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A new species of *Oxelytrum* Gistel (Coleoptera, Silphidae) from southern Argentina, with a key to the species of the genus

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Abstract

A new species of the forensically interesting genus *Oxelytrum* Gistel (Coleoptera, Silphidae), *O. selknan*, is described from Santa Cruz and Tierra del Fuego provinces, Argentina. The new species resembles *O. biguttatum* (Philippi) in outer aspect, but has different male genitalia, in particular a median lobe longer than the paramera. All the described species of *Oxelytrum* have the median lobe shorter than the paramera. The internal sac, as far as it could be reconstructed from dry-pinned specimens, also shows differences between the two species. A key to the species of *Oxelytrum* is given and illustrated.

Resumen

Se describe una nueva especie de *Oxelytrum* Gistel (Coleoptera, Silphidae), género de interés forense: *O. selknan*, de las provincias de Santa Cruz y Tierra del Fuego, Argentina. La nueva especie se parece en aspecto exterior a *O. biguttatum* (Philippi), pero tiene genitales masculinos diferentes, en particular el lóbulo mediano más largo que los parámeros. Todas las especies de *Oxelytrum* descriptas tienen el lóbulo mediano más corto que los parámeros. El saco interno, en la medida en que se pudo reconstituir a partir de especímenes secos y montados, muestra también diferencias entre las dos especies. Se presenta una clave para las especies de *Oxelytrum*, con ilustraciones.

Keywords

Silphidae, forensic entomology, Neotropical fauna, Patagonian fauna

Palabras clave
Silphidae, entomología forense, fauna cadavérica, fauna Neotropical, fauna patagónica.

Introduction

The family Silphidae, in its present sense, comprises 25 genera with some 200 species distributed all over the world (Newton and Thayer in Pakaluk and Slipinsky 1995). The adults of this family are rather large beetles, without ocelli, with elytra punctate but never striate, and with 6–7 differentiated ventrites (Hansen 1997). The male genitalia are of the trilobed type, with an internal sac (Blackburn 1930). The species of Silphidae are necrophages or predators, sometimes a combination of both behaviors. Adults of corpse-frequenting species prey on the eggs and larvae of flies (Dorsey 1940; Payne and King 1970; Oliva and Di Iorio 2008). In the subfamily Nicrophorinae Kirby there is parental care of larvae, which has not been observed in the subfamily Silphinae Latreille. The larvae have maxilae with large, wide mala, divided in the apical ¼; galea with a brush of dense hairs, articulate urogomphi, which may be uni- or bisegmented (Hansen 1997).

The species of Silphidae occurring in Latin America were revised by Peck and Anderson (1985), who mentioned that no larvae had been described for South America. Later, the larvae of *Oxelytrum erythrurum* (Oliva, 2005) and of *O. discicolle* (Velásquez and Viloria 2009, 2010) were studied. Oliva and Di Iorio (2008) reviewed the species found in Argentina and corrected some of the locality names given by Peck & Anderson. The latter treated all of Latin America, and thus mention the genera *Necrodes*, *Heterosilpha*, *Oiceoptoma* and *Thanatophilus* besides *Nicrophorus* and *Oxelytrum* which are the only genera found in South America. A paper on the Ibero-American Silphidae in the collection of the Museo Nacional de Ciencias Naturales of Madrid, Spain, treats five species of the genus *Oxelytrum* and one of the genus *Nicrophorus* (Pérez Valcárcel et al. 2012).

The genus *Oxelytrum* Gistel

A Neotropical genus: only *O. discicolle* reaches the S of USA (Peck and Andersen 1985). Flat, rather large beetles (12–20 mm in length). Antennae (Fig. 1A) gently broadened towards the apex into a three-segmented club, preceded by an antennomere modified in shape, a little like the cupula of Hydrophiloidea (Newton and Thayer 1992; Hansen 1992). Protarsi of the males slightly dilated at base, with thick, stiff hairs on the contact surface (Fig. 10A, 10B). Hairs strongly curved at the apex (Fig. 9C), not dilated. Pronotum wide, laterally expanded; disk, more or less strongly raised according to species, with longitudinal costae that may be obsolete (Fig. 8A). Elytra densely punctate, bearing raised costae (Figs 5, 8A). Humeral humps of elytra projecting, rounded (Fig. 5) or

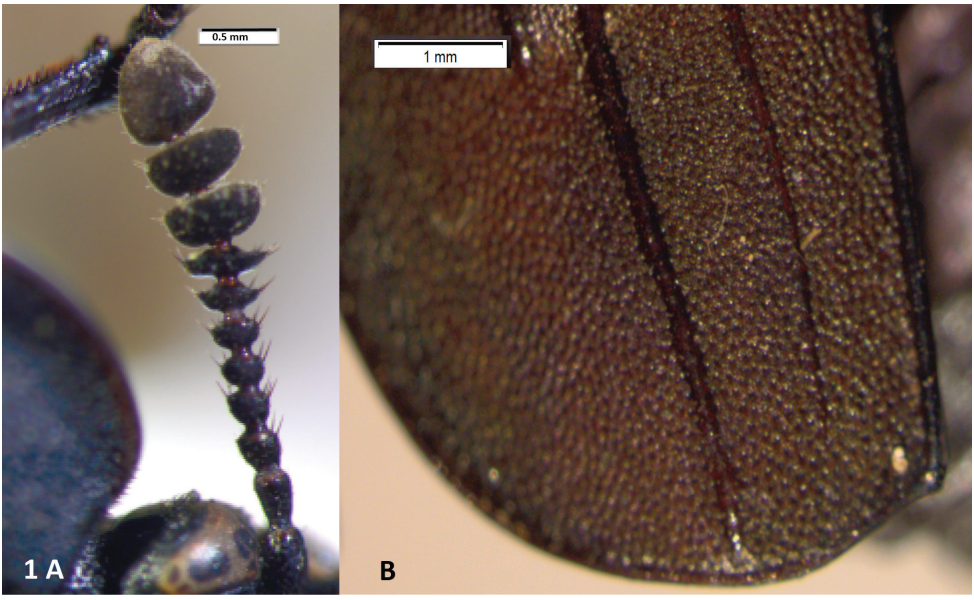

Figure 1. *Oxelytrum selknan* sp. n. **A** antenna, showing antennomere 8 dilated into a disk. Scale bar= 0.5 mm. **B** elytral apex (male), showing gently curved outer margin and posterior margin weakly produced near suture. Scale bar= 1 mm.

toothed (Fig. 8B). Elytral apices produced (Fig. 8A) or not (Fig. 5). General color black or very dark brown, according to the age of the specimen. Specific color patterns are described in the key. Male genitalia trilobed, fairly well sclerotized; they provide good diagnostic characters.

Silphidae: male genitalia

Partly because female genitalia give better diagnostic characters in other families of Staphylinoidea, partly because this genus has external species-diagnostic characters, very little attention has been given to the male genitalia of *Oxelytrum*. Blackburn (1936) and Háva et al. (1999) have described male genitalia in other genera of Silphidae.

The purpose of the present work was to describe the male genitalia of the species of *Oxelytrum* found in Argentina. It was found that what seemed one widely distributed species was comprised of two, one of them new to science.

Male genitalia of Silphidae Silphinae are trilobed, with a membranous internal sac; the median lobe is well sclerotized on the ventral surface and membranous on the dorsal surface; the ejaculatory duct enters the median lobe ventral to the basal piece; there is an internal sac (Blackburn, 1930). In the species of *Oxelytrum*, the basal piece proved small and weakly sclerotized, so it was not taken into account.

The paramera are always narrow,. The median lobe is straight and sturdy in all the species examined, with a complicated internal sac, which sometimes can be extruded after relaxing and clearing.

Silphidae and forensic entomology

Forensic entomology studies the insects found on a corpse, with the purpose of dating the death. Sometimes, circumstances that surrounded or followed the death can be discovered, but not always.

Silphidae of the genus *Oxelytrum* develop on large animal carcasses. Of six species found in Argentina, four have been found in autopsies (Oliva and Di Iorio 2008). One of these species, *O. discicolle*, is tropical and subtropical in distribution and has been found in other South American countries (Velásquez and Viloria 2009). Larvae of *Oxelytrum* are found under the carcass, at least during the day. It is noticeable that the soil beneath is usually hardened by seeping of cadaveric fluids. Oliva (2004) suggested that the larvae may feed on these fluids, and that this is the reason for the absence of a mola in their mandibles. Adult *O. erythrurum* may appear very early in the succession, behaving as necrophiles (predators on necrophages), small larvae together with the adults may occur around 10–15 days from death, and after 20–25 days, large larvae are found, usually without adults. These intervals are for Buenos Aires and Buenos Aires province (Oliva and Di Iorio 2008).

The genus *Nicrophorus* Fabricius is noted for exploiting small carcasses, which the adults bury. Adults may occasionally be found near large carcasses, but there is no evidence that they feed on them. No species of *Nicrophorus* has been found so far on human corpses.

Material and methods

The material examined is in the collections of the Museo argentino de Ciencias naturales "Bernardino Rivadavia" (MACN), Buenos Aires, Argentina. Apart from a few lots collected in recent years and preserved in ethanol, the specimens were dry-mounted. For this study they were relaxed in boiling water and dissected. The extracted pieces were put into plastic genitalia vials with a drop of glycerine, and the pin was run through the vial plug. The male genitalia were cleared in cold NaOH for two to four days; this sometimes permitted to study the internal sac. Additional material from the Museo Nacional de Historia Natural (MNHN), Santiago, Chile, was examined. All the specimens were dry-mounted.

Photographs of male genitalia and of external morphological characters mentioned in the key were taken with an Olympus DPL5 camera adapted in an Olympus SZX16 stereomicroscope.

Most of the pinned specimens were collected in the first half of the twentieth century. The localities are often indicated vaguely, sometimes limited toa province name.

Results

Description of new species

***Oxelytrum selknan* sp. n.**
urn:lsid:zoobank.org:act:A2420D45-607E-4EFF-B220-853A3C364E02
http://species-id.net/wiki/Oxelytrum_selknan

Oxelytrum biguttatum: Oliva & Di Iorio, 2008. Tierra del Fuego, forensic sample.

Description. Large (13–16,5 mm in length), sturdy beetles, black in color, with a pair of subquadrate reddish spots on the margin of the pronotum. Antennomere 8 expanded into a disk (Fig. 1A). Eyes small, not prominent (Fig. 1A). Dorsum of pronotum and of elytra densely punctate. Pronotum flat, bearing two pairs of indistinct longitudinal costae, the outer pair basal, short, the medial pair about two thirds of the pronotal length, not reaching the anterior or the posterior margins. Elytra bearing each three longitudinal costae, the two inner ones reaching the posterior margin, the outer one interrupted about two thirds of elytral length. Elytral apices broadly rounded, in males a little produced at the sutural angle or at the segment of the margin comprised between the two innes elytral costae (Fig. 1B); in females expanded outwards. Protarsi of males with the four basal tarsomeres dilated, bearing thick adhesive hairs forming soles. Female styli short, wide, truncate at apex (Fig. 6A). Outer appearance entirely similar to *O. biguttatum* (Philippi) (Fig. 5).

Male genitalia. Paramera narrow, weakly broadened in apical ⅓, apices blunt, turned inwards. Median lobe distinctly longer than paramera, in dry material triangular, narrowing evenly to the acuminate apex (Fig. 2A). Rehydrated material shows a spindle-shaped median lobe (Fig. 4A, 4B). Everted internal sac with apical cylinder covered in brown microtrichia, slightly constricted about the middle of its length; small rounded lobes basal to apical cylinder, large semi-globular lobe basal to smaller ones (Fig. 4A, 4B, 4C, 4D; small lobes marked by arrows).

Material examined. Holotype, male. “Argentina/Tierra del Fuego”. 14,5 mm. Two male paratypes: Male. “Valle Túnel/Dr. Witte/ Hyponecrodes/biguttatus Phil.” 15,5 mm. Male. “Tierra del Fuego/Ushuaia/XII 1967” Leg. A. O. Bachmann. Four female paratypes: Female. “República Argentina/ Gob. Tierra del Fuego/190-/C. Bruch.” 17 mm. Female. “Tierra del Fuego” 13 mm. Female. “Argentina/Tierra del Fuego” “32938” 16,5 mm. Female. “República Argentina/Santa Cruz/ II-190-/C: Bruch.” “20959” “Hyponecrodes biguttatus”. All in the collection of the MACN.

Etymology. The name alludes to the Native American people, Selk’nan (also called Ona), who inhabited the land part of the Isla Grande de Tierra del Fuego until the end of the nineteenth century.

This species can be recognized by the male genitalia. This is the only species of *Oxelytrum* known so far that has the median lobe longer than the paramera. The general shape of the internal sac is similar in *O. selknam* sp. n. and in *O. biguttatum* Philippi,

but in the latter the apical cylinder is not constricted and bears no microtrichia apparent under 25×, there are no smaller lobes at the base of the cylinder and there are two large basal semi-globular lobes, one ventral and the other dorsal (Fig. 4E, 4F). The paramera of *O. biguttatum* are not broadened at the apex, and the median lobe is distinctly shorter than the paramera, parallel-sided (Fig. 2AB, 2D; 3B).

