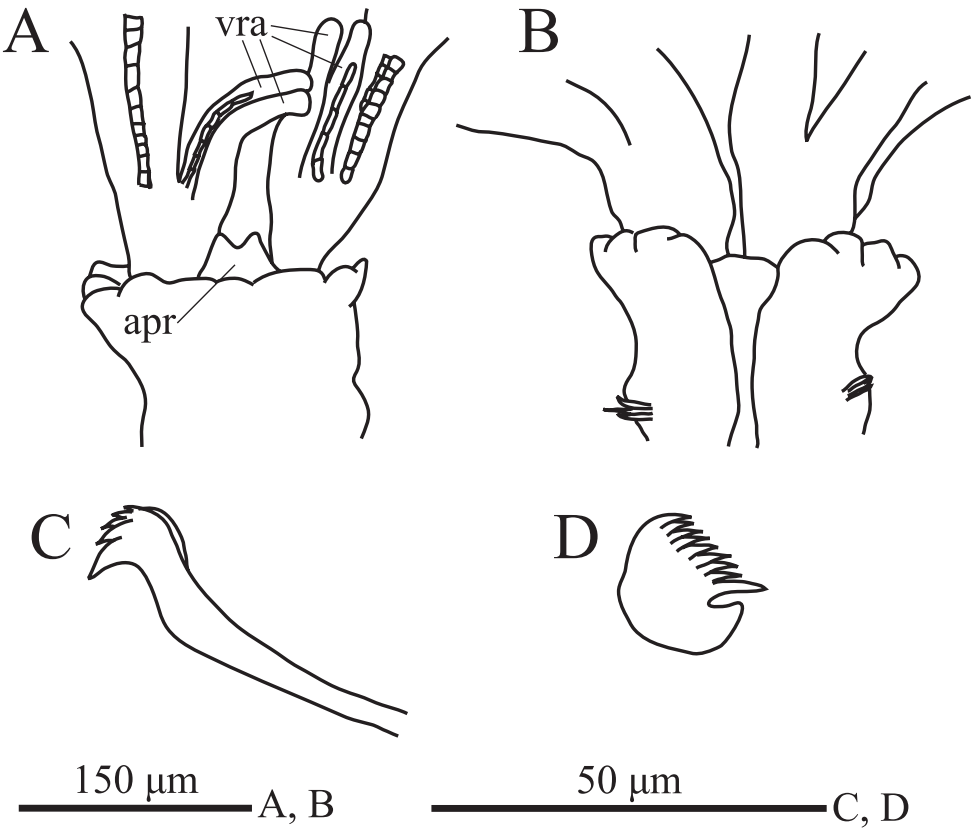

Figure 4. *Amphicorina ezoensis* sp. n., holotype, ZIHU 4255. **A** collar, ventral view **B** collar, dorsal view **C** thoracic uncinus **D** abdominal uncinus. Abbreviations: **apr** anterior peristomial ring **vra** ventral radiolar appendage.

the anterior peristomium is visible, although the angle of the collar is often determined by how the specimen was fixed. *Amphicorina ezoensis* further differs from *A. anneae* and *A. persinosa* in the number of ventral radiolar appendage(s). *Amphicorina ezoensis* has two pairs of appendages, while *A. anneae* and *A. persinosa* have one pair. The number of ventral radiolar appendage(s) was not mentioned in the original description of *A. eimeri* (Langerhans, 1880), but Banse (1957: 72) noted "ventral wenigstens ein Filament" (ventrally at least one filament); Giangrande et al. (1999: 197, Table 1) indicated the species has one pair of appendages, while Rouse (1990: Table 1) lists "1?". *Amphicorina ezoensis* also differs from *A. eimeri* in that the former possesses elongate, narrowly hooded thoracic chaetae, while the latter has broadly hooded thoracic chaetae (Rouse 1990, Giangrande et al. 1999). *Amphicorina ezoensis* also differs from *A. eimeri* in the number of the abdominal chaetigers (12 vs. 10).

We were unable to obtain DNA sequence data for this species due to the paucity of material.

***Amphicorina mobilis* (Rouse, 1990)**
http://species-id.net/wiki/Amphicorina_mobilis
Figs 5, 6

Oriopsis mobilis Rouse, 1990: 230–231, fig. 5a–i.
Amphicorina mobilis: Giangrande et al. 1999: 197, Table 1; Nogueira and Amaral 2000: 622; Rousset et al. 2004: Table 3; 2007: 47, Table 1; Kupriyanova and Rouse 2008: 1177, Table 1; Capa et al. 2010: 2, Table 1; Huang et al. 2011: 3, Table 1.
?*Amphicorina* sp. Giangrande et al. 1999: 199–200, fig. 4a–g.
?*Fabricia ventrilinguata*: Fitzhugh 1990: 14. Not Johansson (1922).
?*Fabricia sabella*: Imajima and Hartman 1964: 366. Not Ehrenberg (1836).

Material examined. Morphology. Twenty-five specimens. ZIHU 3938, among botryllid ascidian colonies, 42°16'N, 142°27'E, Higashi-shizunai, Hokkaido, Japan, 10 June 2010; ZIHU3939, among algae, 42°16'N, 142°27'E, Higashi-shizunai, Hokkaido, Japan, 10 June 2010; ZIHU 3940, 3941, among algae, 42°06'N, 139°25'E, Okushiri-Island, Hokkaido, Japan, 9 May 2010; ZIHU 3942, among algae, 42°16'N, 142°27'E, Higashi-shizunai, Hokkaido, Japan, 10 June 2010; ZIHU 3943, among botryllid ascidian colonies, 43°12'N, 140°51'E, Oshoro, Hokkaido, Japan, 16 October 2009; ZIHU 3944, among algae, 42°16'N, 142°27'E, Higashi-shizunai, Hokkaido, Japan, 10 June 2010; ZIHU 3945, among *Mytilus*, 43°12'N, 140°51'E, Oshoro, Hokkaido, Japan, 23 May 2010; ZIHU 3946, among algae, 43°12'N, 140°51'E, Oshoro, Hokkaido, Japan, 24 May 2010; ZIHU 3947, among algae, 42°06'N, 139°25'E, Okushiri-Island, Hokkaido, Japan, 9 May 2010; ZIHU 3948, among algae, 43°12'N, 140°51'E, Oshoro, Hokkaido, Japan, 23 March 2010; ZIHU 4273, two specimens, among sessile organisms on culture panel for the vase tunicate *Ciona intestinalis* (Linnaeus, 1767) hung from a raft, 35°09'N, 139°36'E, Misaki, Kanagawa, Japan, 22 February 2012, K. Kakui leg; ZIHU 4274, three specimens, same locality data as ZIHU 4273 [ZIHU 3938, 3043–3948, 4273, intact specimens, fixed in 10% seawater formalin, preserved in 70% ethanol; ZIHU3939, dissected, with half of the branchial crown removed; ZIHU 3940, 3941, whole mount on slide; ZIHU 3942, mounted on SEM stub; ZIHU 4273, fixed in Bouin's fluid, preserved in 70% EtOH; ZIHU 4274, fixed and preserved in 99% EtOH].

DNA analysis. Two specimens: one collected among algae, 42°06'N, 139°25'E, Okushiri-Island, Hokkaido, Japan, 9 May 2010; the other collected among laminarian holdfasts, 42°18'N, 140°59'E, Muroran, Hokkaido, Japan, 19 April 2011.

Description. Complete specimens have eight thoracic and five abdominal chaetigers (Fig. 5A). Total length 1.2–3.2 mm (mean, 2.3 mm; n = 9), crown length 0.2–0.6 mm (mean, 0.4 mm; n = 9), maximum width 0.3 mm. Three pairs of radioles with lateral flanges; proximal 1/7 of radioles connected by palmate membrane; each radiole with six pairs of pinnules ending with terminal pinnule; all pinnules ending at same height as terminal pinnule. Each radiole with two longitudinal internal cellular supporting axes; each pinnule with one internal cellular supporting axis. One pair of ventral radiolar ap-

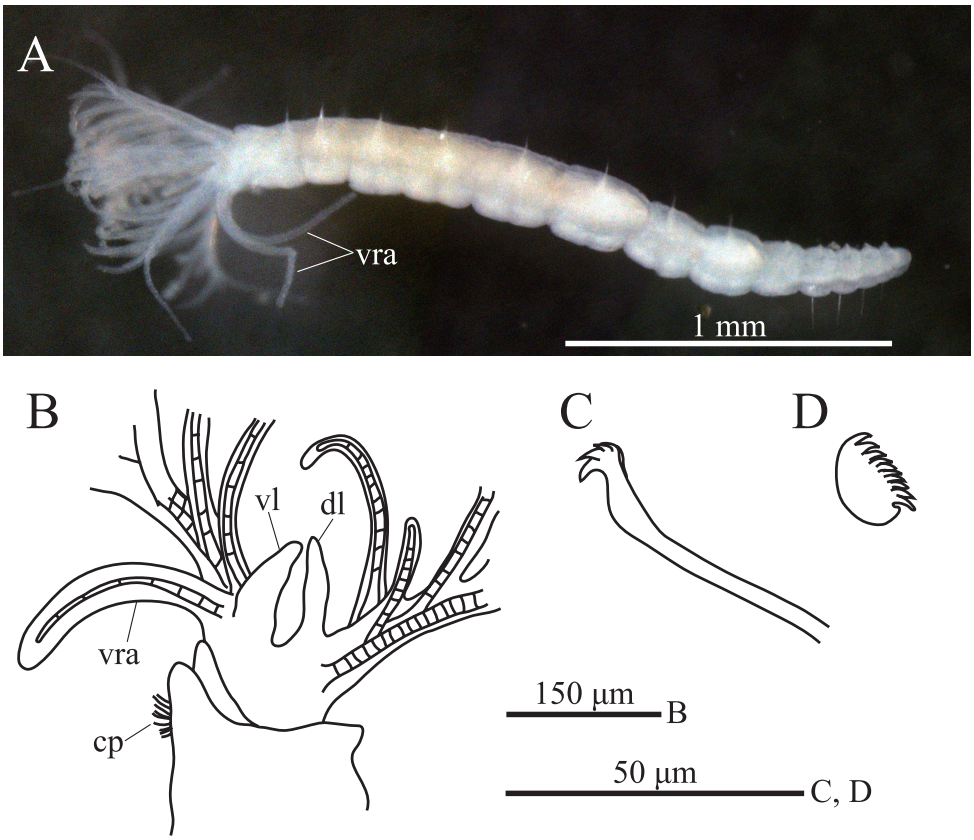

Figure 5. *Amphicorina mobilis* (Rouse, 1990). **A** ZIHU 3938, entire worm, lateral view **B** ZIHU 3939, lateral view of inner surface of branchial crown **C** ZIHU 3940, thoracic uncinus **D** ZIHU 3941, abdominal uncinus. Abbreviations: **cp** ciliated patch **dl** dorsal lip **vl** ventral lip **vra** ventral radiolar appendage.

pendages present, nearly as long as radioles, with one internal cellular supporting axis (Fig. 5B). One pair of elongate dorsal lips present, with neither pinnular nor radiolar appendages; one pair of triangular ventral lips present (Fig. 5B). Distal end of ventral lobe on anterior peristomial ring bifurcate, extending slightly beyond collar margin (Figs 5B, 6A). Posterior peristomial ring collar margin smooth, with small ventral notch (Fig. 6A). Collar with dorsal gap (Fig. 6B). Small ciliated patch located on posterior peristomial ring (Figs 5B, 6A). One pair of red eyes present on peristomium (not visible in preserved specimens). Glandular ridge on second chaetiger (not visible in preserved specimens).

Superior thoracic notochaetae elongate, narrowly hooded, 3–7 per fascicle (n = 10; usually 4–5 within single specimen) (Fig. 6C). Inferior thoracic notochaetae bayonet type, 3–7 per fascicle (n = 10) (Fig. 6C). Thoracic acicular uncini 3–8 per torus (n = 10); each uncinus with three rows of teeth above main fang; teeth on first row distinctly larger than those on upper rows (Figs 5C, 6D). Abdominal uncini quadrangular, with nine rows of teeth above small basal tooth (Figs 5D, 6E), 4–17 uncini per fascicle

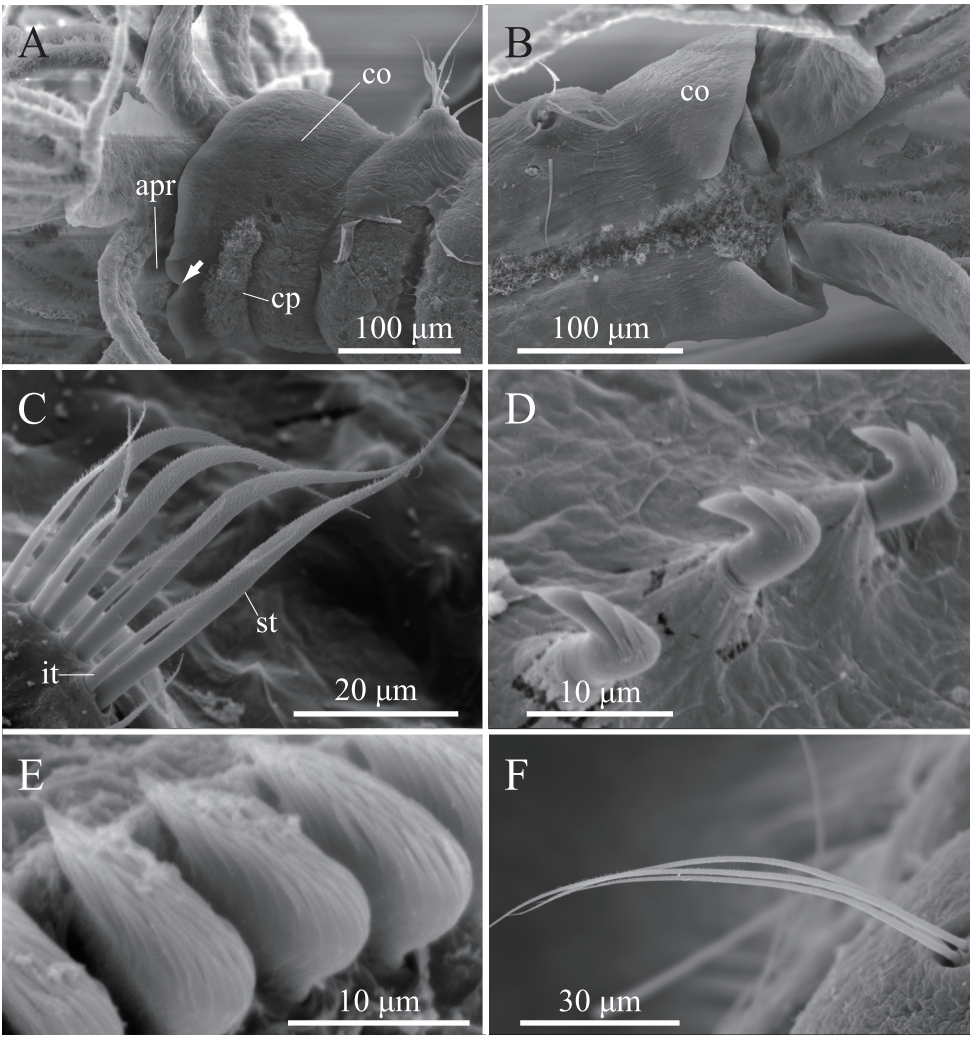

Figure 6. *Amphicorina mobilis* (Rouse, 1990), ZIHU 3942, SEM images. **A** collar segment, ventrolateral view (arrow indicates ventral notch of collar) **B** collar segment, dorsal view **C** thoracic notochaetae on the 5th chaetiger **D** thoracic uncini **E** abdominal uncini **F** abdominal chaetae. Abbreviations: **apr** anterior peristomial ring **co** collar **cp** ciliated patch **it** inferior thoracic notochaeta **st** superior thoracic notochaetae**.**

(n = 10). Abdominal neurochaetae three in number (two in the smallest specimen, ZIHU 3947) (n = 10), needle-like capillaries in form (Fig. 6F).

Pygidium rounded, with one pair of red eyes; color of eyes faded in preserved specimens.

In living specimens, paired statocysts are evident in first thoracic chaetiger; oocytes found in sixth to eighth thoracic chaetigers.

DNA analysis. We obtained sequences for each of the three target gene fragments for this species (GenBank accession numbers AB646767, 18S, 1777 bp; AB646763,

28S-D1, 380 bp; AB646766, 28S-D3–7, 1998 bp). Both strands were sequenced for 18S and 28S-D1; part of the 28S-D3–7 sequence is based on only one strand. In a reliably aligned 320 bp stretch of the 28S-D1 sequence, we observed one indel difference (gap) from the aligned homologous sequence from an Australian specimen (EF116217, Kupriyanova and Rouse 2008). In an aligned 1779-bp region of 18S, we observed two indel differences between our sequence and that from an Australian specimen (EF116206, Kupriyanova and Rouse 2008).

Remarks. *Amphicorina mobilis* was previously known only from Australia (Rouse 1990). A similar form was reported by Giangrande et al. (1999) as *Amphicorina* sp. from the Mediterranean, but it was not identified to species due to the poor condition of the specimens available.

Our specimens are quite similar to those in the original description of *A. mobilis* by Rouse (1990), with differences in body size, in ranges of number of chaetae and pinnules, and in the arrangement of teeth in the thoracic uncini. The Australian specimens were reported to be 1.1 mm in body length, while specimens from this study are up to 3.2 mm. Numbers of chaetae and pinnules reported by Rouse (1990), followed by those in our Japanese material in parentheses, are: thoracic superior notochaetae 3–4 (3–7), thoracic inferior notochaetae 3–4 (3–7), thoracic uncini 3–5 (3–8), abdominal uncini 3–9 (4–17), and abdominal neurochaetae 1–2 (2–3); and pairs of pinnules 5 (6). Rouse (1990) reported that *A. mobilis* has thoracic unicini with two rows of teeth above the main fang; the first row above the main fang has a large central tooth flanked by smaller teeth. By comparison, our specimens possessed no smaller teeth juxtaposing the large central tooth above the main fang.

The DNA sequences shed little light on species identity, as the 18S and 28S genes evolve too slowly to reliably detect significant variation between closely related species, and the few mutations detected could as well be attributed to PCR or sequencing errors. Nonetheless, the Australian and (putative) Japanese populations of *A. mobilis* showed much less sequence divergence from one another than did either from a clearly morphologically distinct species, *A. ascidicola* which lends weight to the interpretation that the Japanese and Australian populations are conspecific.

We consider that the specimen now labeled as the holotype of *Fabricia ventrilinguata* Johansson, 1922 deposited in the Zoologiska Museet, Uppsala (ZUM 206), might represent *A. mobilis*. We concur with Fitzhugh (1990) in that the original specimen (i.e., true *F. ventrilinguata*), or its label, was likely to be replaced later by accident. *Fabricia ventrilinguata* was originally described from Misaki, Japan, based on a polychaete collection made by Sixten Bock in 1914. Imajima and Hartman (1964) and Fitzhugh (1990) observed the "holotype" of *F. ventrilinguata* and pointed out discrepancies between Johansson's (1922) original description and the actual specimen; these include (character states in the parentheses refer to those given in Johansson (1922) vs. those in the actual specimen): the length of the body (6.5 mm vs. 2.1 mm), the number of thoracic chaetigers (4 vs. 8), and the posterior peristomial ring collar (absent vs. present). Because Johansson's (1922) original description lacks important morphological characters used in identifying genera and species within Fabriciidae, the

name *Fabricia ventrilinguata* should be treated as a *nomen dubium*. On the other hand, specimen ZUM 206 redescribed by Fitzhugh (1990) is applicable to *Amphicorina*, and possibly to *A. mobilis*. Taking into account that ZUM 206 might represent an undescribed species, however, further examination for a positive identification is necessary with respect to the shape of the thoracic notochaetae and the size of the tooth on the abdominal uncini. The fact that our specimens from Misaki, the same locality as ZUM 206, were identified as *A. mobilis* with certainty does not contradict our speculation that ZUM 206 would actually represent *A. mobilis*. If this is the case, *A. mobilis* was present in Misaki before 1914.

Distribution. Southeastern Australia and eastern Japan; questionably the Mediterranean. At present we have no definitive evidence whether this distribution pattern represents a natural one or has been artificially expanded. If the latter is the case, much more thorough population genetic studies may reveal the native locality and invasion pathways. Incidentally, among sabellids, *Sabella spallanzanii* (Gmelin, 1791) has been reported to be introduced from European waters to Australia, possibly either via ballast water or hull fouling (Patti and Gambi 2001). The same species has been also reported from New Zealand, introduced either via Australia or directly from Europe (Read et al. 2011). Another sabellid, *Branchiomma bairdi* (McIntosh, 1885), originally distributed in the Caribbean Sea, was recorded in the southern Gulf of California; hull fouling was considered the most probable vector for the translocation (Tovar-Hernández et al. 2009).

Acknowledgments

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RESEARCH ARTICLE

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A new *Pseudachorutes* (Collembola, Neanuridae, Pseudachorutinae) from Nicaragua

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Abstract

A new species of *Pseudachorutes* is described and illustrated from Nicaragua. *Pseudachorutes nica* **sp. n.** is very easy to distinguish from other members of this genus from Central America, because its chaetotaxy consists of macro and microsetae and a postantennal organ with multiple vesicles (close to 20).

Keywords

Neanuridae, Taxonomy, Nicaragua

Introduction

Pseudachorutes is a very large genus with more than 100 species described all over the world. It was established by Tullberg (1871) based on the type species *Pseudachorutes subcrassus*. The genus is characterized by: 1) ocelli 8+8; 2) postantennal organ in one circle or one ellipse; 3) Ant. III and IV dorsally fused, Ant. IV generally with 6 sensilla and apical bulb, Ant. III organ with 2 microsensilla in a cuticular fold, 2 guard sensilla

and one microsensillum; 4) buccal cone sharp, mandible with 2 or more teeth, maxilla styliform; 5) unguiculus absent; 6) furcula usually well developed, mucro present (except *P. amucronatus* Díaz & Najt, 1995); 7) sixth abdominal segment always visible in dorsal view, anal spines absent (Palacios-Vargas 1990; Christiansen and Bellinger 1998; Fjellberg 1998).

Only *Pseudachorutes orghidani* Massoud and Gruia, 1969, from Cuba, *P. difficilis* Denis, 1931, from Costa Rica, *P. legrisi* Thibaud and Massoud, 1983, and *P. reductus* Thibaud and Massoud, 1983 both from the Antilles, have been described from Central America and neighboring areas. Additional records include *Pseudachorutes* sp. and *P. subcrassoides* from Nicaragua (Maes and Palacios-Vargas 1988), and *P. parvulus* from Cuba, a species originally described from Europe (Díaz-Azpiazu et al. 1996).

While studying the Collembola material from a project of the Centre de Recerca Ecologica i Aplicacions Forestals of Barcelona (CREAF) in Nicaragua, we found many specimens of a new species which is described herein.

Abbreviations used in this paper are: Ant. = antennal segment; Abd. = abdominal tergite; M = macroseta; m = microseta; PAO = postantennal organ; vgs = ventral guard sensillum; Th. = thoraxic tergite. Chaetotaxy follows Jordana et al. (1997).