No other differences were found between *O. selknan* sp. n. and *O. biguttatum*. The latter species was described from Valdivia in S Chile. I have examined material from several localities in Magallanes and they all have a parallel-sided median lobe shorter than the paramera. The geographical barrier between the species appears to be the Magallanes strait. *Oxelytrum biguttatum* is found in S Chile, in the Patagonian table-

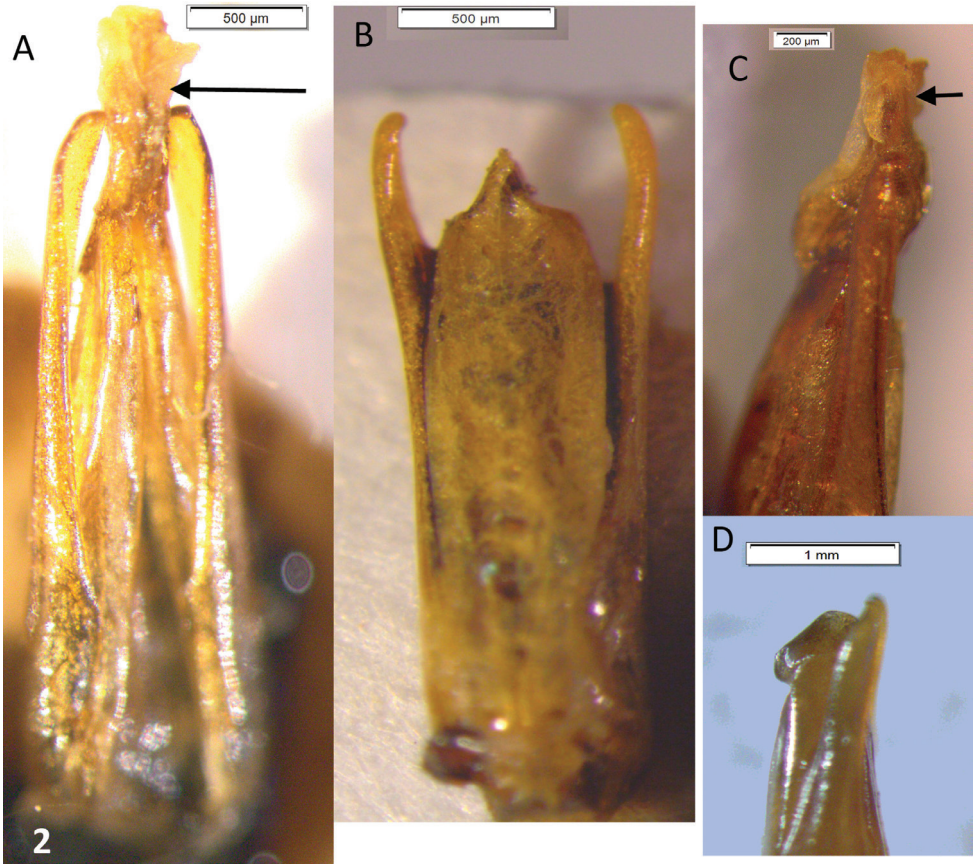

Figure 2. *O. selknan* and *O. biguttatum*, male genitalia, dry mounted. **A** *O. selknan*, male genitalia in dorsal aspect showing median lobe longer than paramera, gradually acuminate to apex. Scale bar= 0.5 mm. **B** *O. biguttatum*, male genitalia in dorsal aspect, showing median lobe shorter than paramera, parallel-sided, abruptly acuminate at apex. Scale bar= 0.5 mm. **C** *O. selknan*, apex of median lobe in lateral aspect, showing acuminate apex (arrow) and rounded ventral ridge. Scale bar= 0.2 mm. **D** *O. biguttatum*, apex of paramera and median lobe in lateral aspect, showing median lobe shorter than paramera, with rounded ventral ridge. Scale bar= 1 mm.

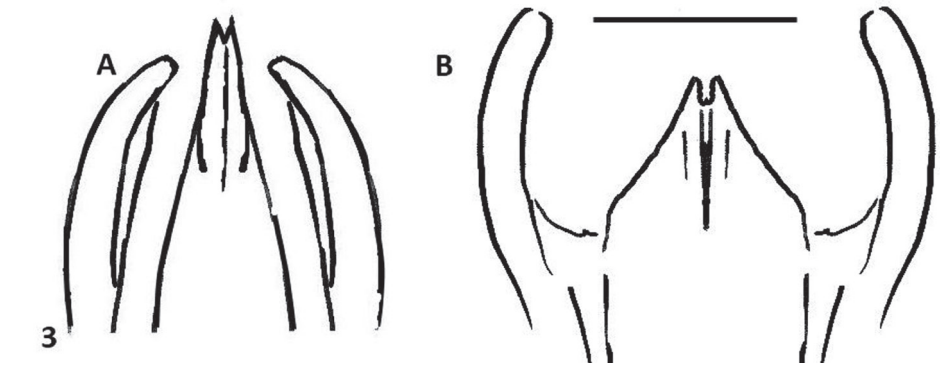

Figure 3. *O. selknan* and *O. biguttatum*, male genitalia: line drawings showing median lobe longer than paramera in the first species **A** and shorter in the other **B** Scale bar= 0.5 mm.

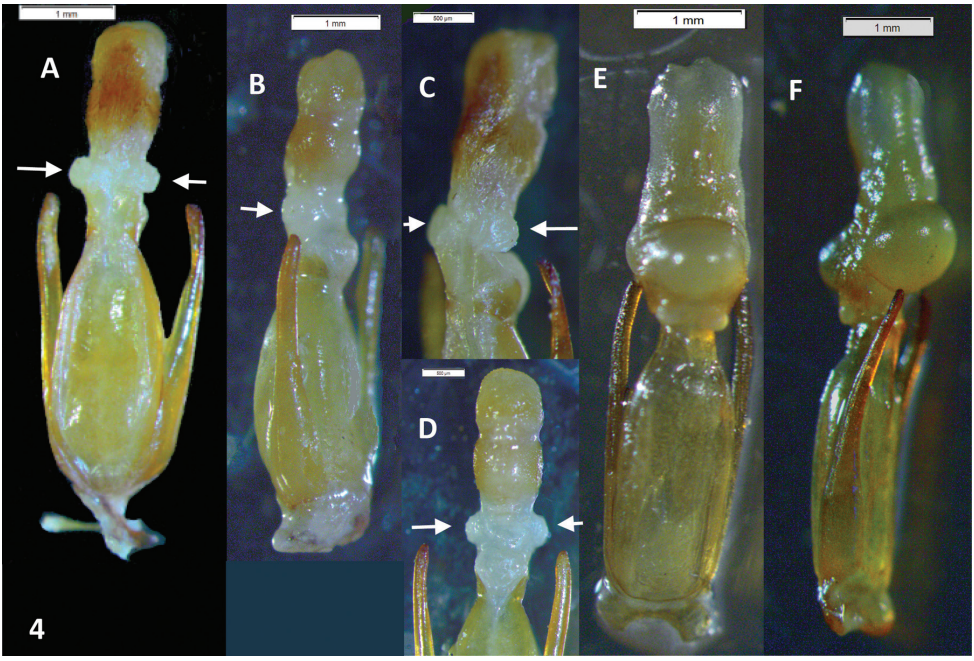

Figure 4. *O. selknan* and *O. biguttatum*, male genitalia with extruded internal sac. **A** *O. selknan,* male genitalia in dorsal aspect, showing sac with brown microtrichia on apical portion and small rounded lobes proximal to the latter (arrows). Scale bar= 1 mm. **B** *Idem*, lateral aspect. Scale bar= 1 mm. **C** *Idem*, detail of internal sac, showing small lobes (arrows) and large basal lobe partially extruded. Scale bar= 1 mm. **D** *Idem*, ventral aspect, showing lighter coloring of apical portion and extruded small lobes (arrows). Scale bar= 0.5 mm. **E** *O. biguttatum*, male genitalia in dorsal aspect, showing apical portion without apparent microtrichia, absence of small median lobes, and large basal lobes fully extruded. Scale bar= 1 mm. **F** *Idem*, lateral aspect. Scale bar= 1 mm

land in Argentina, and in some mountain localities in SW Argentina. This species may have spread across the Andes through the present-day province of Neuquén. On the the other hand, *O. selknan* sp. n. could have evolved in the main island of Tierra del

Figure 5. *O. biguttatum*, dorsal aspect, showing pronotum with a pair of reddish spots and broadly rounded elytral apices. Scale bar = 2 mm.

Fuego (Isla Grande). Although the distances may appear small in the map, the straits are actually an effective barrier for flying insects. The presence of some specimens in the mainland could be explained by recent man-aided dispersion.

***Oxelytrum biguttatum* (Philippi)**
http://species-id.net/wiki/Oxelytrum_biguttatum

Localities. MACN: Argentina: Tucumán: Depto Tafí Viejo: San José, 2500 m, III-1933 (26°7167'S, 65°6167'W). La Rioja: Lamadrid: Nevado de Famatina: Los Cor-

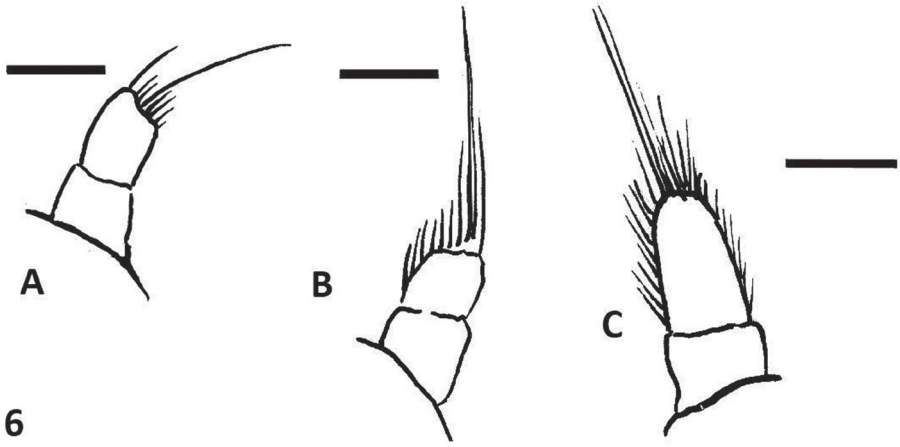

Figure 6. Female styli: line drawings. **A** *O. selknan* **B** *O. biguttatum* **C** O. lineatocolle. Scale bars= 0.2 mm.

rales: 2300–3000 m. 5-14-I-1931 (29°S, 67°85'W). Río Negro (no locality). 1981, Coll. C. Bruch. MNHN: Magallanes: Ojo Bueno, 20-1-1975, Cerda. (Mainland. 53°017'S, 70°867'W). Magallanes: Parque nacional Torres del Paine, Laguna Pehué. 12-12-1986. Leg.F. Soto. (Mainland.) Two syntypes, male and female, of which only the male has a handwritten label "Valdivia". Dr M. Elgueta (pers. com.) suggests that this may be a mistake as all the material in the collections is from Magallanes Region.

Key to the species of *Oxelytrum* in South America

(Modified from Peck and Anderson 1985)

1 Eyes small, not prominent (Fig. 5), separated by a distance clearly greater than 3× eye diameter..... **2**

– Eyes large, prominent (Fig. 8A), separated by a distance equivalent to 3 × eye diameter, or less **4**

2 Pronotum with a small reddish spot on each of the posterolateral angles (Fig. 5) **3**

– Pronotum entirely black (dark brown in individuals that have not darkened completely)..... **4**

3 Paramera narrow, weakly curved inwards, apices narrowly rounded (Fig. 3B). Median lobe shorter than paramera, parallel-sided, apex abruptly acuminate, with a high ventral ridge (Fig. 2D). Internal sac with apical portion subcylindrical, whitish, not bearing brown microtrichia, proximal to this portion two large hemispherical lobes (Fig. 4E, 4F)..... ***O. biguttatum* (Philippi)** NW Argentina above 2,300 MASL; Río Negro, Neuquén. Chile: Antártica, Magallanes; Última esperanza; Valdivia (?)(MNHN); also Aisen, Chiloé; Llanquihue; Osorno; (Peck and Anderson 1985)

– Paramera narrow, almost straight, weakly broadened at apical ¼, apices rounded (Fig. 2A). Median lobe longer than paramera, gradually narrowed to the apex (Fig. 2A, 2C, 3A). Inner sack with cylindrical apical portion covered in brown microtrichia (Fig. 4A–4D), proximal to this three small rounded lobes, proximal to them hemispheric lobe..... ***O. selknan* sp. n.**
Santa Cruz, Tierra del Fuego.

4 Antennal club with the three apical segments yellow or orange. Paramera narrow, straight, apices rounded and strongly turned inwards. Median lobe slightly shorter than paramera, spindle-shaped, gradually acuminate (Fig. 7A); apex narrowly rounded, with ventral ridge weakly angular in lateral aspect (Fig. 7B, 7C) ..... ***O. apicale* (Brullé)**
NW of Argentina (Oliva and Di Iorio 2008)

– Antennal club entirely black ..... ***O. anticola* Gérin-Méneville**
Bolivia: La Paz; Oruro; Chile: Parinacota (Elgueta and Arriagada 1989); Ecuador: Latacunga; Quito. Perú: several localities (Peck and Anderson 1985)

5 Pronotum and elytra entirely black or dark brown. Apical antennomere yellow or orange. Paramera narrow, broadened at apical ¼, apices rounded, weakly turned inwards. Median lobe shorter than paramera, parallel-sided, very thick, weakly acuminate towards bifid apex (Fig. 7D)..... ***O. lineatocolle* (Laporte)**
Patagonia (Oliva and Di Iorio 2008). Chile: several localities; associated with Valdivian rainforest, often with *Nothofagus* forest (Peck and Anderson 1985).

– Pronotum with reddish margins, disk black at least on part (Fig. 8A). Color of antennal club varying.....7

6 Humeral humps rounded. Pronotum with strongly raised longitudinal costs. Elytra with the second elytral cost clearly raised in its whole length 7

– Humeral humps dentate (Fig. 8B). Pronotum with obsolete costae. Elytra with second costa obsolete on elytral disk **8**

7 Antennal club with apical antennomere yellow or orange. Elytral apices emarginate, with sutural angles acuminate..... ***O. emarginatum* (Portevin)**
Brasil: Minas Gerais, Rio de Janeiro, Sao Paulo (Peck and Anderson 1985)

– Antennal club black. Elytral apices not emarginate, sutural angles rounded or weakly produced. Paramera narrow, broadened at apical ¼. Median lobe much shorter than paramera, parallel-sided, apex shaped as a straight angle (Fig. 10E)..... ***O. erythrurum* (Blanchard)**
Argentina: Chaco-Pampean plain, reaching the mountainous areas in the NW through the valleys (Oliva and Di Iorio 2008). Bolivia: Beni; S. Cruz. Brasil: Amapá; Amazonas; M. Grosso; Minas Gerais; Pará; R. de Janeiro; Rondonia; Sao Paulo. Colombia: Amazonas; Cundinamarca; Norte de Santander. Ecuador: Manabí; Napo; Pastaza; Pichincha. French Guiana. Guyana. Perú: Loreto; Junín. Venezuela: Amazonas; Aragua; Zulia (Peck and Anderson 1985).

8 Pronotum with the postcoxal lobe yellowish. Pronotal disk darkened on the central portion only. Elytral apices produced, blunt. Paramera narrow, acuminate, weakly turned inwards. Median lobe somewhat shorter than paramera, spindle-shaped, apex acuminate (Fig. 9C) ..... ***O. cayennense* (Sturm)**
Argentina: Tucumán; Bolivia: Cochabamba: Chapare; Brasil: Minas Gerais; Rio de Janeiro; Sao Paulo (Peck & Anderson).