Taxonomy

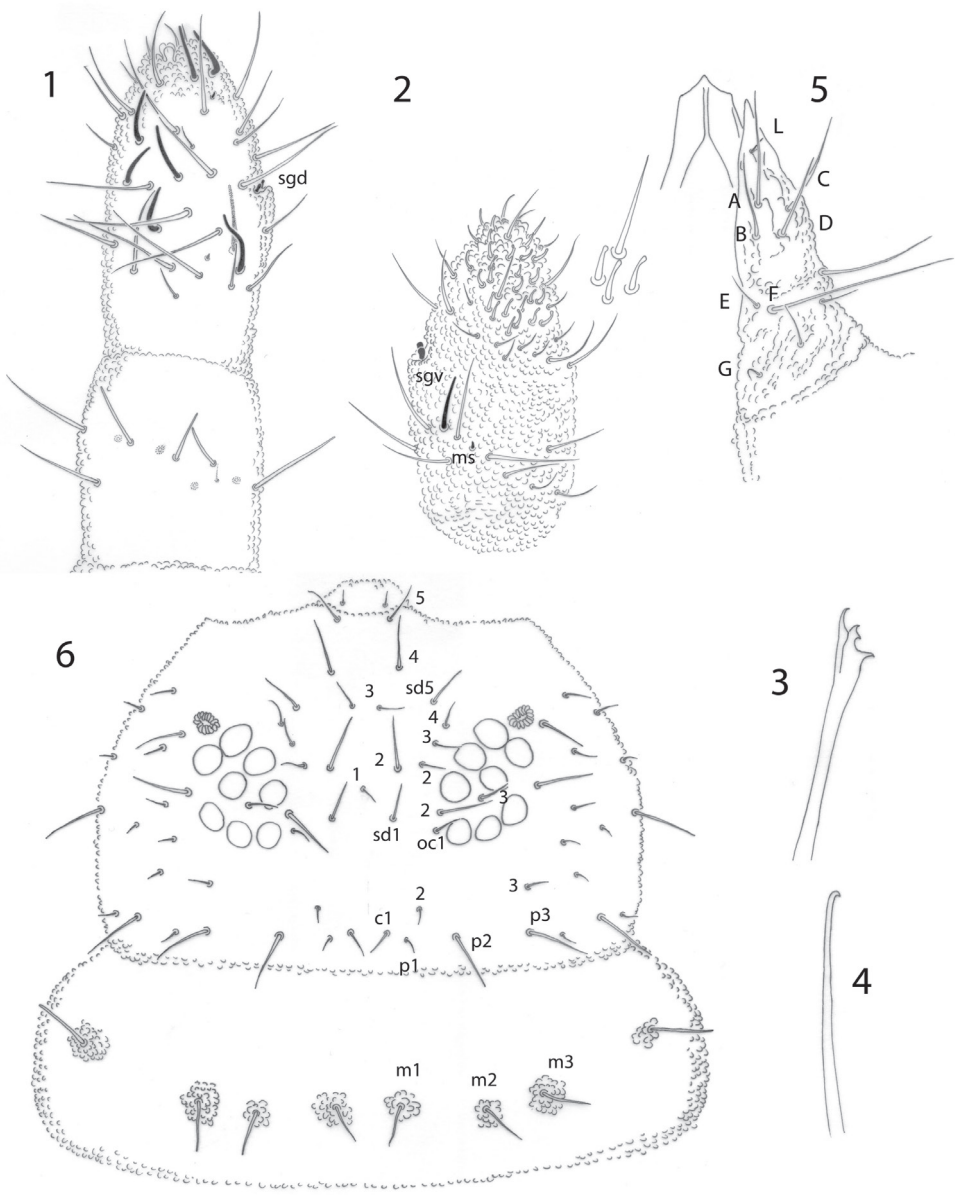
***Pseudachorutes nica* sp. n.**
urn:lsid:zoobank.org:act:61AA57D8-D9F5-4AF7-8137-59225D1871F6
http://species-id.net/wiki/Pseudachorutes_nica
Figs 1–11

Material Examined. Type-locality: Nicaragua, Province Estelí: Mesas de Moropotente, 12°55'09"N; 85°11'90"W; ex soil, *Acacia pennatula, Oplinemus, Croton jalapensis,* forest, 23 August 2007, ex soil from pitfall traps, Pilar Andrés collector.

Type-specimen. Holotype mounted on slide. Original label: "23/8/07 Nicaragua: Mesas de Moropotente (Estelí). 1260 m.s.n.m. Coord. UTM 16P0581619 y 1456016 Suelo Bosque monoespecífico *Acacia pennatula* Recub. *Oplisnemus* sp. (100%) P. Andrés, col. Sample C3 (8)" [printed label] " *Pseudachorutes nica* sp. n. Holotipo ♀ C3 (8)" [handwritten label].

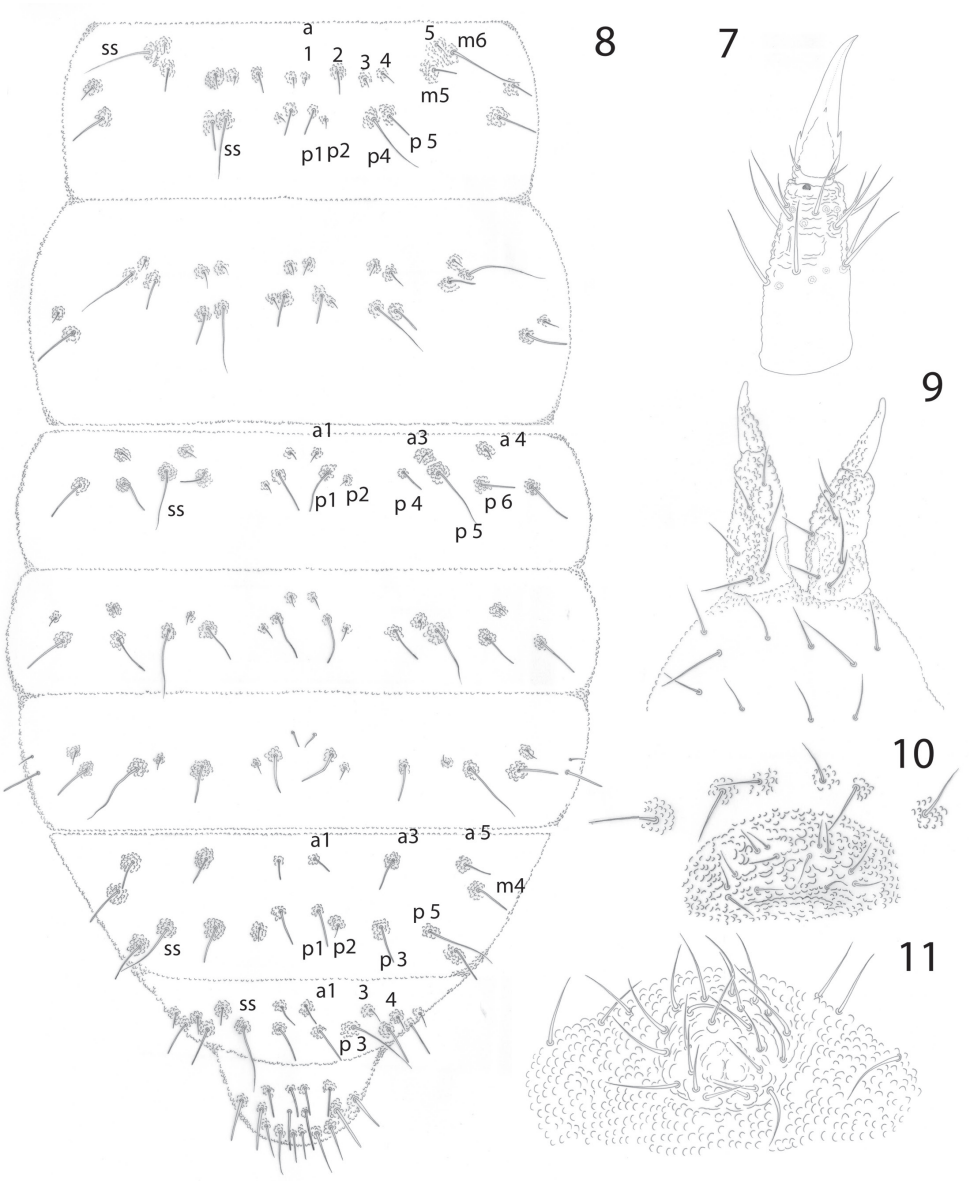
Paratypes. 55 females, 38 males, 9 juveniles, 33 of undetermined sex, all under slides. Two females and two males will be deposited in Museum National d'Histoire Naturelle de Paris (MNHNP) and Museum d'Histoire Naturelle de Genève (MHNG), the others are kept at Facultad de Ciencias, UNAM.

Diagnosis. Postantennal organ with about 20 vesicles in an ellipse; ocular area, head, and body with setae of different size; Ant. IV with a well developed ventral sensorial file with 20–25 setae; one lateral teeth on each side of unguis, presence of setae d1 unpaired on head and m2 on Th. II. Abd. IV with three rows of setae, p1 longer than seta p2 and a1. No capitate tenent hairs on tibiotarsi.



Figures 1–6. *Pseudachorutes nica* sp. n. **1** right antenna from II to IV dorsal view **2** Ant. III and IV in ventral view with magnification of some setae from ventral file **3** mandible **4** maxilla **5** labium **6** dorsal chaetotaxy of the head and thorax I (thorax has a drawing style represents granulation close to setae).

Description. Body length: 1.1–1.6 mm (mean 1.4 mm, n=10). Color of body deep dark blue. Cuticular granulation strong. Body setae simple and smooth, medium macrosetae (25–35 μm) with slightly capitate tips, short microsetae (9–12 μm) usually acuminate, sensorial setae longer than macrosetae (60 – 81 μm)**,** with blunt apex.



Figures 7–10. *Pseudachorutes nica* sp. n. **7** tibiotarsus III and unguis in ventral view **8** dorsal chaetotaxy of Th. II and III and Abd. I–VI (drawing style represents granulation close to setae) **9** furcula **10** female genital plate **11** male genital plate.

Antennae as long as head. Ant. I with 7 setae, Ant. II with 12 setae, including one ventral seta very small. Ant. III and IV dorsally fused. Antennal segments ratio I: II: III+IV as 1: 1.25–2.75. Sensory organ of Ant. III with two small straight internal sensilla under a cuticular fold, two guard sensilla, and 1 microsensillum close to vgs. Ant.

IV with trilobed apical bulb, 6 cylindrical sensilla, seta "i", microsensillum and subapical organite (Fig. 1), and with a ventral file with about 20–25 short setae (Fig. 2).

Postantennal organ elliptical composed of 14–20 simple vesicles, as large as the nearby ocelli. Eye patch with 8+8 small ocelli (Fig. 6), F, G a little smaller than others. Buccal cone elongated. Mandible with four slender teeth (Fig. 3). Maxilla styliform, with one apical hook (Fig. 4). Labrum with 2/5, 5, 2 setae, the sclerotization in the shape of ogive (Fig. 5). Labium with typical number of setae for the genus and seta L situated on small tubercle (Fig. 5).

Dorsal chaetotaxy as in Figs 6 and 8. Seta a0 on the head absent, unpaired seta d1 present. Th. I with 3+3 dorsal setae. Setae a2 present on Th. II, but absent from Th. III to Abd. IV, with m4 present on Abd. IV. Sensory setae on the body in position of p4 and m6 on Th. II and III, and p5 from Abd. I–IV and p3 on Abd. V. Sensorial formula of the body 022/11111. Sensory setae longer and slender than ordinary setae. Ratio of unguis III: largest Abd. V seta = 1: 0.5. Thoracic sterna without setae, but paratergal areas of Th. II and III with two setae on each side. Ventral tube with 4+4 setae, the posterior pair is longer than the others. Female genital plate with 3+3 pregenital, 7–12 circumgenital and 2 eugenital setae (Fig. 10); male genital plate with 3+3 pregenital, 10–13 circumgenital and 4+4 to 6+6 eugenital setae (Fig. 11). Each anal valve with 13 setae and 3 hr setae.

Tibiotarsi I, II, III with 18, 18, 17, setae respectively, without tenent hairs. Unguis with one tooth on each side, 1/3 from base, and a tiny inconspicuous tooth on inner edge. Ratio tibiotarsus III: unguis about 1.3 (Fig. 7). Femora I, II, III with 11, 11, 10 setae respectively, one of them longer and acuminate. Trochanters with 5 setae each.

Furcula well developed. Manubrium with one pair of dorsal longer setae. Dens with moderate granulation dorsally and with 6 setae, with a smooth triangular area ventrally devoid of secondary granulation. Mucro about half the length of dens, triangular, with two very short lamellae and granulation similar to dens, apex slightly curved (Fig. 9). Tenaculum with 3+3 teeth.

Etymology**.** The name is derived from the country nickname that is the type locality.

Distribution. Known only from type locality. Province Estelí: Mesas de Moropotente, *Acacia pennatula, Oplinemus, Croton jalapensis* forest, 23 August 2007, ex soil from pit fall traps.

Ecology. More than 135 specimens were found in the samples of pitfall traps from two different pasture fields on August 23, 2007. The species is very abundant in most of the collecting traps.

Discussion. *Pseudachorutes nica* sp. n. is easily distinguished from all other species of the genus by the combination of the following characters: presence of many vesicles in the postantennal organ, well-differentiated macrosetae and microsetae on dorsal side of head and body, one ventral sensorial file on Ant. IV, presence of one lateral tooth on each side of unguis, presence of setae d1 unpaired on the head and presence of setae m2 on Th. II. On Abd. IV p1 is longer than p2 and a1. The new species is close to *P. orghidani* Massoud and Gruia 1969, but differs in the number of teeth on the mandible (3 versus 4) and in the morphology of the apex of the maxilla (sharp versus

hooked). Other similarities and differences among species from the Caribbean region are summarized in Table 1.

Variation. The number of vesicles of postantennal organ varies asymetrically from 14 to 20. The number of circumgenital setae on the male genital plate varies from 10 to 13 and that of eugenital setae from 4 + 4 to 6 + 6. Some of the adult specimens have macrosetae with blunt tips.

Table 1. Comparison of *P. nica* sp. n. with other Caribbean species (size in mm; Ant bulb = number of lobes in antennal apical bulb; Ant. IV = number of cylindrical sensilla; PAO = number of vesicles; PAO/E = size PAO/eye ratio; Md = number of mandibular teeth; Ocular = type of ocular setae 1, 2 and 3; Inner u = inner unguis teeth; LUT = lateral unguicular teeth); D = number of dental setae; TH = number of tenent hairs, ac = acuminate, cap = capitate.

Species/ Character	Size	Ant bulb	Ant IV	PAO	PAO/E	Md	Ocular 1 2 3	Inner u	LUT	D	TH
nica sp. n.	1.4	3	6	14–20	1.0	4	mMm	-	+	6	None
orghidani	1.2	3	5	17	1.1	3	???	+	+	6	None
difficilis	0.5	3	6	6–7	?	3	mmm	-	-	6	1 ac
legrisi	0.8	1	5?	10–13	1.8	3	mmm	+	-	6	1 cap
reductus	0.8	3	6?	8	1.2	5	mmm	+	-	3	1 ac

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RESEARCH ARTICLE

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Cheiriphotis trifurcata, new species (Crustacea, Amphipoda, Corophiidae, Protomedeiinae) from the Seagrass Bed of the Lower Gulf of Thailand

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Abstract

A new species of corophiid Amphipoda, *Cheiriphotis trifurcata*, collected from the seagrass bed of the Lower Gulf of Thailand, is described. *Cheiriphotis trifurcata* is characterized by its trifurcated tip of the modified setae on the outer ramus in male pleopod 3. In this paper, the new species is fully described and compared with related species and a complete key of the 16 valid species in the genus *Cheiriphotis* is given.

Keywords

Crustacea, Amphipoda, Isaeidae, *Cheiriphotis trifurcata*, Gulf of Thailand, taxonomy

Introduction

Species of the genus *Cheiriphotis* Walker, 1904, are predominant and widespread in both marine circumtropical and warm-temperate waters of the world. Of the 15 valid species that have been described so far, only *C. megacheles* (Giles, 1885) was reported

in the Andaman Sea while the Gulf of Thailand has no reports of amphipods in this genus (e.g. Angsupanich and Kuwabara 1995; Angsupanich et al. 2005; Ariyama et al. 2010; Bussarawich 1985; Chilton 1925; and Ruensirikul et al. 2007).

Cheiriphotis megacheles was first described from the Bay of Bengal in 1885 by Giles, and later reported from Sri Lanka (Ceylon) by Walker in 1904. However, the specimens from the two localities are clearly distinctive in male gnathopod 1 and uropod 3 which Walker (1904) concluded as an ontogeny. Salman and Jabbar (1990) redescribed *C. megacheles* based on material collected from the north-west of the Arabian Gulf and found that the variation between Giles's and Walkers' specimens is not an ontogeny, instead they are two distinct species. In the present study we provide a detailed description and illustration of both male and female species of *Cheiriphotis trifurcata* new species collected from the seagrass bed area. This description represents the first record of the genus *Cheiriphotis* in the Gulf of Thailand. A key for the genus *Cheiriphotis* is also presented.

Material and methods

Amphipods were collected using a 20×20 cm^2 Ekman's grab in a seagrass bed of Talet bay (Figure 1). The sites were visited at low tide and amphipods were collected from the subtidal zone. Seagrass and sediment were sieved with a 0.5 mm sieve. Amphipod specimens were sorted out and fixed in formalin for 1 week and then stored in 70% alcohol. In the laboratory, the animals were examined using a compound microscope and later selected for dissection. The appendages were examined and figures were produced using an Olympus CH30 light microscope with a camera lucida. The following abbreviations are used: A, antenna; G, gnathopod; HD, head; LL, lower lip; MD, mandible; MX, maxilla; MP, maxilliped; P, pereopod; Pl, pleopod; T, telson; U, uropod; UR, urosome; UL, upper lip; r, right; l, left; ♂, male; ♀, female. The type material of the new species is deposited at Prince of Songkla University Zoological Collection (PSUZC) and the Universiti Kebangsaan Malaysia Muzium Zoologi (UKMMZ), Malaysia.

Results

Corophiidae Leach, 1814
Protomedeiinae Myers & Lowry, 2003

***Cheiriphotis* (Giles, 1885)**
http://species-id.net/wiki/Cheiriphotis

Type species. *Melita megacheles* Giles, 1885 by monotypy.

Diagnosis. Eyes small. Antenna 1, accessory flagellum pluriarticulate. Mandibular palp article 3 rectolinear or clavate. Coxae small, relatively short, coxa 1 dilated, pro-

Figure 1. Map of sampling area

duced forward. Gnathopod 1 (male) subchelate. Gnathopod 2 subchelate and greatly larger than gnathopod 1. Pereopods 6–7, dactylus elongate, falcate. Uropods 1 – 2 biramous; rami slighty subequal; peduncle with ventrodistal process. Uropod 3 uniramous. Telson entire.

Species composition. *Cheiriphotis* contains 16 species: *Cheiriphotis australiae* Stebbing, 1910; *C. delloyei* Pirlot, 1934; *C. durbanensis* K.H. Bamard, 1916; *C. erythraeus* Ruffo, 1969; *C. geniculata* K.H. Barnard, 1916; *C. madagascarensis* Ledoyer, 1979; *C. mediterranea* Myers, 1983; *C. megacheles* (Giles, 1885); *C. minima* Ledoyer, 1982; *C. neotropicalis* Valerio-Berardo, 2007; *C. pediformis* Myers, 1995; *C. quadrichelatus* Ortiz & Lalana, 1997; *C. rotui* Myers, 1989; *C. walkeri* Stebbing, 1918; *C. williamsoni* Salman & Jabbar, 1990;

***Cheiriphotis trifurcata* sp. n.**
urn:lsid:zoobank.org:act:37DAB18F-70EF-42C3-BD57-0E0911C11128
http://species-id.net/wiki/Cheiriphotis_trifurcata

Type material. *Holotype*. ♂, THAILAND, Lower Gulf of Thailand, Talet Bay (09°18'39.5"N, 99°46'46.4"E), seagrass bed (associated with *Thalassia hemprichii*), 24 September 2008, Puttapreecha, R., PSUZC-CR-0264.

Allotype. ♀, collected with holotype, PSUZC-CR-0265 (adult female, 4.16 mm)

Other material. Same data as for holotype, UKMMZ-1446 (5♂; 15♀); PSUZC-CR-0266 (5♂; 20♀)

Description. Male (*holotype*). Total body length 3.5 mm (from tip of rostrum to apex of telson). *Body* rather slender and subcylindrical. *Head* subequal in length to first 2 pereonites; rostrum not developed; inferior antennal sinus short and concave, about 0.3 times of head length; *eye* distinct. *Antenna 1* slightly longer than antenna 2, ratio of peduncular article 1–3 as 5:9:8; article 1 slender, with 2 postero-marginal setae; flagellum with 10 articles, 0.7 times as long as peduncle; accessory flagellum with 4 articles, last article scale-like. *Antenna 2* peduncle slender; article 1–4 in ratio of 2:5:4:2; inner margin of article 4 and 5 with long postero-marginal setae; article 5 shorter than 4; flagellum short with long setae, subeaqual in length to peduncular article 5, composed of 7 articles, last article scale-like.

Upper lip or labrum round and broad, with small depression in the middle and pubescent on each lobe. *Lower lip* inner lobe small and pubescent, mandibular process well developed; outer plate with a group of finger-like setae on the inner face of the outer lobe, covered with thin hair-like setae. *Mandible*, both incisors with 5 teeth; lacinia mobilis armed with 4 teeth on the left side and 5 teeth on the right side; molar process columnar, ridged distally; palp 3-articulate with ratios of 1:3:3, article 1 with 2 marginal setae, article 2–3 with apical and marginal setae. *Maxilla 1*, inner plate small with 2 apical setae, outer plate with 8 apical and marginal serrate robust setae; palp extending beyond outer plate, biarticulate with 6 apical serrate robust setae. *Maxilla 2*, inner plate with 19 slender marginal setae; outer plate larger than inner plate with 20 slender setae. *Maxilliped*, inner plate broad and short, reaching half of outer plate, apically provided with 4 conate setae and fine setae; outer plate broad, almost reaching palp article 2 with 7 conate setae; palp 4-articulate with ratio of 3:5:2:1.