– Pronotum with postcoxal lobe entirely black. Pronotal disk entirely black (Fig. 8A, 8B). Elytral apices produced, acuminate (Fig. 8C). Paramera very narrow, broadened and slightly turned inwards at apical 1/8. Median lobe very little shorter than paramera, thick, spindle-shaped, apex abruptly narrowed, bifid (Fig. 9A). Internal sac bearing a pair of sclerites (Fig. 9B) ..... ***O. discicolle* (Brullé)**
Argentina: Misiones to USA: Texas (Peck and Anderson 1985).

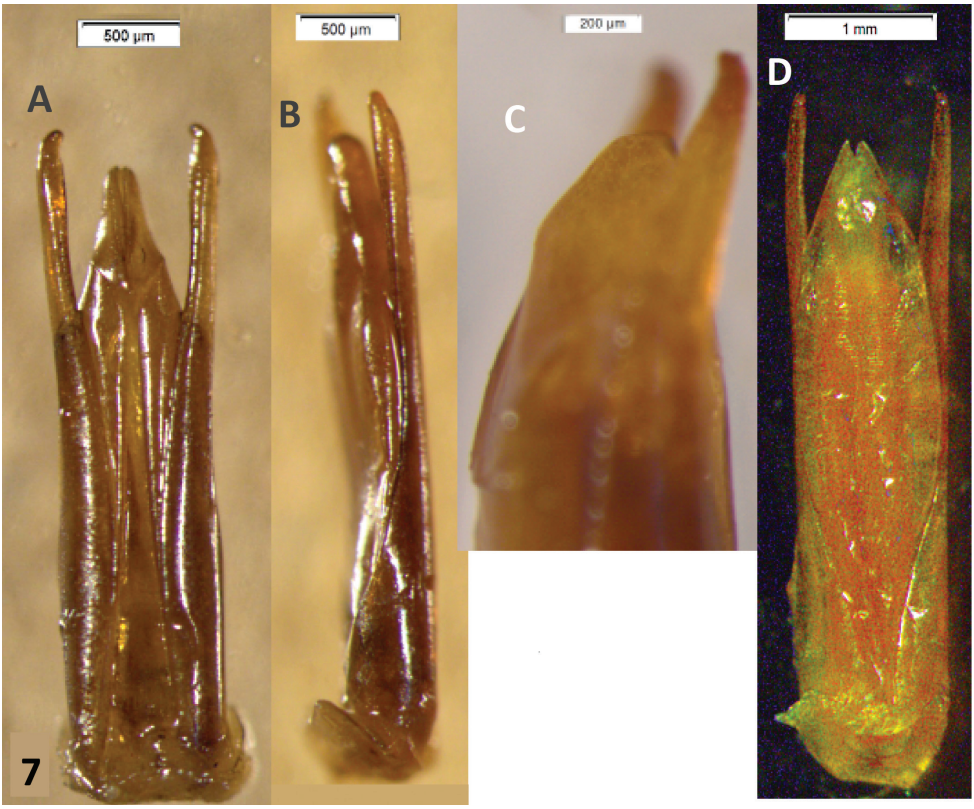

Figure 7. *O. apicalis* and *O. lineatocolle*, male genitalia. **A** *O. apicalis*, male genitalia in dorsal aspect, showing median lobe shorter than paramera, acuminate to a narrowly rounded apex. Scale bar = 0,5 mm. **B** *Idem*, lateral aspect. Scale bar = 0, 5 mm. **C** *Idem*, apex of median lobe in lateral aspect, showing angular ventral ridge **D** *O. lineatocolle*, male genitalia in dorsal aspect, showing broad median lone with bifid apex. Scale bar = 1 mm.

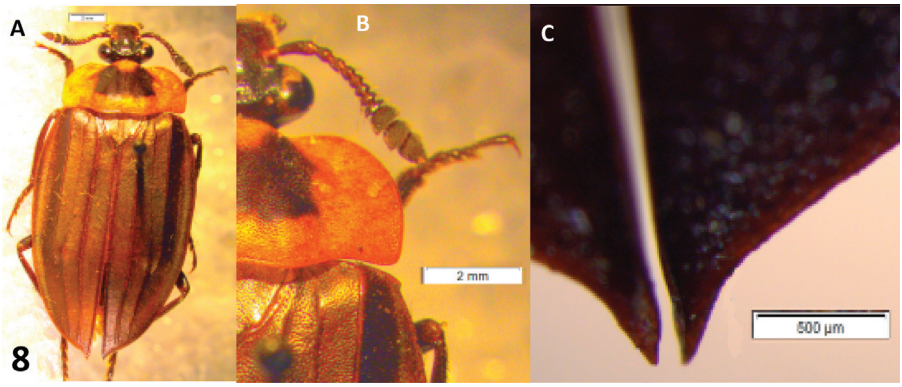

Figure 8. *O. discicolle*, external morphology. **A** dorsal aspect, showing reddish pronotal disk, obsolete pronotal ridges and produced elytral apices. Scale bar = 2 mm. **B** right half of head and pronotum showing prominent compound eye and dentate humeral hump. Scale bar = 2 mm. **C** elytral apices, produced and acuminate. Scale bar = 0.5 mm.

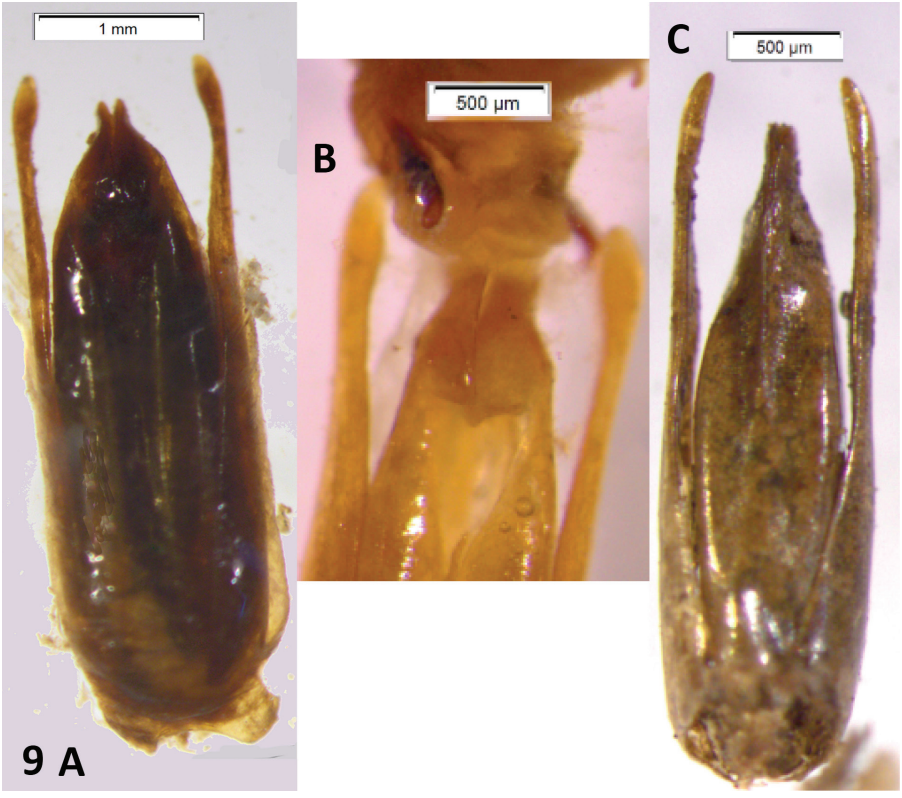

Figure 9. *O. discicolle* and *O. cayennense*, male genitalia. **A** *O. discicolle*, male genitalia in dorsal aspect, showing narrow paramera dilated on apical one-eight and median lobe shorter than paramera, very broad, spindle-shaped. Scale bar = 1 mm. **B** Idem, apices of distal pieces with partly everted internal sac, showing a pair of sclerites. Scale bar = 0.5 mm. **C** *O. cayennense*, male genitalia in dorsal aspect, showing paramera curved inwards, median lobe shorter than paramera, gradually acuminate. Scale bar = 500 µm.

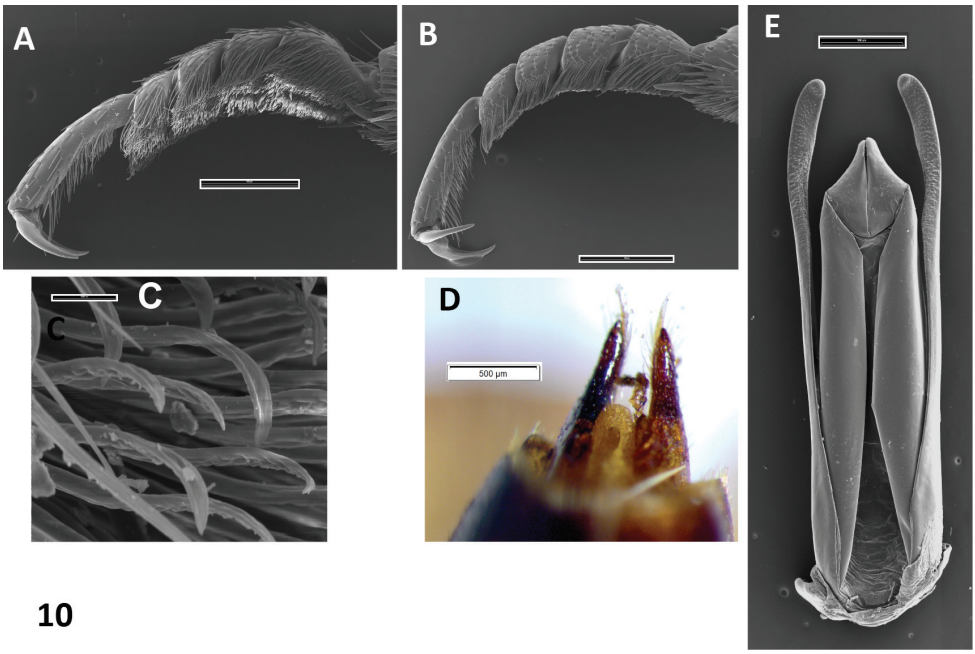

Figure 10. *O. erythrurum*. **A** male protarsus, showing soles of hairs. SEM image. Scale bar = 500 µm. **B** female protarsus, without soles. SEM image. Scale bar = 500 µm. **C** detail of hairs. SEM image. Scale bar = 10 µm. **D** female styli. Scale bar= 0.5 mm. **E** male genitalia in dorsal aspect, showing paramera broadened on apical ¼, median lobe shorter than paramera, parallel-sided with triangular apex. SEM image. Scale bar = 500 µm.

Discussion

Oxelytrum selknan appears to be a case of speciation through geographic isolation. The discovery of a new species which differs from a described one only by the male genitalia suggests that there may be more undescribed species. The internal sac is often poorly preserved in pinned specimens; work upon fresh material would probably allow a fuller description of all the species. Also, most specimens have poorly determined localities. An extensive sampling over the country would make clear the distribution of the species, giving a better idea of the usefulness of each as a forensic indicator.

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RESEARCH ARTICLE

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Two new species and one newly recorded species of *Elaphropeza* Macquart from Taiwan (Diptera, Empididae, Tachydromiinae)

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Abstract

Previously 11 *Elaphropeza* species were known from Taiwan. The following two species of the genus *Elaphropeza* are described: *Elaphropeza flaviscutum* **sp. n.** and *E. trimacula* **sp. n.** One species, *Elaphropeza plumata* Yang, Merz & Grootaert, is newly recorded from Taiwan. A key to 14 known species of *Elaphropeza* from Taiwan is presented.

Keywords

Diptera, Empididae, Tachydromiinae, *Elaphropeza*, new species

Introduction

Elaphropeza Macquart is a large genus in the subfamily Tachydromiinae traditionally placed in the family Empididae (Melander 1928; Steyskal and Knutson 1981; Woodley 1989; Yang et al. 2007; Cumming and Sinclair 2009) or assigned to the family Hybotidae (Chvála 1983; Sinclair and Cumming 2006; Chvála and Kovalev 1989; Shamshev

and Grootaert 2007). *Elaphropeza* is very similar to *Drapetis* Meigen and was originally considered as a subgenus of the latter genus. It can be separated from *Drapetis* by the following features: occiput more convex; antenna not upturned; first flagellomere conical with lower margin as straight as upper margin; mesopleuron bare; hind tibia usually with 1-2 antero-dorsal setae (Collin 1961; Chvála 1975; Yang and Gaimari 2005; Shamshev and Grootaert 2007; Cumming and Sinclair 2009). It is distributed worldwide with 212 known species (Yang et al. 2007; Shamshev and Grootaert 2007; Grootaert and Shamshev 2012). The species from the Chinese mainland were reviewed by Yang and Gaimari (2005), and the Oriental species were reviewed by Shamshev and Grootaert (2007). Eleven species of the genus were known from Taiwan (Yang et al. 2007; Shamshev and Grootaert 2007). In this study three species including two new species of *Elaphropeza* are added to the fauna of Taiwan. A key to 14 known species of *Elaphropeza* from Taiwan is presented.

Material and methods

The terminology follows Shamshev and Grootaert (2007). The types are deposited in Entomological Museum of China Agricultural University (CAU), Beijing. The following abbreviations for setae are used: acr–acrostichal, ad–anterodorsal, av–anteroventral, dc–dorsocentral, h–humeral, npl–notopleural, oc–ocellar, prsc-prescutellar, psa–postalar, pv–posteroventral, sc–scutellar, vt–vertical.