Pereon. *Gnathopod 1* subchelate, smaller than gnathopod 2; coxal plate subtriangular, produced anteriorly with long fine setae on anteroventral corner; length ratio of articles from basis to dactylus about 14:5:6:13:10:9; basis slender, broader distally, posterior margin bearing long setae; ischium short, subrectangular with apical setae; merus subtriangular with posteromarginal setae, longer than ischium; carpus longer than propodus with plumose setae on posterior margin; propodus shorter than dactylus, palm oblique with a robust seta at the proximal half, surface of palm toothed; dactylus slightly longer than palm, falcate, inner margin with a robust seta,. *Gnathopod 2* subchelate; coxal plate short and wide, subrectangular, length ratio of articles from basis to dactylus about 9:5:8:8:19:19; basis robust, nearly as long as wide, broader

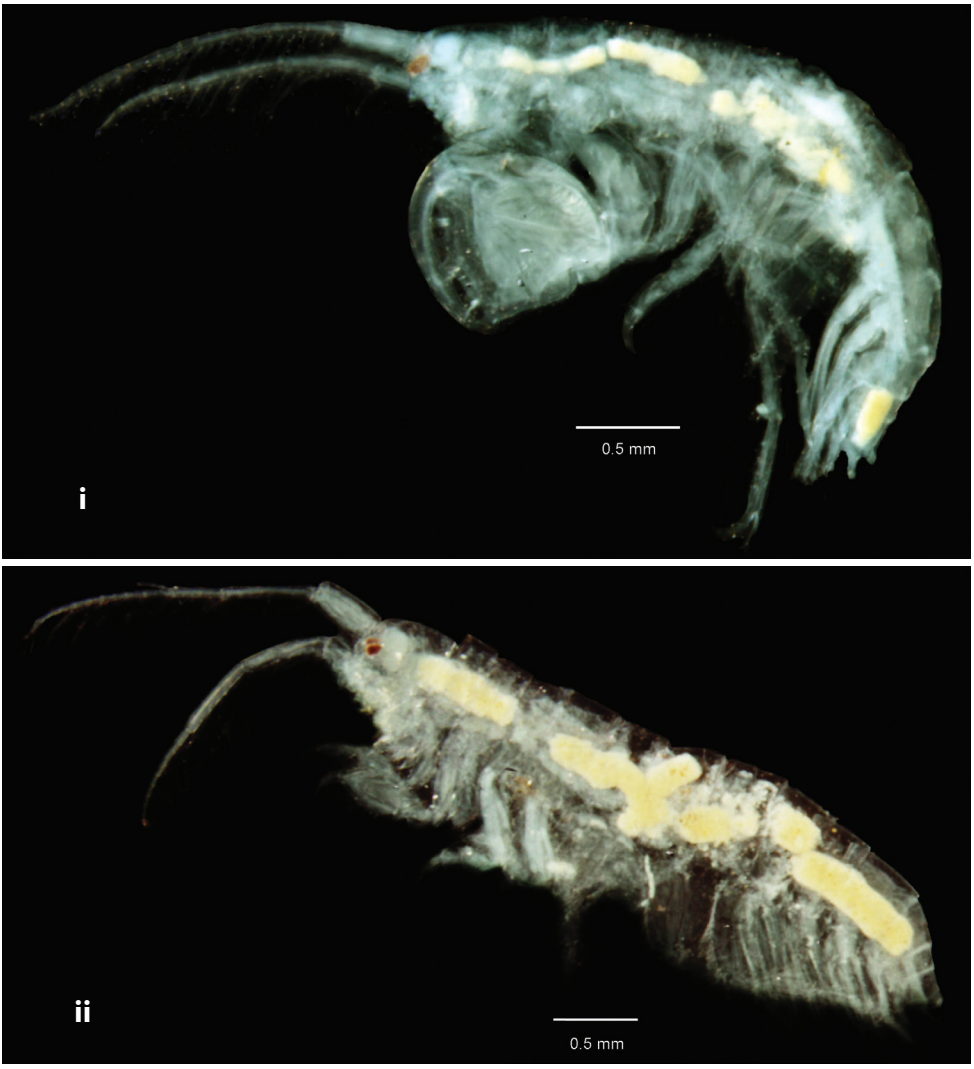

Figure 2A. Photography of *Cheiriphotis trifurcata* sp. n. **i** holotype, male, (PSUZC-CR-0264), 3.47 mm. **ii** allotype, female, (PSUZC-CR-0265), 4.16 mm. Talet Bay, Lower Gulf of Thailand.

distally, anterior margin straight, both sides naked; ischium subrectangular; merus longer than ischium; carpus distal and anterior margin fused with propodus; propodus enlarged, as long as wide, anterior margin with a row of plumose setae, posterior margin with short setae; palm transverse, with 4 blunt teeth and one acute palmar corner; dactylus slightly longer than palmar margin, inner margin smooth.

Pereopod 3 slender and elongate; coxal plate small and suboval, with 3 plumose setae on anterior side; length ratio of articles from basis to dactylus 10:3:6:2:6:4; basis slender, distally extended; ischium short, subrectangular; merus longer than carpus, slightly

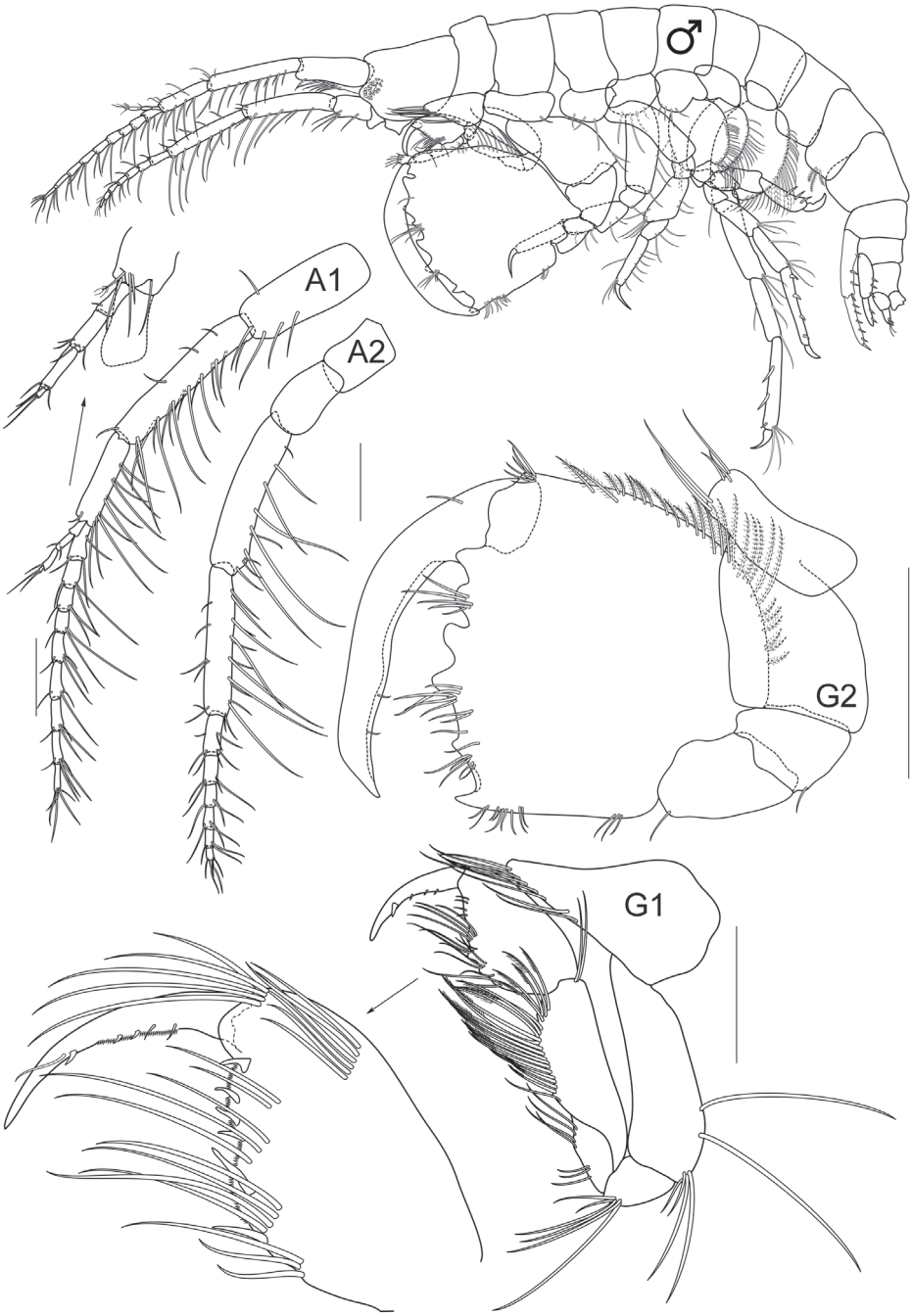

Figure 2B. *Cheiriphotis trifurcata* sp. n., holotype, male, (PSUZC-CR-0264), 3.47 mm. Talet Bay, Lower Gulf of Thailand. All scales represent 0.2 mm.

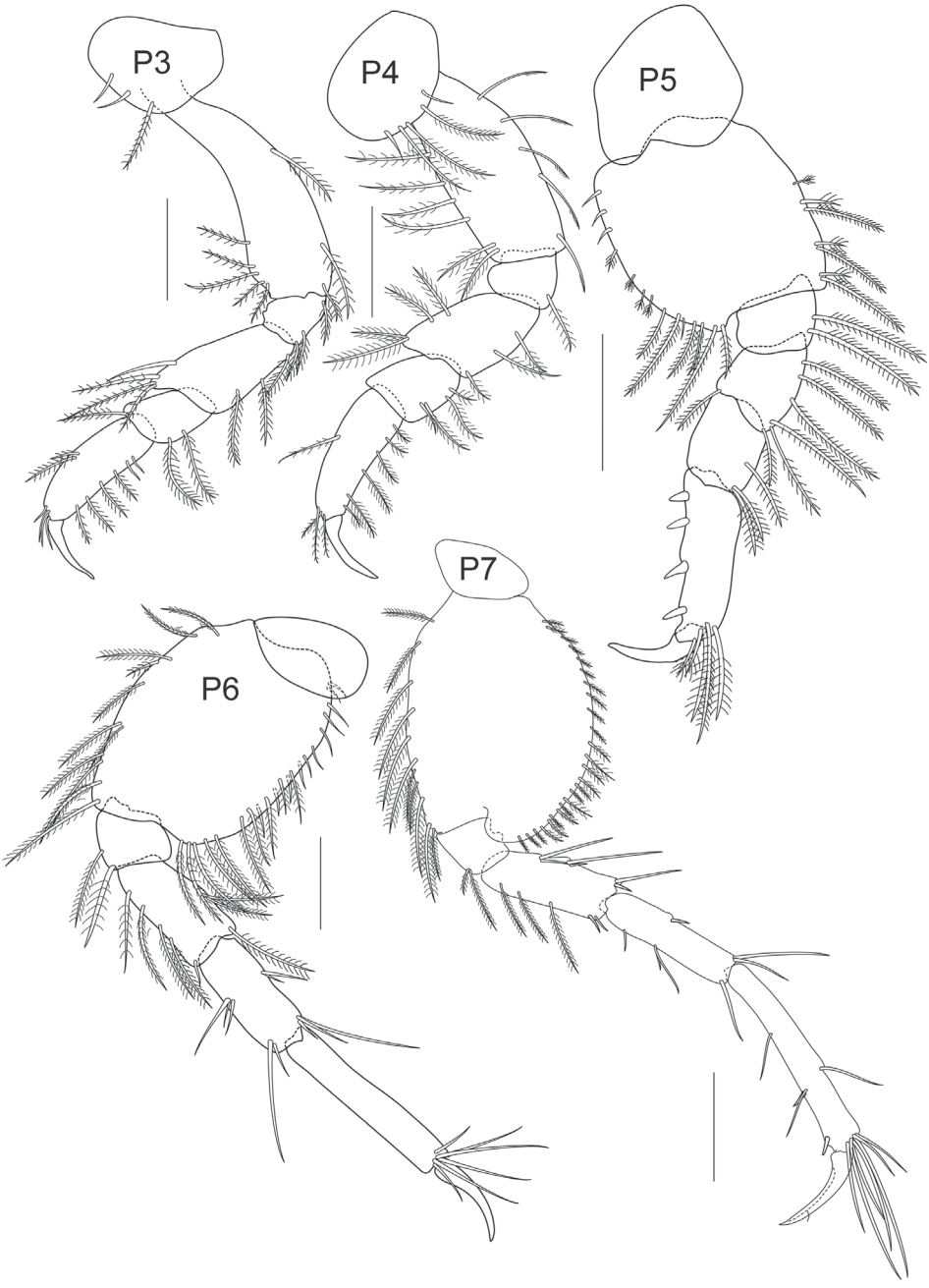

Figure 2C. *Cheiriphotis trifurcata* sp. n., holotype, male, (PSUZC-CR-0264), 3.47 mm. Talet Bay, Lower Gulf of Thailand. All scales represent 0.2 mm.

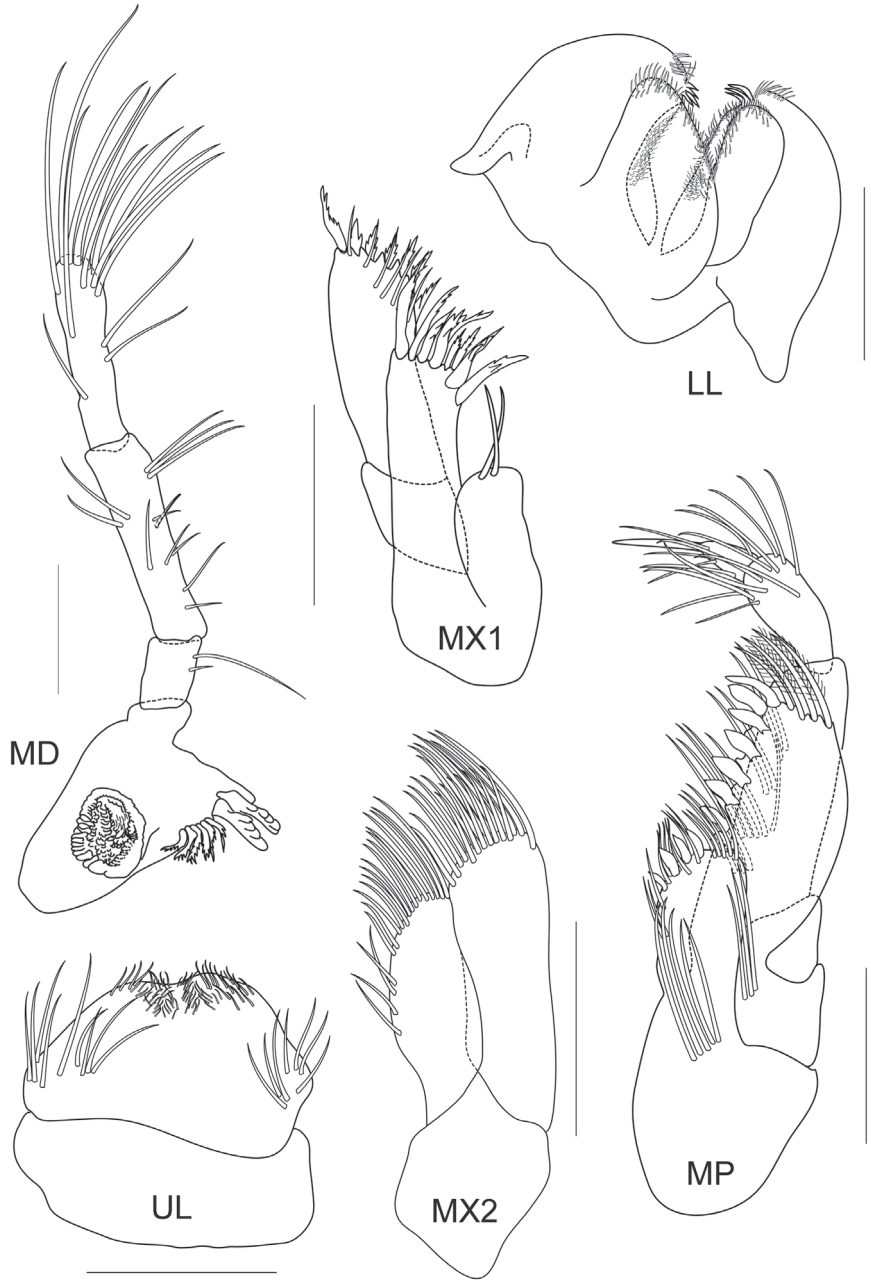

Figure 2D. *Cheiriphotis trifurcata* sp. n., holotype, male, (PSUZC-CR-0264), 3.47 mm. Talet Bay, Lower Gulf of Thailand. All scales represent 0.1 mm.

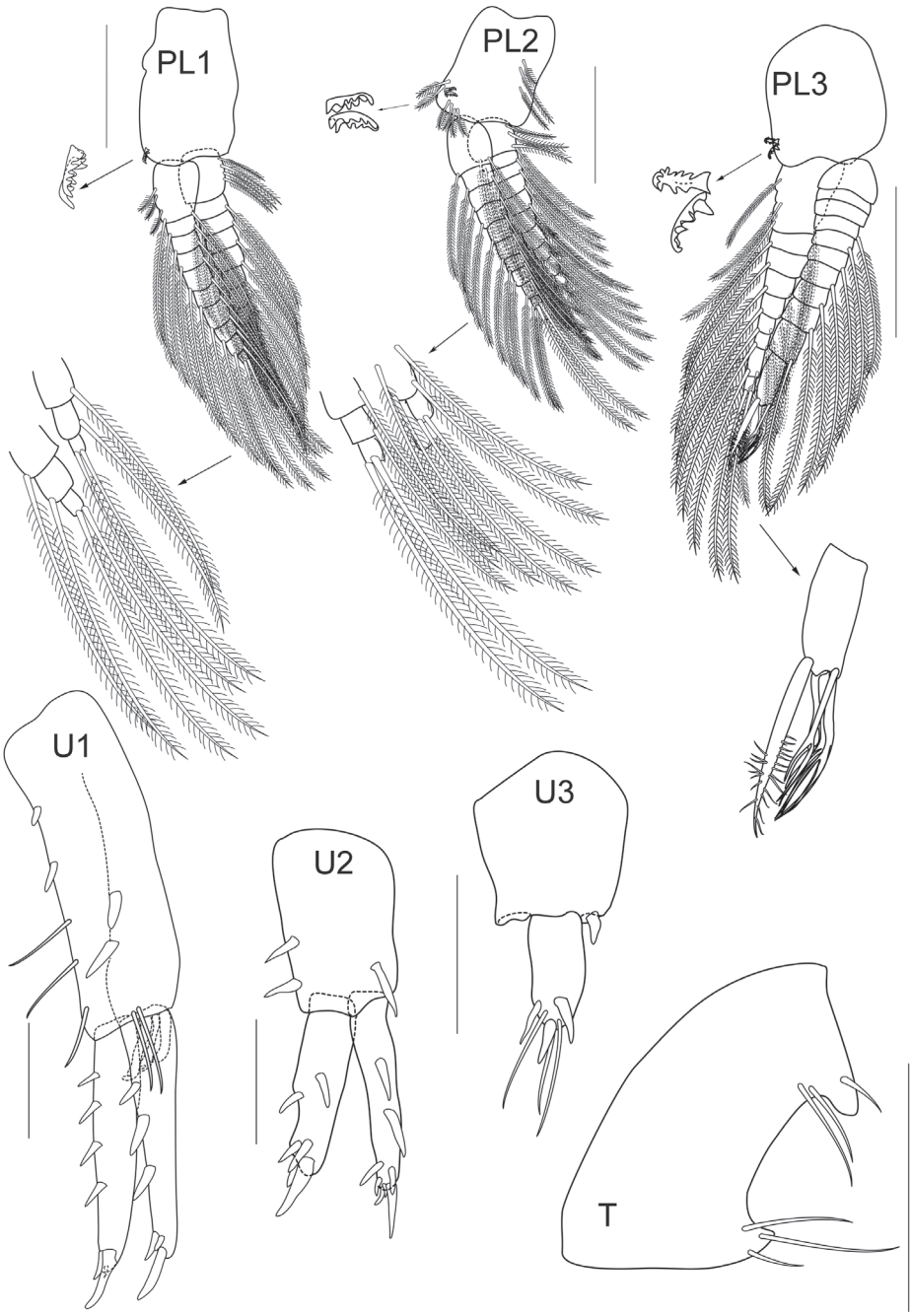

Figure 2E. *Cheiriphotis trifurcata* sp. n., holotype, male, (PSUZC-CR-0264), 3.47 mm. Talet Bay, Lower Gulf of Thailand. Scales for U1– U3 and T represent 0.1 mm; PL1 – PL3 represent 0.2 mm.

produced anterodistally; carpus subrectangular, medially broad, posterior margin setose; propodus subrectangular; basis – propodus bearing plumose setae on both sides; dactylus falcate, long and thin, shorter than propodus. *Pereopod 4* rather similar to pereopod 3, coxal plate suboval with plumose setae on ventral side; length ratio of articles from basis to dactylus about 10:2:5:3:6:4; basis slender; ischium short, subrectangular; merus longer than carpus, slightly produced anterodistally; carpus subquadrate, shorter than propodus; basis to propodus with plumose setae on both margins; propodus long and narrow; dactylus long and thin, shorter than propodus. *Pereopod 5* shorter than pereopod 6 and 7; coxa bilobed; length ratio of articles from basis to dactylus about 14:2:3:3:6:3; basis subrectangular with plumose setae on both margins; ischium shortest with posteromarginal plumose setae; merus subequal to carpus, with posteromarginal plumose setae and 1 anterodistal seta; carpus with posteromarginal plumose setae; propodus with 4 robust setae along posterior margin; dactylus short, strongly curved. *Pereopod 6* elongate, 1.5 times as long as pereopod 5; coxa posteriorly produced with rounded lobe; length ratio of articles from basis to dactylus about 5:2:3:3:5:2; basis oval with plumose setae on both margins; ischium short with plumose setae on anteroventral corner; merus oblong, with plumose setae on both margins; carpus shorter than propodus, bearing long setae; propodus slender with marginal robust setae and setose posterodistally; dactylus falcate. *Pereopod 7* elongate, 1.6 times as long as pereopod 5; coxa short and wide, subtriangular, anteriorly produced; length ratio of articles from basis to dactylus about 13:5:7:7:11:6; basis posteriorly produced, bearing plumose setae on both margins; ischium short and subquadrate with plumose setae on anterodistal corner; merus elongate with plumose setae on both sides; carpus subequal to merus, both margins with sparse setae; propodus slender, longer than merus, distally extended; bearing setae on both margins and one robust seta on anterodistal corner; dactylus falcate, with one thin seta at 2/3 from proximal end.

Pleon. *Pleopods 1–2* well developed; peduncles subcylindrical, longer than broad and fringed with several plumose setae and a pair of retinaculae on the inner margin; inner ramus subequal to peduncle with 9–10 articles, outer ramus shorter than inner ramus, both rami with facial setae.

Pleopod 3 similar to pleopod 1 and 2 except the tip of outer ramus modified; bearing long setae with sparse setule and having three additional modified setae with three forked tips respectively, outer ramus longer than inner ramus.

Uropod 1 longest, extending beyond uropods 3; peduncle longer than both rami, beset with robust setae, peduncular apex bearing 3 posteroventral robust setae; outer and inner margins of both rami lined with a row of robust setae, distal margin rounded and bearing several robust setae. *Uropod 2* not reaching uropod 3, peduncle shorter than rami, both outer and inner margins with a row of robust setae; outer ramus slightly longer than inner one, both rami lined with a row of robust setae and distal margin bearing several short and long robust setae. *Uropod 3* uniramous, peduncle extended with robust seta on apex, subequal to ramus; apically 3 robust setae and 2 setae. *Telson* subtrapezoidal, distally excavated with long simple setae near both distal corners.