Key to species of *Elaphropeza* from Taiwan

1	Head black	**2**
–	Head yellow	***Elaphropeza xanthocephala* Bezzi**
2	Hind tibia with 1-2 ad	**3**
–	Hind tibia without ad	***Elaphropeza trimacula* sp. n.**
3	Hind tibia with 1 ad	**4**
–	Hind tibia with 2 ad	**9**
4	Mesoscutum entirely yellow	**5**
–	Mesoscutum patterned	**8**
5	Hind tibia with short rounded projection	**6**
–	Hind tibia with long pointed apical projection	***Elaphropeza calcarifera* Bezzi**
6	Scutellum wholly brown or black	**7**
–	Scutellum brown medially	***Elaphropeza marginalis* Bezzi**
7	Arista short, as long as basal three segments; acr and dc muliseriate	***Elaphropeza melanura* Bezzi**
–	Arista very long, at least twice as long as basal three segments; acr biseriate, dc uniseriate	***Elaphropeza kerteszi* Bezzi**

8 Arista not thickened; mesoscutum pattern not as below..... ***Elaphropeza pictithorax* Bezzi**

– Arista thickened with plumose pubescence; mesoscutum with two small lateral spots and one large mid-posterior spot ..... ***Elaphropeza plumata* Yang, Merz & Grootaert**

9 Mesoscutum entirely yellow.....**10**

– Mesoscutum patterned.....**12**

10 Scutellum black at middle or entirely blackish **11**

– Scutellum entirely yellow..... ***Elaphropeza formosae* Bezzi**

11 Scutellum black at middle; hypopleuron yellow, metapleuron brownish at upper part.....***Elaphropeza scutellaris* Bezzi**

– Scutellum entirely black; hypopleuron black except narrow lower portion, metapleuron entirely yellow.....***Elaphropeza flaviscutum* sp. n.**

12 Hind tibia with indistinct, rounded projection **13**

– Hind tibia with long pointed apical projection ..... ***Elaphropeza longicalcaris* (Saigusa)**

13 Scutellum wholly black..... ***Elaphropeza lanuginosa* Bezzi**

– Scutellum black at middle.....***Elaphropeza scutellaris* Bezzi**

Taxonomy

***Elaphropeza flaviscutum* sp. n.**
urn:lsid:zoobank.org:act:1A8DFF1F-A5BF-4D4A-82C6-D217BD5B2ACD
http://species-id.net/wiki/Elaphropeza_flaviscutum
Figs 1–2, 5–7

Diagnosis. Mesoscutum entirely yellow; scutellum entirely blackish; postnotum entirely blackish. Thoracic pleuron with only hypopleuron black except lower portion. Left surstylus large and broad; left cercus long with swollen apex.

Description. Male. Body length 2.4–2.6 mm, wing length 2.2–2.5 mm.

Head black with pale gray pollinosity. Setulae and setae on head brownish yellow. Eyes contiguous on face. Ocellar tubercle with 2 oc and 2 short posterior setulae; 1 vt curved inward, slightly longer than oc. Antenna brown except scape and pedicel yellow; scape bare, shorter than pedicel; pedicel with circlet of blackish apical setulae; 1st flagellomere short, conical, 2.0 times longer than wide, short pubescent; arista long (4 times longer than 1st flagellomere), dark brown, short pubescent. Proboscis brownish yellow with blackish setulae; palpus yellow with blackish setulae and 1 blackish apical seta.

Thorax mostly yellow with thin pale gray pollinosity; mesoscutum lacking dark spots; scutellum and postnotum blackish, laterotergite yellow; hypopleuron black except lower portion, metapleuron without spot. Setulae and setae on thorax blackish; mesoscutum with sparse setulae; h absent, 2 npl (posterior npl longer), 1 sa, 1 psa, biseriate acr, uniseriate dc and 1 long strong posteriormost dc; scutellum with two pairs of sc (basal pair very

Figures 1–2. *Elaphropeza flaviscutum* sp. n. **1** adult, lateral view **2** adult, dorsal view. Scale bar 1 mm.

short, about ¼ as long as apical pair). Legs yellow. Setulae and setae on legs blackish; fore coxa with 2 anterior setae at base, apically with 2 anterior setae; mid coxa apically with 3 anterior setae; hind coxa with 1 outer seta at apical margin. Fore femur 1.1 times as thick as mid femur, mid and hind femora subequal in thickness. Fore and mid femora each with 1 long thin pv at extreme base; mid femur with 1 preapical anterior seta; hind femur with 3 weak ad at base. Fore tibia apically with 1 av and 1 pv; mid tibia with row of short spine-like brown ventral setae, apically with 1 av and 1 pv; hind tibia with 2 ad, apically with 1 av. Hind tarsomere 1 without distinct ventral setae. Wing hyaline, veins dark brown, crossvein m-cu nearly vertical. Calypter brown with blackish setulae. Halter brown.

Abdomen mostly yellow with thin pale gray pollinosity; tergite 1 wholly membranous; tergites 2–3 brown, each with pair of subtrianglur lateral sclerites brown, medially linear and interrupted; tergite 4 broadest and tergite 5 narrow, blackish; tergite 5 anteriorly with large, separated, bare, blackish sclerite hidden within tergite 4; hypopygium dark brownish yellow. Setulae and setae on abdomen blackish except tergites 4–5 each with group of short squamiform black setae laterally, tergite 7 with row of long setae at posterior margin.

Male genitalia (Figs 5–7): Left epandrial lobe rather narrow in dorsal view, with surstylus large and broad in lateral view. Right epandrial lobe rather large in dorsal view, fused with apically narrowed surstylus. Left cercus long with swollen apex; right cercus rather short, about 1/3 as long left cercus.

Female. Unknown.

Type material. Holotype male, Taiwan, Nantou, Lianhuachi (120.8900E, 23.9260N), 2010. XI.11, Ding Yang. Paratype 2 males, same data as holotype. These specimens were collected from tropical forest by sweep net.

Distribution. China (Taiwan).

Etymology. The specific name refers to the yellow scutum.

Remarks. This new species belongs to *E. ephippiata* group, and is similar to *E. scutellaris* Bezzi from Taiwan of China, but may be separated from the latter by the scutum entirely yellow, scutellum and postnotum entirely blackish, hypopleuron black except narrow lower portion and metapleuron without spot. In *E. scutellaris*, the scutum usually has the indistinct vittae; the scutellum and postnotum are yellow with brownish spot in middle; the hypopleuron has no spot, the metapleuron is brownish at the upper part (Bezzi 1912; Shamshev and Grootaert 2007).

***Elaphropeza plumata* Yang, Merz & Grootaert**

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

Elaphropeza plumata Yang, Merz & Grootaert, 2006: 575. Type locality: China: Guangdong, Zijing.

Diagnosis. Arista thick with plumose pubescence. Mesoscutum with two small lateral spots and one large mid-posterior spot. Abdominal tergites 3–5 without short squamiform setae.

Specimen examined. 1 female, Taiwan, Jiayi, Shuisheliao (120.6595E, 23.6544N), 1165 m, 2010. XI. 16, Ding Yang. This specimen was collected from tropical forest by sweep net.

Distribution. China (Guangdong, Taiwan).

Remarks. This can be easily distinguished from other known species of the genus by the thick arista and unique marking pattern of the mesoscutum.

Elaphropeza trimacula sp. n.

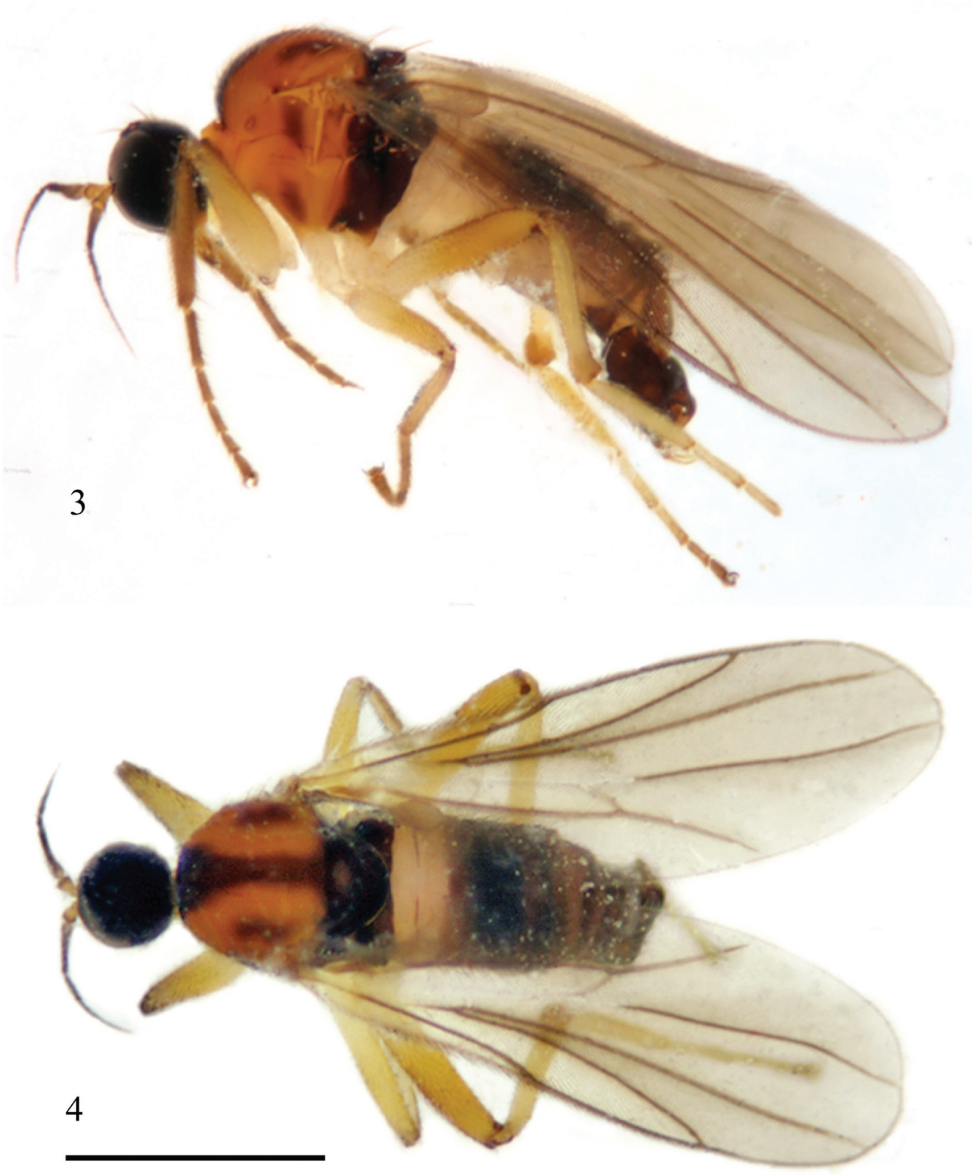
urn:lsid:zoobank.org:act:1EB36F18-11CA-4C67-B43D-911A6220D062
http://species-id.net/wiki/Elaphropeza_trimacula
Figs 3–4, 8–10

Diagnosis. Arista with distinct pubescence. Mesoscutum with three black spots. Hind tibia without ad. Left cercus rather large with 7 long strong apical setae.

Description. Male. Body length 2.3 mm, wing length 2.5 mm.

Head black with pale gray pollinosity. Setulae on head yellow, setae brownish yellow. Eyes contiguous on face. Ocellar tubercle with 2 oc and 2 short posterior setulae; 2 vt curved inward, outer vt shorter than inner vt. Antenna dark brown except scape and pedicel yellow; scape bare, shorter than pedicel; pedicel with circlet of blackish apical setulae; 1st flagellomere long, conical, 2.4 times longer than wide, short pubescent; arista long (3.6 times longer than 1st flagellomere), dark brown, distinctly pubescent. Proboscis dark brownish yellow with blackish setulae; palpus yellow with blackish setulae and 1 blackish apical seta.

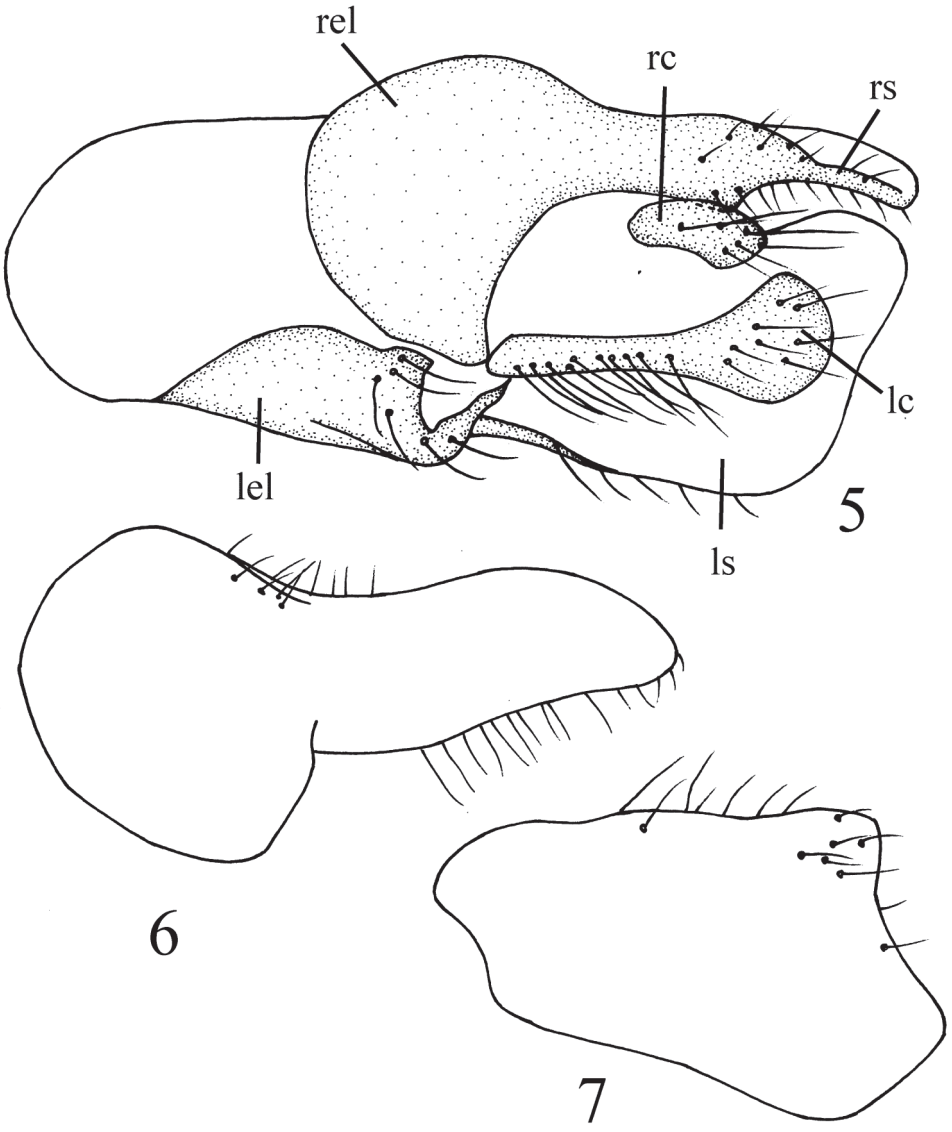
Thorax mostly yellow with thin pale gray pollinosity; mesoscutum with three blackish spots, median spot running through entire scutum and wider anteriorly; scutellum and postnotum black; pleuron with posterior portion (including hypopleuron, metapleuron and posterior portion of pteropleuron) black, mesopleuron and sternopleuron each with a blackish spot. Setulae on thorax yellow, setae brownish yellow; mesoscutum with short dense setulae; h absent, 2 npl (posterior npl longer), 1 prsc, 1 sa, 1 psa, acr and dc multiseriate and uniformly short; scutellum with two pairs of sc (basal pair very short, about ¼ as long as apical pair). Legs yellow except fore tibia and tarsus brown, mid tarsus and hind tarsomere 5 brownish yellow. Setulae and setae on legs blackish; fore coxa with 2 anterior setae at base, apically with 2 anterior setae; mid coxa apically with 3 anterior setae; hind coxa with 1 outer seta at apical margin. Fore femur 1.1 times as thick as mid femur, fore and hind femora subequal in thickness. Fore and mid femora each with row of short thin pv, and 1 long thin pv at extreme base; mid femur with 1 preapical anterior seta; hind femur with 3 weak ad at base. Fore tibia apically with 1 av and 1 pv; mid tibia with row of short spine-like black ventral setae, apically with 1 short av and 1 long pv; hind tibia without ad, apically with 1 av. Hind tarsomere 1 with 4–5 very short, irregular av. Wing hyaline, slightly uniformly tinged grayish; veins dark brown, crossvein m-cu oblique. Calypter brown with blackish setulae. Halter brown.