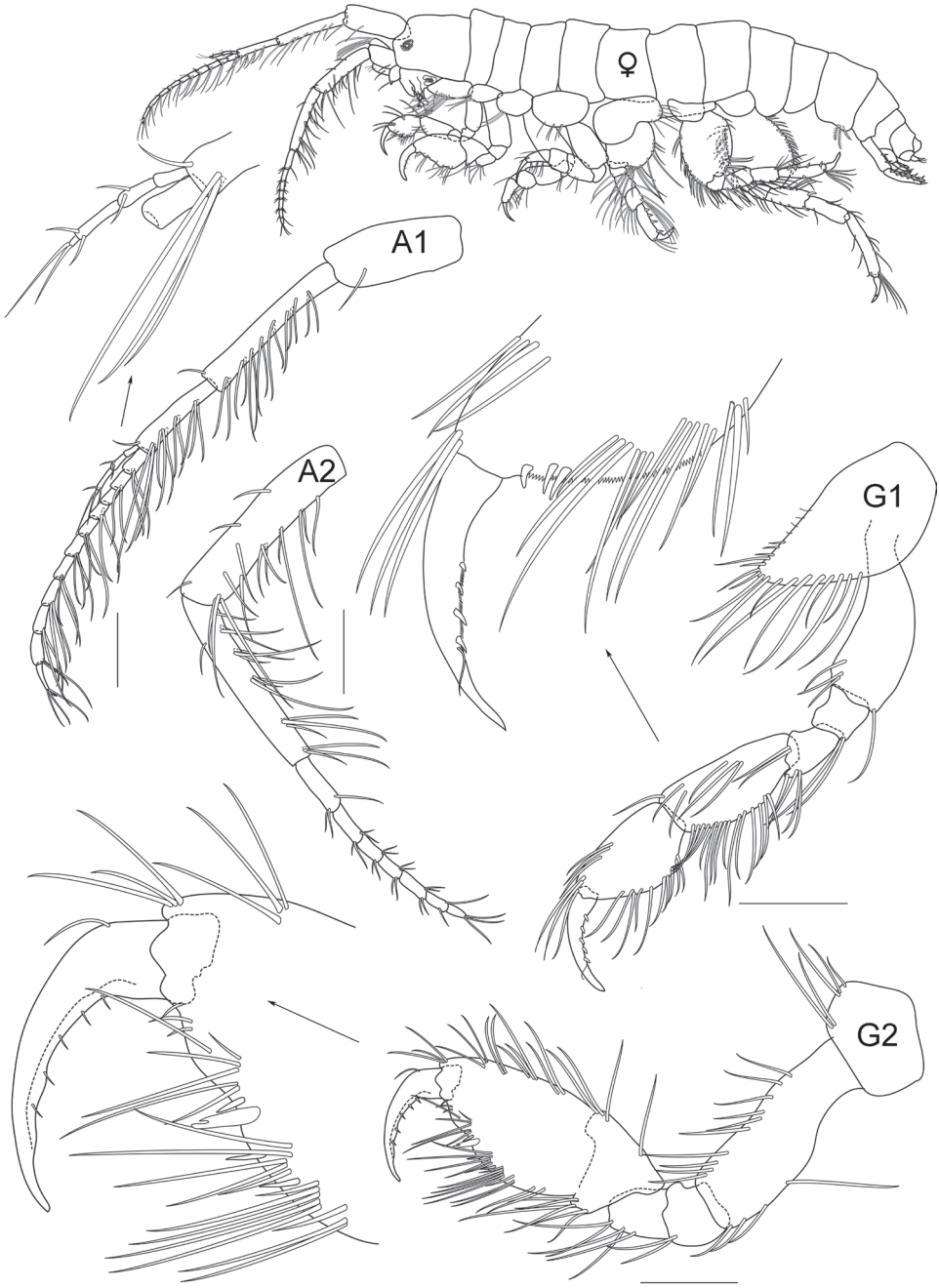

Figure 3A. *Cheiriphotis trifurcata* sp. n., allotype, female, (PSUZC-CR-0265), 4.16 mm. Talet Bay, Lower Gulf of Thailand. All scales represent 0.2 mm.

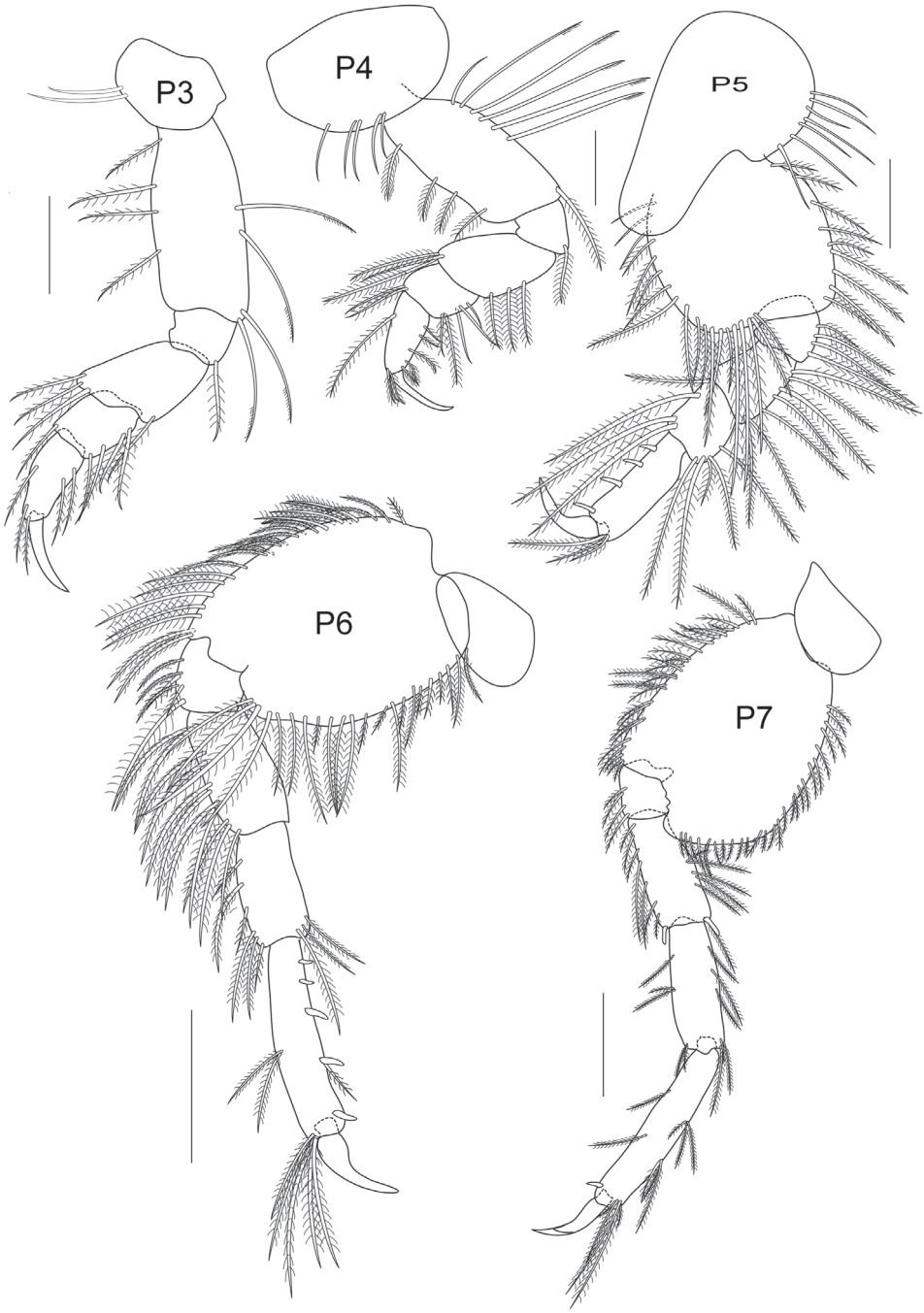

Figure 3B. *Cheiriphotis trifurcata* sp. n., allotype, female, (PSUZC-CR-0265), 4.16 mm. Talet Bay, Lower Gulf of Thailand. All scales represent 0.1 mm.

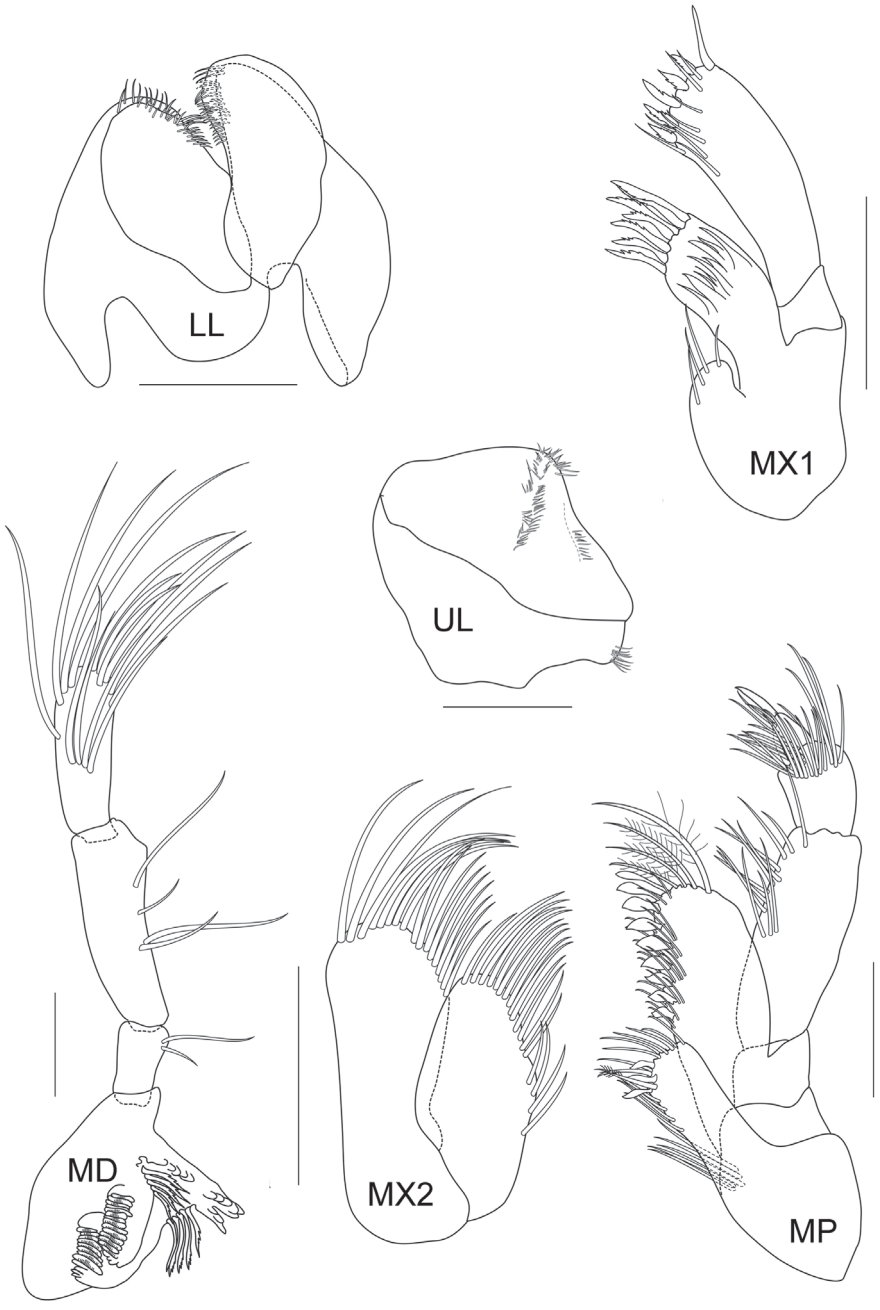

Figure 3C. *Cheiriphotis trifurcata* sp. n., allotype, female, (PSUZC-CR-0265), 4.16 mm. Talet Bay, Lower Gulf of Thailand. All scales represent 0.1 mm.