Figures 3–4. *Elaphropeza trimacula* sp. n. **3** adult, lateral view **4** adult, dorsal view. Scale bar 1 mm.

Abdomen dark brown with thin pale gray pollinosity; tergites complete except tergite 1 linear; tergite 3 relatively board, blackish; hypopygium blackish. Setulae and setae on abdomen blackish except tergites 3–5 each with group of short squamiform black setae laterally, tergite 7 with row of long setae at posterior margin.

Male genitalia (Figs 8–10): Left epandrial lobe rather narrow, with surstylus finger-like and apically curved inward in dorsal view. Right epandrial lobe rather large

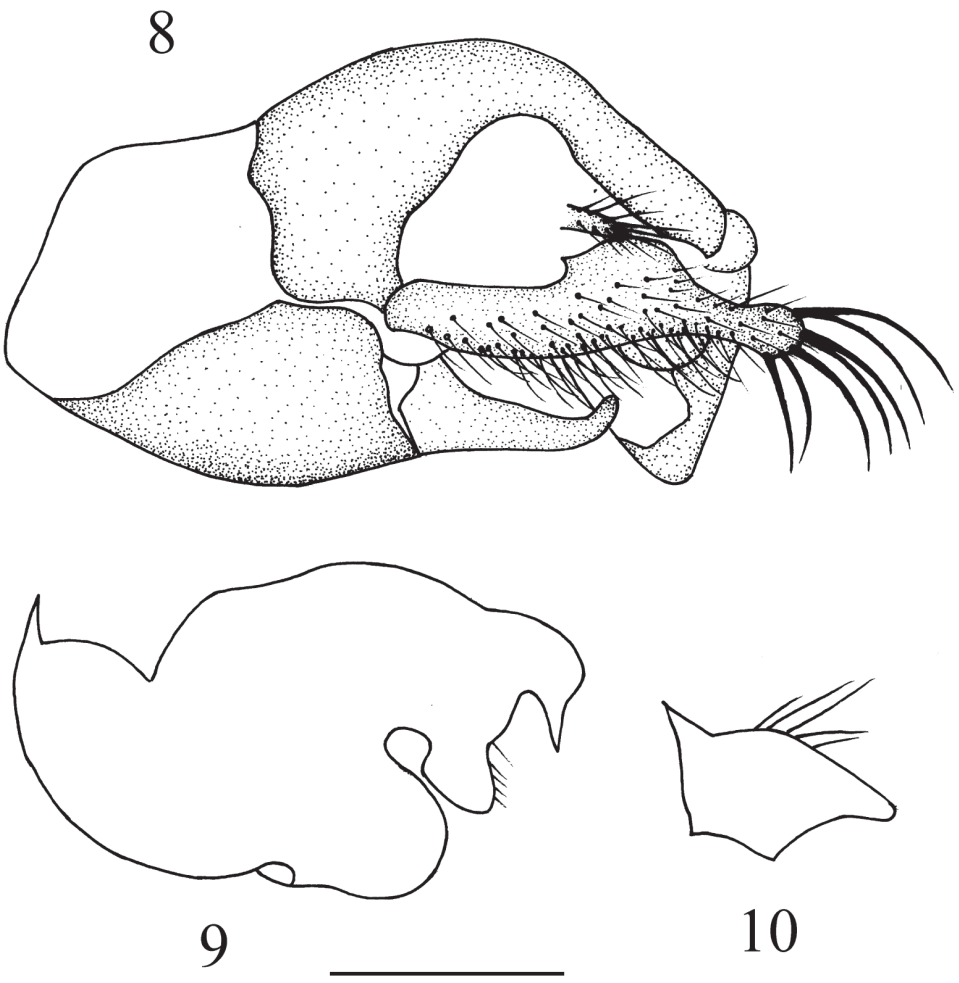


Figures 5–7. *Elaphropeza flaviscutum* sp. n. **5** male genitalia, dorsal view **6** right epandrial lobe **7** left surstylus. Scale bar 0.25 mm. Abbreviations: **lc** = left cercus; **lel** = left epandrial lobe; **ls** = left surstylus.

and broad, fused with surstylus of complicated shape. Left cercus rather long and large with 7 long strong apical setae. Right cercus very small (about 1/10 as long as left cercus), short finger-like.

Female. Unknown.

Type material. Holotype male, Taiwan, Taoyuan, Tamanshan (121.4507E, 24.7058N), 1620 m, 2011. VI. 14, Xiaoyan Liu. This specimen was collected from tropical forest by sweep net.



Figures 8–10. *Elaphropeza trimacula* sp. n. **8** male genitalia, dorsal view **9** right epandrial lobe **10** left surstylus. Scale bar 0.25 mm.

Distribution. China (Taiwan).

Etymology. The specific name refers to the mesoscutum with three spots.

Remarks. This new species belongs to *E. biuncinata* group. In the key of Shamshev and Grootaert (2007), this species runs to *E. acanthi* Shamshev & Grootaert from Singapore, but may be separated from the latter by the mesoscutum with three spots, the first flagellomere relatively long (2.4 times longer than wide), and arista with the distinct pubescence. In *E. acanthi*, the mesoscutum has only one middle spot, the first flagellomere is relatively short (2.0 times longer than wide), and the arista is clothed in very short pubescence (Shamshev and Grootaert 2007).

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RESEARCH ARTICLE

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A review of the genus *Neopsocopsis* (Psocodea, "Psocoptera", Psocidae), with one new species from China

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Abstract

A review of species of the genus *Neopsocopsis* Badonnel, 1936 is presented. Four species are redescribed, viz. *N. hirticornis* (Reuter, 1893), *N. quinquedentata* (Li & Yang, 1988), *N. profunda* (Li, 1995), and *N. flavida* (Li, 1989), as well as the description of one new species, *N. convexa* **sp. n.** Seven new synonymies are proposed as follows: *Pentablaste obconica* Li **syn. n.** and *P. clavata* Li **syn. n.** of *N. hirticornis*, *P. tetraedrica* Li **syn. n.** of *N. longiptera*, *Neoblaste schizopetala* Li **syn. n.** and *Nb. flavae* Li **syn. n.** of *N. profunda*, *Blastopsocidus pini* Li **syn. n.** and *P. lanceolata* Li **syn. n.** of *N. flavida*. *N. hirticornis* (Reuter, 1893) is recorded from Japan and China for the first time, and *N. longiptera* Vishnyakova, 1986 is newly recorded from China. Illustrated keys to adult males and females are presented.

Keywords

Psocodea, Psocoptera, Psocidae, *Neopsocopsis*, redescriptions, new synonymies, new species, new records, distribution, key

Introduction

The psocopteran genus *Neopsocopsis* is a small group in the subfamily Amphigerontiinae, formerly characterized by head-covering glandular setae, female fore wing brachypterous, and male hypandrium with three lobes (one median lobe and two lateral lobes) and 2 internal apophyses (Badonnel 1936; Günther 1974; Smithers 1972). In 1986, Vishnyakova redefined the genus, pointing out the existence of macropterous female specimens. Afterward, Yoshizawa (2010) synonymized the Chinese genus *Pentablaste* Li with *Neopsocopsis* and considered the genus to be a well defined monophyletic group, mainly based on genitalic characters. The type species, *Neopsocopsis hirticornis* (Reuter, 1893), is widely distributed in the Palaearctic Region ranging from East Asia to West Europe, and the remaining bulk of species occurring in the Oriental Region, principally in Japan and China.

Badonnel (1935) described *Neopsocus pyrenaicus* based on a single female specimen collected from France, with the character states: 1) body-covering glandular setae and 2) a brachypterous fore wing. Later, in 1936, after reexamination of the accompanying male specimens collected with *Np. pyrenaicus*, Badonnel separated *Neopsocopsis* from *Neopsocus* as a new genus on the basis of distinct male venational and genitalic characters, with *N. pyrenaicus* as the type species. In 1938, Badonnel moved the Finland species *Psocus hirticornis* Reuter, 1893 (=*P. bastmannianus* Enderlein, 1918) to *Neopsocopsis* and considered *N. pyrenaicus* as a subspecies of *N. hirticornis*, and later proposed it as a new junior synonymy (Badonnel, 1982). Afterward, macropterous females of *N. hirticornis* were found from Europe (Günther 1980, 1991; Hedström 1989). Meinander (1981) described a second species from Egypt, *N. aegyptiacus*, which was proposed as a junior synonym of *Blaste* (*Euclismiopsis*) *medleri* New by Lienhard (1986). Vishnyakova (1986) and Yoshizawa (2010) described *N. longiptera* (from Russia) and *N. sakishimensis* (from Japan), respectively. Yoshizawa (2010) also treated the Chinese genus *Pentablaste* Li, 2002 as a new junior synonym of the genus *Neopsocopsis*, which raised the species of the genus to 19.

In the present paper, one new species of *Neopsocopsis* is described, *N. convexa* sp. n., with redescriptions of four species: *N. hirticornis* (Reuter, 1893), *N. quinquedentata* (Li & Yang, 1988), *N. profunda* (Li, 1995), and *N. flavida* (Li, 1989). Seven new synonymies are proposed as follows: *Pentablaste obconica* Li, syn. n. and *P. clavata* Li, syn. n. of *N. hirticornis*, *P. tetraedrica* Li, syn. n. of *N. longiptera*, *Neoblaste schizopetala* Li, syn. n. and *Nb. flavae* Li, syn. n. of *N. profunda*, *Blastopsocidus pini* Li, syn. n. and *P. lanceolata* Li, syn. n. of *N. flavida*. *N. hirticornis* (Reuter, 1893) is recorded from Japan and China for the first time, and *N. longiptera* Vishnyakova, 1986 is newly recorded from China. Updated keys for adult males and females of world species in the genus is presented.

Material and methods

All specimens treated in this paper were from Entomological Museum of China Agricultural University (CAU), Beijing, China, and Hokkaido University Insect Collection

(SEHU), Sapporo, Japan. Specimen preparation and measurements were undertaken following Liu et al. (2011). Images of fore wings were taken with a Canon EOS 500D digital camera attached to a stereoscopic microscope.

Taxonomy

***Neopsocopsis* Badonnel**
http://species-id.net/wiki/Neopsocopsis

Neopsocopsis Badonnel, 1936: 420. Type species: *Psocus hirticornis* Reuter, 1893: 42, original designation.
Pentablaste Li, 2002: 1367. Type species: *Pentablaste obconica* Li, 2002. Synonymy: Yoshizawa, 2010: 24.

General characters. Small to medium sized psocids. Antennae short, not reaching tip of fore wing. Wings membranous, usually hyaline with brownish tinge; fore wing normal in both sexes or brachypterous in female; fore wing Rs and M meeting at point, fused for short distance or connected by crossvein, areola postica pentagonous, first and second sections of Cu_{1a} forming obtuse angle about 120°. Male abdomen with distal segments dark brown colored, 8th sternum broadly sclerotized and fused to hypandrium, with lateral margins overlapping clunium; epiproct round, dorsally with sclerotized projection at middle of anterior margin; hypandrium symmetrical and 5-lobed, with posteromedian lobe forming dorsal-curved structure, pair of lateral lobes carinate with outer surface covering denticles, and pair of internal lobes rod-like or expanded; phallosome free posteriorly, anteriorly fused or connected by membrane. Female subgenital plate with sclerotized arms forming flat V-shaped regions and expanded laterally, egg guide relatively long; ventral valve of gonapophyses distally tapering to slender tip, outer valve with well developed posterior lobe.

Distribution. China; Finland; France; Germany; Hungary; Italy; Japan; Macedonia; Mongolia; Romania; Russia; Serbia; Spain; Sweden; Switzerland.

Remarks. The genus *Neopsocopsis* is placed in the subfamily Amphigerontiinae mainly based on the following characters: male 8th sternum broadly sclerotized and fused to hypandrium, with lateral margins overlapping clunium (Yoshizawa et al. 2011); hypandrium symmetrical with various projections; phallosome free posteriorly; female subgenital plate with prominent egg guide plate and ventral valve of gonapophyses tapering distally (also observed in some other genera of Psocinae). *Neopsocopsis* can be easily distinguished from genera in Amphigerontiinae by the 5-lobed hypandrium as well as the carinate and dentigerous lateral lobes, which are considered to be an autapomorphy of the genus. In addition, the shape and sclerotization pattern of the female subgenital plate are also distinct in Amphigerontiinae. Described based on a single male specimen from China, *Pentablaste pentasticha* (Li, 1990) apparently lacks the above characters, and it appears to correspond more closely to the generic characters of *Neo-*

blaste in genitalic details. However, classification of this species cannot be confirmed until more samples are analyzed, and we do not discuss *P. pentasticha* in this work.

One Indonesian genus, *Javablaste* Endang, Thornton & New, 2002, shared many generic characters of *Neopsocopsis* and was different from the latter by 1) female with normal fore wing, 2) subgenital plate with transverse sclerotized bar at mid line and 3) male hypandrium with lateral spinous lobes (Endang et al. 2002). However, as discussed above, the brachypterous fore wing is not a stable character of *Neopsocopsis*. Later, in 2010, Endang and New recorded three new species of *Javablaste* from Sumatra, Indonesia, including *J. darmayasai* Endang & New, 2010, in which the second condition was not observed. In addition, there is little difference between the terms "tuberculate" or "spinous" in reference to the lateral lobes of the hypandrium. According to Endang and New (2010), the Chinese species, *N. flavida*, was pointed out to be very similar to species of *Javablaste* with minor genitalic differences. It is strong possible that *Javablaste* is also a junior synonym of *Neopsocopsis*.

Identification keys

Pentablaste pentasticha (Li, 1990) is not included in the key as re-examination of the species and its possible relationship with *Neoblaste* were not possible for this study.

Key to adult males of *Neopsocopsis*

1 Internal lobes of hypandrium well developed, expanded and longer than posteromedian lobe (Fig. 3C) **2**

– Internal lobes of hypandrium not well developed, usually rod-like, equal length or shorter than posteromedian lobe (Fig. 4C) **3**

2 Small in size, fore wing length about 2.5–3.0 mm; epiproct fully sclerotized, with tiny projection dorsally; lateral lobes of hypandrium small; phallosome with parameres absent. See Yoshizawa, 2010, Fig. 10 ..... ***N. sakishimensis***

– Large in size, fore wing length about 3.2–4.5 mm; epiproct with membranous regions medially (Fig. 3B), with large and sharp projection dorsally (Fig. 3AB); lateral lobes of hypandrium large (Fig. 3C); phallosome paired with parameres (Fig. 3D) ..... ***N. hirticornis* (=*P. obconica; =P. clavata*)**

3 Posteromedian lobe of hypandrium with distal margin almost straight, or concave with projection medially (Fig. 5C) **4**

– Posteromedian lobe of hypandrium with distal margin convex medially (Fig. 2C) **6**

4 Posteromedian lobe of hypandrium with distal margin straight; lateral lobes of hypandrium with anterior part short. See Yoshizawa, 2010, Fig. 12 ..... ***N. longiptera* (=*P. tetraedrica*)**

– Posteromedian lobe of hypandrium with distal margin concave, and with projection medially; lateral lobes of hypandrium with anterior part long and curved anteromedially (Fig. 4C)..... **5**

5 Epiproct with sharp projection dorsally (Fig. 4B); internal lobes of hypandrium not forked distally (Fig. 4C) ..... ***N. quinquedentata***

– Epiproct with large and round projection dorsally (Fig. 5B); internal lobes of hypandrium forked distally (Fig. 5C)..... .....***N. profunda* (= *Nb. schizopetala*; = *Nb. flavae*)**

6 Clunium with posterior margin sharply convex medially (Fig. 2B); internal lobes of hypandrium distally forked (Fig. 2C)..... ***N. convexa* sp. n.**

– Clunium with posterior margin smoothly convex medially (Fig. 6B); internal lobes of hypandrium tortuous forming right-angle and distally not forked (Fig. 6C)..... ***N. flavida* (=*B. pini; =P. lanceolata*)**

Key to adult females of *Neopsocopsis*

1 Subgenital plate with egg guide not sclerotized **2**

– Subgenital plate with egg guide sclerotized wholly (Fig. 2E) or at basal 1/3–1/2 (Fig. 5E)..... **4**

2 Fore wing pale brown with anterior part dark colored; outer valve of gonapophyses with posterior lobe narrowing to internal tip. See Li 2002, pp. 1381, Fig. 1240 ..... ***N. minuscula***

– Fore wing pale brown wholly; outer valve of gonapophyses with posterior lobe broad at internal tip **3**

3 Subgenital plate with large membranous region anteromedially, pigment arms with small lateral expansions, widely separated; dorsal valve of gonapophyses slender. See Li 2002, pp. 1384, Fig. 1243 ..... ***N. longicaudata***

– Subgenital plate with small membranous region anteromedially, pigment arms with large lateral expansions close to each other; dorsal valve of gonapophyses broad. See Li 2002, pp. 1383, Fig. 1242..... ***N. auctachila***

4 Subgenital plate with egg guide sclerotized wholly (Fig. 2E).... ***N. convexa* sp. n.**

– Subgenital plate with egg guide sclerotized at basal 1/3–1/2..... **5**

5 Subgenital plate with distal margin of sclerotized regions straight (Fig. 5E)..... **6**

– Subgenital plate with distal margin of sclerotized regions not straight (Fig. 3E)..... 7

6 Subgenital plate with egg guide sclerotized at basal 1/3 (Fig. 5E); internal plate with round plate surrounding spermathecal opening (Fig. 5G)..... .....***N. profunda* (= *Nb. schizopetala*; = *Nb. flavae*)**

– Subgenital plate with egg guide sclerotized at basal 1/2; internal plate without round plate surrounding spermathecal opening. See Li, 2002, pp. 1385, Fig. 1244 ..... ***N. jinxiuica***

7 Egg guide with distal margin of sclerotized regions sharply convex (Fig. 6E) **8**

– Egg guide with distal margin of sclerotized regions concave medially, forming fork-like structure (Fig. 3E) **9**

8 Small in size, forewing length about 3.1–3.7 mm; outer valve of gonapophyses with posterior lobe broad at internal tip (Fig. 6F) .... ***N. flavida* (=*B. pini*; =*P. lanceolata*)**

– Large in size, forewing length about 4.1 mm; outer valve of gonapophyses with posterior lobe narrowing to internal tip. See Li 2002, pp. 1386, Fig. 1245 ..... ***N. lushannensis***

9 Small in size, forewing length about 2.5–3.0 mm; egg guide with short neck region; subgenital plate with large membranous region anteromedially. See Yoshizawa 2010, Fig. 11..... ***N. sakishimensis***

– Large in size, forewing length more than 3.0 mm; egg guide with relatively long neck region; subgenital plate with small membranous region anteromedially..... **10**

10 Egg guide with fork-like sclerotized regions slightly concave; internal plate with two small sclerotized regions laterally. See Yoshizawa 2010, Fig. 13..... ..... ***N. longiptera* (= *P. tetraedrica*)**

– Egg guide with fork-like sclerotized regions strongly concave (Fig. 3E); internal plate with sclerotized regions marginally, paired with strong processes directed laterally (Fig. 3G) ..... ***N. hirticornis* (=*P. obconica*; =*P. clavata*)**

Descriptions

***Neopsocopsis convexa* Liu, Li & Liu, sp. n.**
urn:lsid:zoobank.org:act:DB945C8B-2D6F-4367-B9C7-15332C71F172
http://species-id.net/wiki/Neopsocopsis_convexa
Figures 1A, 2

Type material. Holotype ♂: China, Yunnan Prov., Lüchun Co., Huanglianshan Natural Reserve, 5.v.2011 (LX Liu). Paratypes. China: 1♀, same date as holotype; 1♂1♀, same locality and collector as holotype, 6.v.2011; 1♀, Yunnan Prov., Jinping Co., Fenshuiling Natural Reserve, 9.v.2011 (LX Liu); 1♂1♀, same locality and collector, 10.v.2011; 2♂, Yunnan Prov., Pingbian Co., Daweishan Natural Reserve, 16.v.2006 (JX Cui); 1♂, same locality, 12.v.2006 (Y Tang); 3♂, same locality, 24.v.2009 (XS Yang); 1♂, Gansu Prov., Wenxian Co., Qiujiaba Reg., 26.vii.2011 (SP Liu).

Etymology. The specific name refers to the characteristic convex-shaped posteromedian lobe of the hypandrium.

Diagnosis. Medium sized psocids. Fore wing hyaline with brownish coloration; Rs and M fused for very short distance, meeting at point or connected by crossvein. Male: 8th sternum strongly sclerotized and fused to hypandrium; epiproct swollen with

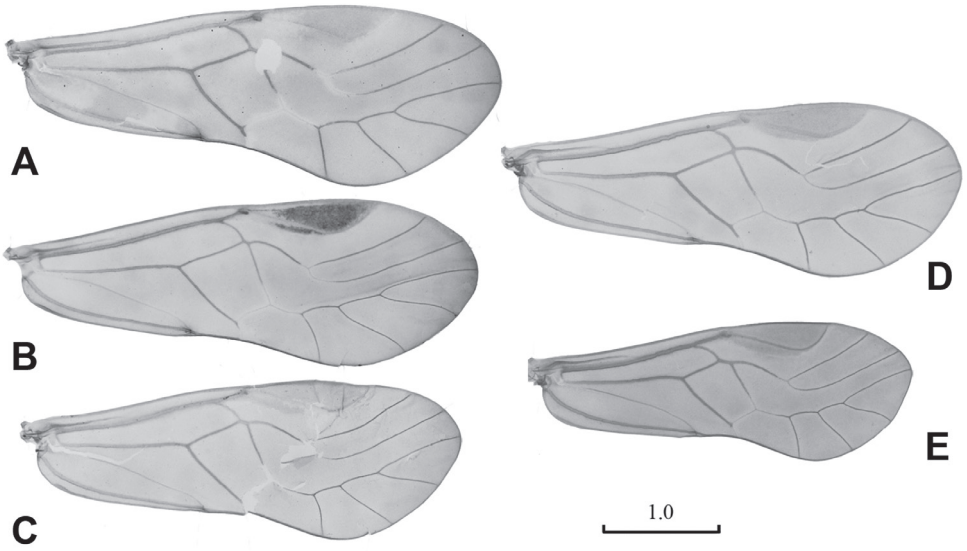

Figure 1. Male wings. **A** *Neopsocopsis convexa* sp. n. **B** *N. hirticornis* **C** *N. quinquedentata* **D** *N. profunda* **E** *N. flavida*. Scales in mm.

tiny projection at middle of anterior margin; hypandrium 5-lobed with posteromedian lobe convex distaromedially, internal lobes rod-like and distally forked. Female: subgenital plate with egg guide distally round, slightly sclerotized, pigment arms forming flat V-shaped regions and expanded laterally.

Discription. Male. Head creamy brown; compound eyes grayish black, ocelli black with grayish black ocellar field; antennae and labrum brown; maxillary palpi brown with distal segments dark colored. Thorax brown with dark brown markings on mesonotum; legs brown, with tarsi and distal part of tibia dark brown. Abdominal segments mostly creamy white, with apical regions dark brown. Fore wing (Fig. 1A) hyaline with brownish tinge, pterostigma dark brown with dark brown band along proximal margin; veins brown, except for Rs fork and M-Cu_{1a} fusion hyaline. Venation: Rs and M fused for very short distance, meeting at point or connected by crossvein; distal margin of discoidal cell straight; first and second sections of Cu_{1a} almost equal length, diverging at angle about 120°. Hind wing hyaline with brownish coloration; veins brown.

Abdomen. Male genitalia: 8^{th} sternum strongly sclerotized and fused to hypandrium. Clunium (Fig. 2A) with posterior margin sharply convex medially. Epiproct (Fig. 2AB) swollen, unsclerotized medially, with tiny projection at middle of anterior margin. Paraproct (Fig. 2A) round and broadened distally. Hypandrium 5-lobed, lateral lobes carinate with outer surface covering denticles; posteromedian lobe forming dorsal-curved structure, with distal margin convex medially, basally with small membranous regions; internal lobes rod-like and distally forked. Phallosome (Fig. 2D) free posteriorly, distally broadened and paired with parameres.

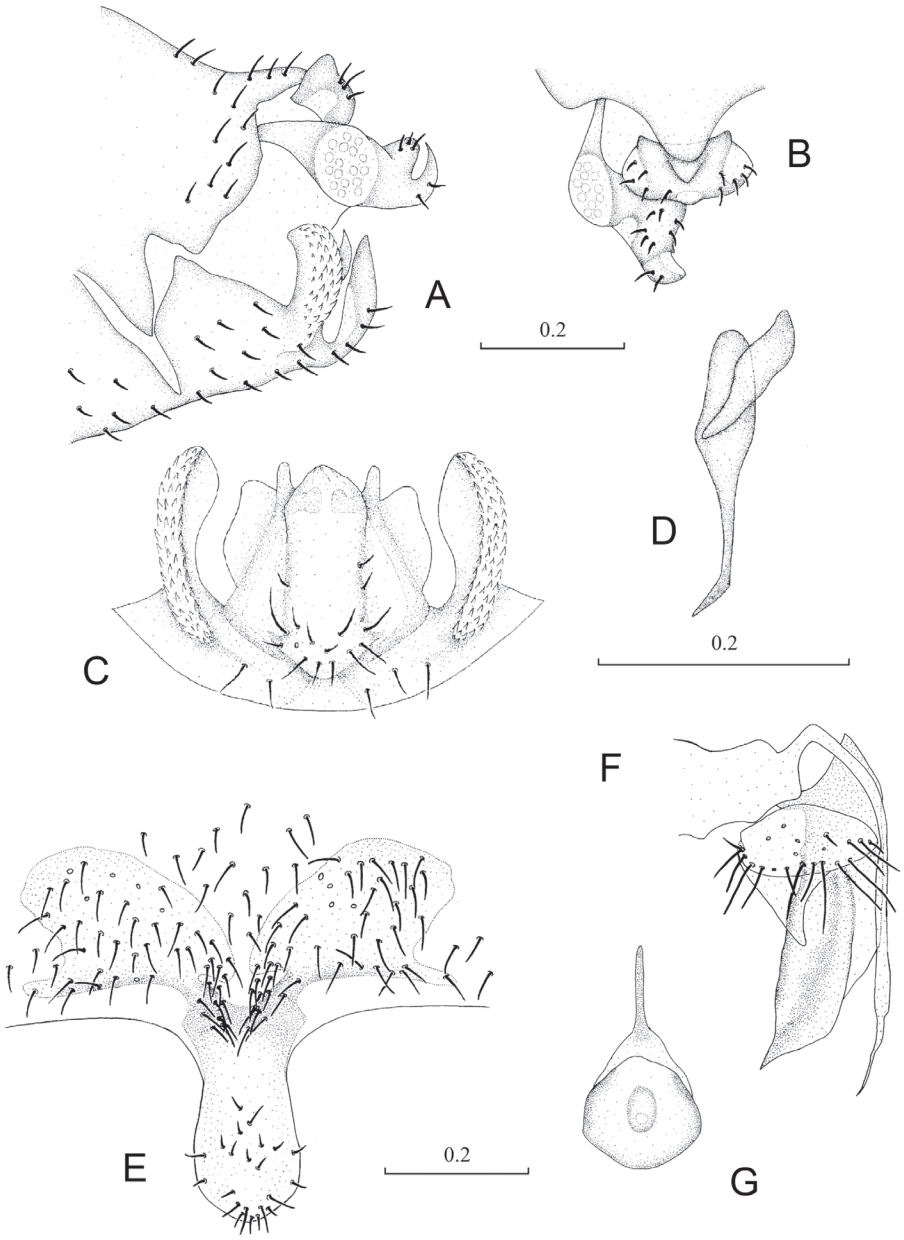

Figure 2. Terminalia of *Neopsocopsis convexa* sp. n.. **A** terminalia, lateral view **B** terminalia, dorsal view **C** hypandrium, posterior view **D** phallosome, lateral view **E** subgenital plate, ventral view **F** gonapophyses **G** internal plate, ventral view. Scales in mm. **AB, CD, E–G** to common scale.