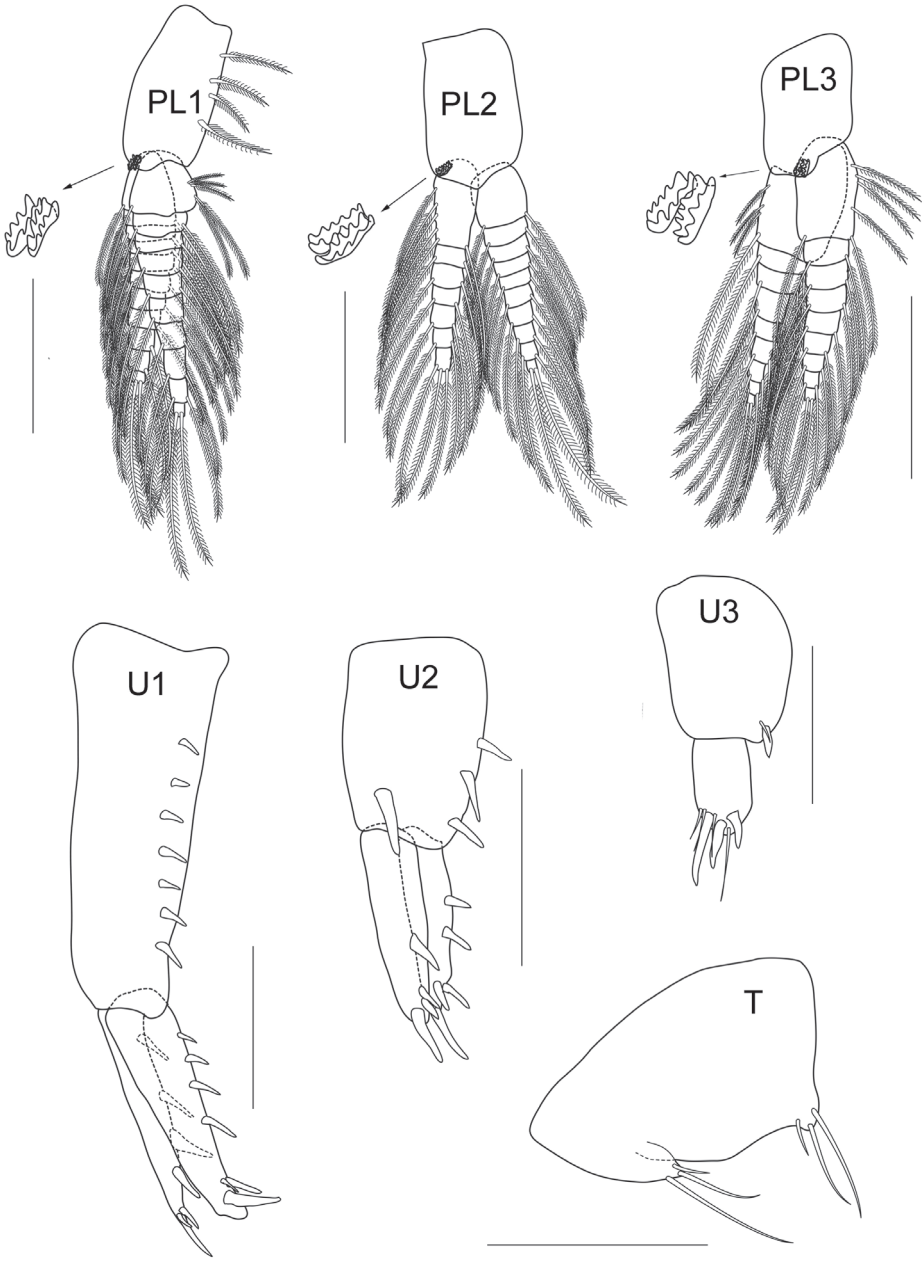

Figure 3D. *Cheiriphotis trifurcata* sp. n., allotype, female, (PSUZC-CR-0265), 4.16 mm. Talet Bay, Lower Gulf of Thailand. Scale for U1-U3 and T represents 0.1 mm; remaining represents 0.2 mm.

Female. (*allotype*). Total body length 4.2 mm (from tip of rostrum to apex of telson). – (sexually dimorphic characters).

Antenna 1 flagellum with 12 articles.

Pereon. *Gnathopod 2* subchelate, smaller than that of male, basis to propodus setose; basis more slender, about 2.3 times as long as broad; carpus subtriangular, as long as broad; propodus suboval, longer than carpus, palm oblique and defined by a large bifid robust seta, palmar margin convex, distal end covered with sparse setae; dactylus curved with 5 inner marginal short setae. Coxa 4 and 5 longer than those of male.

Pleopod 3 without modified tip of outer ramus.

Etymology. The specific name "*trifurcata*" is from latin 'tri = three' and 'furcated = forked', referring to the distinct three forked tips of the modified setae on the outer ramus in male pleopod 3.

Remarks. Even *Cheiriphotis trifurcata* shows a distinct character, with the presence of the three additional modified setae in male pleopod 3 and each seta equipped with three forked tips, but this character might be overlooked in other species. Besides, the general characters in the present species are closely related to *C. williamsoni*, *C. neotropicalis*, *C. mediterranea* and *C. walkeri* especially in the; 1) fused carpus-propodus of male gnathopod 2; 2) propodus with transverse palm and; 3) uropod 3 uniramus. Further examination on the present species also indicated that *C. trifurcata* can be distinguished from *C. williamsoni* by the male gnathopod 1 which has the carpus longer than the propodus and the palm of male gnathopod 2 which bears 4 blunt teeth and 4 blunt teeth and one acute palmar corner. The present species also differs from *C. neotropicalis* in the carpus of male gnathopod 1 which is longer than the propodus and the propodus of male gnathopod 2 as long as broad in contrast to *C. neotropicalis* where the carpus of gnathopod 1 is subequal to propodus and propodus of gnathopod 2 is broader than long.

Cheiriphotis trifurcata shares a character of epimeron 2 with plumose setae on the ventral margin of epimera 2 with four known congeners, *C. erythraeus*, *C. mediterranea*, *C williamsoni* and *C. neotropicalis.* The former can be distinguished from *C. erythraeus* by the carpus of the male gnathopod 1 which is partly fused with the propodus, the transverse palm which has 4 blunt teeth and the uniramus uropod while in the latter the carpus of the male gnathopod 1 is not fused with the propodus, the palm is medially V-shaped excavated with two teeth on both sides and the uropod is biramus. *Cheiriphotis trifurcata* is easily separated from *C. mediterranea* by the distally expanded peduncle of uropod 3 (vs. peduncle of uropod 3 not expanded distally).

To date, only one species of *Cheiriphotis* (i.e. *C. megacheles*) has been reported from the Andaman Sea and the South China Sea (Imbach 1967 and Rabindranath 1971). The absence of robust setae along the palm of gnathopod 1, the unfused carpus-propodus of the male gnathopod 2, a rounded epimeron 2, and the biramus uropod 3 in *C. megacheles* readily differentiates that species from the present one.

Table 1. Comparison of some distinguished characters between *Cheiriphotis trifurcata* sp. n. and the related species

Characters	Accessory flagellum	♂ G1 palm	♂ G1 carpus: propodus	♂G2 carpus and propodus	♂G2 propodus	♂ G2 palm	epimeron 2	♂pleopod 3	U3
C. trifurcata	4 articles	oblique with a robust seta at the proximal half	>	fused	as broad as long	palm transverse, with 5 blunt teeth	with plumose setae on ventral margin	outer ramus last article modified	uniramus peduncle expanded distally
C. erythraeus Ruffo,1969	4 articles	oblique, palm longer than posterior margin	=	not fused	longer than broad	palm transverse, half way excavated with two teeth on both side and a defining tooth	with plumose setae on ventral margin	normal	biramus, inner ramus small
C. mediterranea Myers, 1983	4 articles	oblique, posterodistal excavated	>	fused	broader than long	palm transverse, with 3 rounded lobes and a defining tooth	with plumose setae on ventral margin	normal	uniramus, peduncle poorly expanded
C. megacheles (Giles,1885)	5 articles	oblique, not distinctly defined,	>	not fused	as long as broad	palm oblique, palmar corner with a strong tooth projecting posteriorly	round	normal	biramus, inner ramus small
C. neotropicalis Valerio-Berado et al. 2007	3 articles, last article small	palm excavate, defining palm with subdistal robust seta	=	fused	broader than long	palm transverse, with three rounded lobes and a defining tooth	with plumose setae on ventral margin	normal	uniramus, peduncle poorly expanded
C. walkeri Stebbing, 1918	no data	palm oblique, emarginate at anterior margin	>	fused	broader than long	palm transverse with 2 depressions	round	normal	uniramus
C. williamsoni Salman & Jabbar, 1990	4 articles	palm oblique, longer than posterior margin	<	not fused	slightly longer than broad	palm transverse, with 3 large blunt teeth and a defining tooth,	round	normal	uniramus, peduncle broad

World key to species of *Cheiriphotis*

1 Male gnathopod 2 carpus vestigial, partly fused with propodus **2**
– Male gnathopod 2 carpus not fused with propodus **6**
2 Male gnathopod 1 palm excavate, palmar corner with subdistal robust seta, carpus subequal to propodus..... ..... ***C. neotropicalis*** **Valerio-Berardo, de Sousa&Rodigues, 2007**
– Male gnathopod 1 palm not excavate..... **3**
3 Male gnathopod 1 carpus shorter than propodus, palm longer than hind margin ..... ***C. williamsoni*** **Salman & Jabbar, 1990**
– Male gnathopod 1 capus longer than propodus, palm shorter than hind margin **4**
4 Epimeron 2 without plumose setae on ventral margin, male gnathopod 2 basis dilated in anterodistal corner ..... ***C. walkeri*** **Stebbing, 1918**
– Epimeron 2 with plumose setae on ventral margin, male gnathopod 2 basis not dilated in anterodistal corner **5**
5 Male outer ramus of pleopod 3 tip modified into fork shape, gnathopod 2 carpus rectangular..... ***C. trifucata*** **sp. n.**
– Male outer ramus of pleopod 3 not modified, gnathopod 2 carpus triangular ..... ***C. mediterranea*** **Myers, 1983**
6 Accessory flagellum 2 articles ..... ***C. minima*** **Ledoyer, 1982**
– Accessory flagellum more than 2 articles 7
7 Male gnathopod 2 palm oblique **8**
– Male gnathopod 2 palm transverse..... **14**
8 Male gnathopod 1 palm acute, longer than hind margin..... ..... ***C. australiae*** **Stebbing, 1910**
– Male gnathopod 2 palm not as above, not longer than hind margin **9**
9 Uropod 3 uniramus **10**
– Uropod 3 biramus, inner ramus small..... **13**
10 Male gnathopod 1 carpus subequal to propodus ..... ***C. delloyei*** **Pirlot, 1934**
– Male gnathopod 2 carpus longer than propodus 11
11 Male gnathopod 2 propodus as long as broad .... ***C. megacheles*** **(Giles, 1885)**
– Male gnathopod 2 propodus longer than broad **12**
12 Epimeron 2 with 2 notches on distoinferior corner..... ..... ***C. pediformis*** **Myers, 1995**
– Epimeron 2 round on distoinferior corner .... ***C. madangensis*** **Ledoyer, 1979**
13 Male gnathopod 2 basis robust, wider than half of the length .... ***C. durbanensis*** **K.H. Barnard, 1916**
– Male gnathopod 2 basic slender, not wider than half of the length .... ***C. rotui*** **Myers, 1989**
14 Palm not excavated and smooth, defining tooth long like a finger, directed fore and upward..... ***C. quadrichelatus*** **Ortiz & Lalana,1997**
– Palm medially V-shaped excavated with two teeth on both sides and a not much longer defining tooth ..... ***C. erythaeus*** **Ruffo, 1969**

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