Female genitalia: Subgenital plate (Fig. 2E) with egg guide round distally, invaginated basally and slightly sclerotized; pigment arms forming flat V-shaped regions and expanded laterally. Gonapophyses (Fig. 2F) with ventral valve distally tapering to slen-

der tip; dorsal valve broad with pointed distal process; outer valve oval, with posterior lobe slender and well pointed. Internal plate (Fig. 2G) brown around spermathecal opening and marginally, with rod-like dark brown sclerotization anteriorly.

Measurements. Male: Body length 2.5–3.2 mm; fore wing length 3.9–4.3 mm; hind wing length 2.9–3.6 mm. Female: Body length 3.2–3.9 mm; fore wing length 3.7–4.4 mm; hind wing length 2.6–3.2 mm.

Distribution. China (Gansu, Yunnan).

Discussion. The new species appears to be closely related to *N. hirticornis* (Reuter, 1893), *N. sakishimensis* (Yoshizawa, 2010) and *N. flavida* (Li, 1989) based on similarity of the hypandrium with posteromedian lobe convex distaromedially. However, it can be easily separated from them by the larger body size, by the structure of male clunium, and by the shape and sclerotized pattern of the female subgenital plate. The new species is distinguished from all the other *Neopsocopsis* species by the characteristic shape of the internal lobes of hypandrium.

***Neopsocopsis hirticornis* (Reuter, 1893)**
http://species-id.net/wiki/Neopsocopsis_hirticornis
Figures 1B, 3

Psocus hirticornis Reuter, 1893: 42.
Neopsocopsis hirticornis (Reuter). Badonnel, 1938: 239.
Psocus bastmannianus Enderlein, 1918: 487. Synonymy: Badonnel, 1938: 239.
Neopsocus pyrenainus Badonnel, 1935: 47. Synonymy: Badonnel, 1982: 261.
Pentablaste obconica Li, 2002: 1373, syn. n.
Pentablaste clavata Li, 2002: 1368, syn. n.

Material examined. *Pentablaste obconica* – Holotype ♂: China, Shanxi Prov., Wenshui Co., Guandishan Reg., 2.viii.1981 (FS Li); *Pentablaste clavata* – Holotype ♂: China, Hebei Prov., Pingquan Co., Guangtoushan Reg., 2.vii.1986 (FS Li). Other material examined. China: 1♂, Nei Mongol Aut. Reg., Alax Left. B., Helanshan Natural Reserve, 6.viii.2010 (YL Tian); 1♂, same locality, 13.viii.2010 (SG Liang); 2♂, Shanxi Prov., Wenshui Co., Guandishan Reg., 3.viii.1981 (CK Yang); 1♀, same locality, 3.viii.1981 (FS Li); 1♀, Hebei Prov., Pingquan Co., Guangtoushan Reg., 2.vii.1986 (FS Li); 1♂, Beijing M., Xiangshan Reg., 12.v.1962 (FS Li). Japan: 1♀, Kanagawa Pref., Yokohama C., Serigatani, 7.iv.2011 (Y Hoshino); 2♀, same locality and collector, 12.iv.2011.

Redescription. Male. Head creamy brown, with dark brown markings; compound eyes grayish black, ocelli black with grayish black ocellar field; antennae, labrum and maxillary palpi brown. Thorax brown with dark brown spots; legs brown, with band of dark brown marking on femur, tarsi and distal part of tibia dark brown. Fore wing (Fig. 1B) hyaline with brownish tinge, pterostigma dark brown with dark brown band along proximal margin; veins brown, except for Rs fork and M-Cu_{1a} fu-

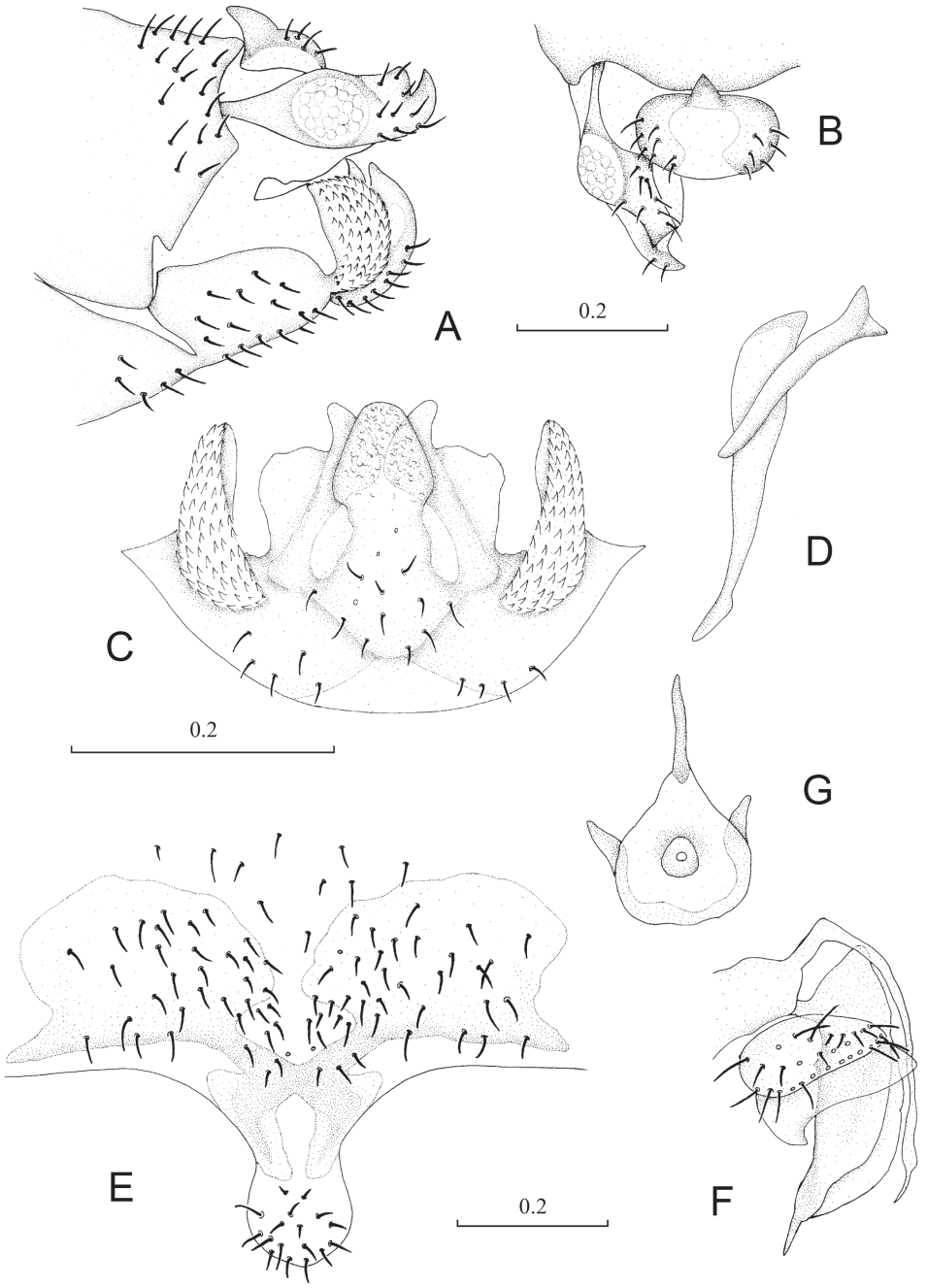

Figure 3. Terminalia of *Neopsocopsis hirticornis*. **A** terminalia, lateral view **B** terminalia, dorsal view **C** hypandrium, posterior view **D** phallosome, lateral view **E** subgenital plate, ventral view **F** gonapophyses **G** internal plate, ventral view. Scales in mm. **AB, CD, E–G** to common scale.

sion hyaline. Venation: Rs and M fused for very short distance; distal margin of discoidal cell straight; first and second sections of Cu_{1a} almost equal length, diverging at angle about 120°. Hind wing hyaline; veins brown.

Abdomen. Male genitalia: 8th sternum strongly sclerotized and fused to hypandrium. Clunium (Fig. 3A) with posterior margin convex medially and invaginated bilaterally. Epiproct (Fig. 3AB) swollen, unsclerotized medially, with sharp projection at middle of anterior margin. Paraproct (Fig. 3A) round and broadened distally. Hypandrium (Fig. 3C) 5-lobed, lateral lobes carinate with outer surface covering denticles; posteromedian lobe forming dorsal-curved structure, with distal margin smoothly round, basally with fan-shaped membranous regions; internal lobes well developed, with distal part crescent-like and directed dorsolaterally. Phallosome (Fig. 3D) free posteriorly, distally broadened and paired with parameres.

Female genitalia: Subgenital plate (Fig. 3E) with egg guide round distally, basally invaginated; pigment arms forming flat V-shaped regions and expanded laterally, posteriorly forked. Gonapophyses (Fig. 3F) with ventral valve distally tapering to slender tip; dorsal valve broad with pointed distal process; outer valve oval, with posterior lobe broad and well pointed. Internal plate (Fig. 3G) with brown coloration around spermathecal opening and marginally, with rod-like dark brown sclerotization anteriorly.

Measurements. Male: Body length 2.4–2.9 mm; fore wing length 3.2–4.5 mm; hind wing length 2.5–3.3 mm. Female: Body length 3.0–3.5 mm; fore wing length 3.7–4.5 mm; hind wing length 3.0–3.6 mm.

Distribution. China (Beijing, Gansu, Hebei, Hubei, Hunan, Jilin, Nei Mongol, Ningxia, Shanxi, Zhejiang: new distributional record); Finland; France; Germany; Hungary; Italy; Japan (new distributional record) ; Macedonia; Mongolia; Romania; Russia; Serbia; Spain; Sweden; Switzerland.

Discussion. *Pentablaste clavata* was described by Li (2002) based on one male and one female from Hebei, with the characters of the fore wing Sc ending at R and the crossvein Rs-M. *Pentablaste obconica* is the type species of Li's genus *Pentablaste*, which is the most widely distributed species of China. *Neopsocopsis hirticornis* is the type species of *Neopsocopsis*, distributed mainly in Europe. After reexamining all the specimens, we found they all have similar genitalia, but the crossvein Rs-M is not a stable character to distinguish *P. clavata* from the others. Thus we consider *P. obconica* and *P. clavata* be new junior synonyms of *N. hirticornis*. Females of *N. hirticornis* are mostly brachypterous (Vishnyakova 1986; Lienhard 1998), but a few macropterous females have also been recorded (Günther 1980, 1991; Hedström 1989). Females collected in Japan (new distributional record) are all brachypterous, but those from China are all macropterous. Therefore, there might be some genetic differences between Chinese and other populations of *N. hirticornis* but, in the absence of more distinct differences, we treat them as a single species. This species is similar to *Neopsocopsis sakishimensis* Yoshizawa, 2010 from Japan, however *N. hirticornis* can be distinguished by the larger body size and by the genitalic characters.

***Neopsocopsis longiptera* Vishnyakova, 1986**
http://species-id.net/wiki/Neopsocopsis_longiptera

Neopsocopsis longiptera Vishnyakova, 1986: 350.
Pentablaste tetraedrica Li, 2002: 1371, syn. n.

Material examined. *Pentablaste tetraedrica* – Holotype ♂: China, Hebei Prov., Pingquan Co., Guangtoushan Reg., 2.vii.1986 (FS Li). Other material examined. China: 2♂3♀, same locality and collector, 2.vii.1986; Japan: 1♂1♀, Fukuoka Pref., Hisayama C., Yamada, 5.vi.1994 (K Yoshizawa).

Distribution. China (Hebei: new distributional record); Russia; Japan.

Discussion. *Pentablaste tetraedrica* was described based on 3 males and 3 females from China. The species is distinguished from other Chinese species based on the character of the hypandrium posteromedian lobe lacking apically horn-like processes (Li, 2002). *Neopsocopsis longiptera* was described based on the specimens from the Russian Far East and differed from *Neopsocopsis hirticornis* (Reuter, 1893) in having a macropterous female and a larger male IO/D (Vishnyakova, 1986). After reexamining the two specimens, we found the main characters of the wings and genitalia are nearly identical. Thus we consider *P. tetraedrica* to be a new synonym of *N. longiptera*.

***Neopsocopsis quinquedentata* (Li & Yang, 1988)**
http://species-id.net/wiki/Neopsocopsis_quinquedentata
Figures 1C, 4

Blastopsocidus quinquedentata Li & Yang, 1988: 79.
Neopsocopsis quinquedentata (Li & Yang). Yoshizawa 2010: 36.

Material examined. Holotype ♂: China, Guizhou Prov., Jiangkou Co., Fanjingshan Natural Reserve, 27.vii.1983 (FS Li). Other material examined. China: 1♂, Guizhou Prov., Leishan Co., Leigongshan Natural Reserve, 14.iv.2005 (Y Tang).

Redescription. Male. Head creamy brown; compound eyes grayish black, ocelli black with grayish black ocellar field; antennae and labrum brown, maxillary palpi brown with apical segment lighter. Thorax brown with dark brown spots; legs brown, with band of dark brown marking on femur, tarsi and distal part of tibia dark colored. Fore wing (Fig. 1C) hyaline with light brownish tinge, pterostigma brown; veins brown, except for Rs fork and M-Cu_{1a} fusion hyaline. Venation: Rs and M fused for very short distance; distal margin of discoidal cell straight; first section of Cu_{1a} shorter than the second section, diverging at angle about 120°. Hind wing hyaline; veins brown.

Abdomen. Male genitalia: 8th sternum strongly sclerotized and fused to hypandrium. Clunium (Fig. 4A) with posterior margin sharply convex medially and with tiny projection bilaterally. Epiproct (Fig. 4AB) swollen, unsclerotized medially, with

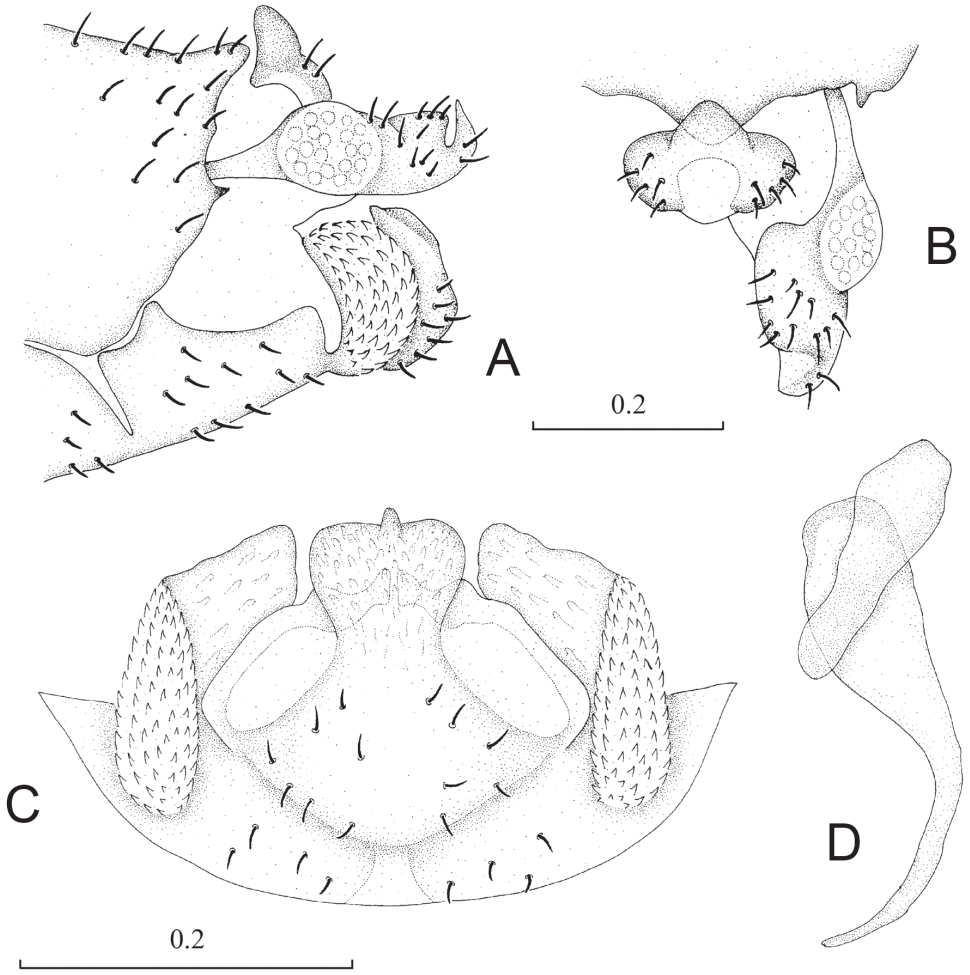

Figure 4. Terminalia of *Neopsocopsis quinquedentata*. **A** terminalia, lateral view **B** terminalia, dorsal view **C** hypandrium, posterior view **D** phallosome, lateral view Scales in mm. **AB, CD** to common scale.

moderate projection at middle of anterior margin. Paraproct (Fig. 4A) round and broadened distally. Hypandrium (Fig. 4C) 5-lobed, lateral lobes carinate with anterior part long and curved anteromedially, outer surface covering denticles; posteromedian lobe forming dorsal-curved structure, with distal margin almost straight and with tiny projection medially, basally with small membranous regions; internal lobes not well developed, much smaller than posteromedian lobe and distally bud-like. Phallosome (Fig. 4D) free posteriorly, distally broadened and paired with parameres.

Female unknown.

Measurements. Male: Body length 1.9–2.3 mm; fore wing length 4.0–4.1 mm; hind wing length 2.9–3.1 mm.

Distribution. China (Guizhou).

Discussion. *Neopsocopsis quinquedentata* was described based on one male from Guizhou, with the character of fore wing Rs-M fusion. It can be separated from other species by the hypandrial posteromedian lobe with projection medially, and by the characteristic structures of internal lobes and parameres.

***Neopsocopsis profunda* (Li, 1995)**
http://species-id.net/wiki/Neopsocopsis_profunda
Figures 1D, 5

Neoblaste profunda Li 1995: 186.
Neopsocopsis profunda (Li). Yoshizawa 2010:35.
Neoblaste schizopetala Li 1997: 488, syn. n.
Neoblaste flavae Li 1995: 187, syn. n.

Material examined. *Neoblaste profunda* – Holotype ♂: China, Zhejiang Prov., Qingyuan Co., Baishanzu Natural Reserve, 3.x.1993 (H Wu). *Neoblaste schizopetala* – Holotype ♂: China, Chongqing M., Fengdu Co., Shiping Reg., 5.x.1994 (FS Li). *Neoblaste flavae* – Holotype ♀: China, Zhejiang Prov., Qingyuan Co., Baishanzu Natural Reserve, 27.x.1993 (H Wu). Other material examined. China: 1♀3♂, Zhejiang Prov., Qingyuan Co., Baishanzu Natural Reserve, 20.xi.1993 (H Wu); 1♀, same locality and collector, 3.x.1993; 2♀, same locality and collector, 27.x.1993; 1♂, Chongqing M., Fengdu Co., Guicheng Reg., 4.x.1994 (FS Li); 1♀, Chongqing M., Fengdu Co., Shiping Reg., 5.x.1994 (FS Li); 1♂, Hubei Prov., Xingshan Co., Longmenhe Reg., 12.ix.1994 (FS Li); 1♀, Henan Prov., Luanchuan Co., Longyuwan Reg., 7.viii.2008 (WH Li).

Redescription. Male. Head yellowish, with brown markings; compound eyes grayish black, ocelli black with grayish black ocellar field; antennae and labrum brown, maxillary palpi brown with distal segments dark colored. Thorax brown with dark brown spots; legs pale brown. Fore wing (Fig. 1D) hyaline with yellowish tinge, pterostigma and veins brown, except for Rs fork and M-Cu_{1a} fusion hyaline. Venation: Rs and M connected by short crossvein or meeting at point; distal margin of discoidal cell straight; first and second sections of Cu_{1a} almost equal length, diverging at angle about 120°. Hind wing hyaline; veins brown.

Abdomen. Male genitalia: 8th sternum strongly sclerotized and fused to hypandrium. Clunium (Fig. 5A) with posterior margin convex medially and with slight invagination bilaterally. Epiproct (Fig. 5AB) swollen, unsclerotized medially, with round projection at middle of anterior margin. Paraproct (Fig. 5A) round and broadened distally. Hypandrium (Fig. 5C) 5-lobed, lateral lobes carintae with anterior part long and curved anteromedially, outer surface covering denticles; posteromedian lobe forming dorsal-curved structure, with distal margin concave and with tiny projection medially, basally with small membranous regions; internal lobes rod-like and distally forked. Phallosome (Fig. 5D) free posteriorly, distally broadened and paired with parameres.

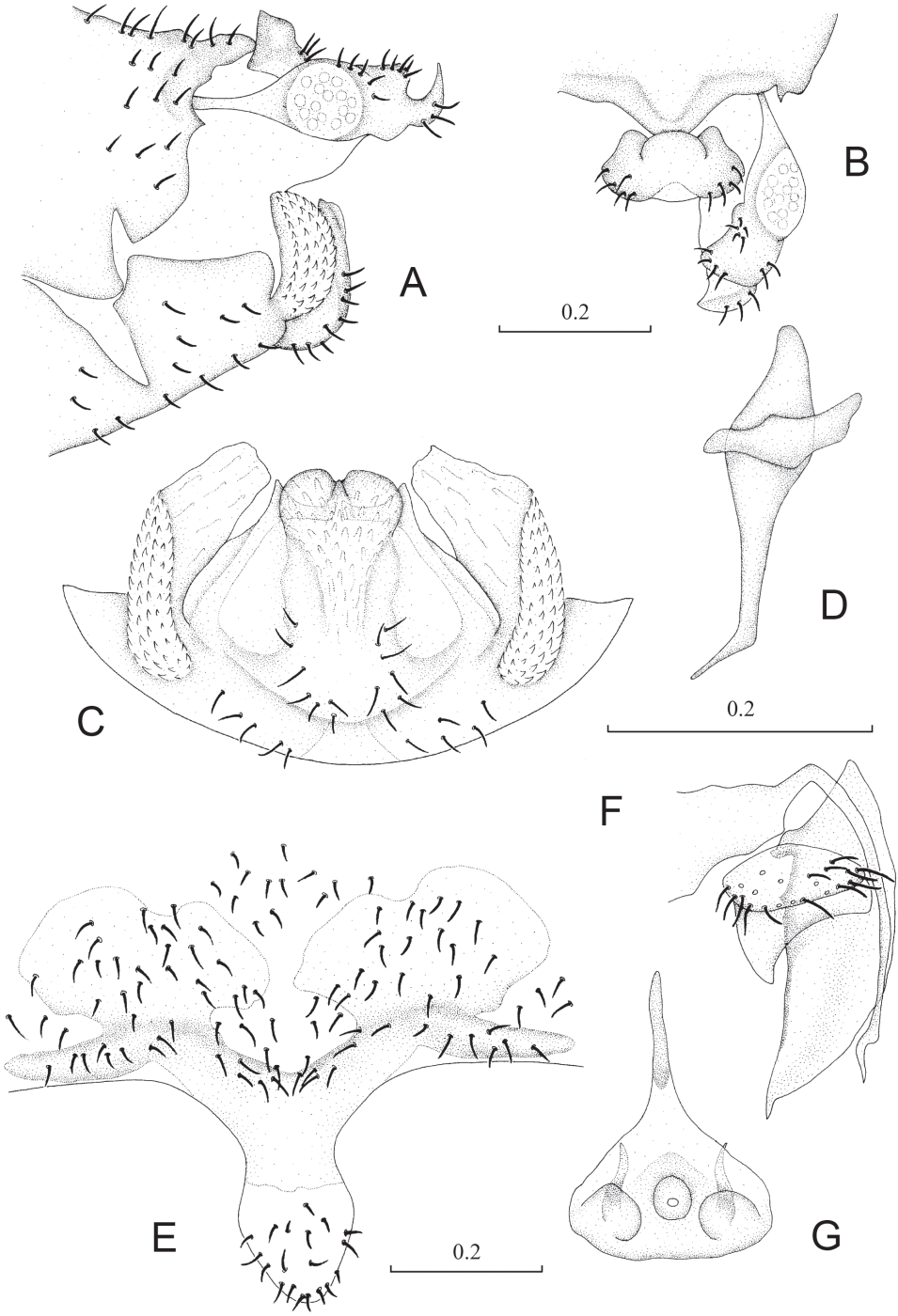

Figure 5. Terminalia of *Neopsocopsis profunda*. **A** terminalia, lateral view **B** terminalia, dorsal view **C** hypandrium, posterior view **D** phallosome, lateral view **E** subgenital plate, ventral view **F** gonapophyses **G** internal plate, ventral view. Scales in mm. **AB, CD, E–G** to common scale.

Female genitalia: Subgenital plate (Fig. 5E) with egg guide round with slightly narrowed margins distally, basally invaginated and sclerotized at basal 1/3; pigment arms forming flat V-shaped regions and expanded laterally. Gonapophyses (Fig. 5F) with ventral valve distally tapering to slender tip; dorsal valve broad with pointed distal process; outer valve oval, with posterior lobe broad and well pointed. Internal plate (Fig. 5G) with brown coloration around spermathecal opening and marginally, with rod-like dark brown sclerotization anteriorly.

Measurements. Male: Body length 3.0–3.2 mm; fore wing length 3.7–4.1 mm; hind wing length 2.9–3.1 mm. Female: Body length 3.1–3.5 mm; fore wing length 3.8–4.6 mm; hind wing length 2.8–3.4 mm.

Distribution. China (Chongqing, Henan, Hubei, Zhejiang).

Discussion. *Neoblaste profunda* was described by Li (1995) based on specimens from Zhejiang, and *Neoblaste schizopetala* was described on the basis of one male and one female from Chongqing (Li, 1997). Li pointed out that both species were very similar to *Neopsocopsis quinquedentata* (Li & Yang, 1988), and could be differentiated by characters of the male hypandrium and phallosome. *Neoblaste flavae* was described based on a single female specimen from Zhejiang, which was collected with a female of *Neopsocopsis profunda* and differed from the latter by larger body size and the form of the internal plate (Li 2002). After reexamining all the species, we found there are only minor differences between these three species, e.g. the color markings in fore wings and pigment patterns of the female subgenital plate. Therefore, we consider *Nb. schizopetala* and *Nb. flavae* to be two new synonyms of *N. profunda*. The species can be separated from the other species by the following features: hypandrial posteromedian lobe concave at distal margin with tiny projection medially, subgenital plate with egg guide sharply round distally and sclerotized at basal 1/3.

***Neopsocopsis flavida* (Li, 1989)**
http://species-id.net/wiki/Neopsocopsis_flavida
Figures 1E, 6

Blastopsocidus flavidus Li 1989: 46.
Neopsocopsis flavida (Li). Yoshizawa 2010: 35.
Blastopsocidus pini Li 1990: 5, syn. n.
Pentablaste lanceolata Li 2002: 1377, syn. n.

Material examined. *Blastopsocidus flavidus* – Holotype ♂: China, Guizhou Prov., Guiyang C., Huaxi D., 9.vi.1981 (FS Li). *Blastopsocidus pini* – Holotype ♂: China, Guizhou Prov., Guiyang C., Bagongli Reg., 21.viii.1988 (FS Li). *Pentablaste lanceolata* – Holotype ♂: Guizhou Prov., Guiyang C., Bagongli Reg., 21.viii.1988 (FS Li). Other material examined. China: 13♀22♂, Guizhou Prov., Guiyang C., Huaxi D., 9.vi.1981 (FS Li); 1♂, same locality and collector, 27.v.1981; 1♂, same locality and collector, 28.v.1981; 7♀3♂, Guizhou Prov., Guiyang C., Bagongli Reg., 21.viii.1988 (FS Li); 1♂, Guizhou

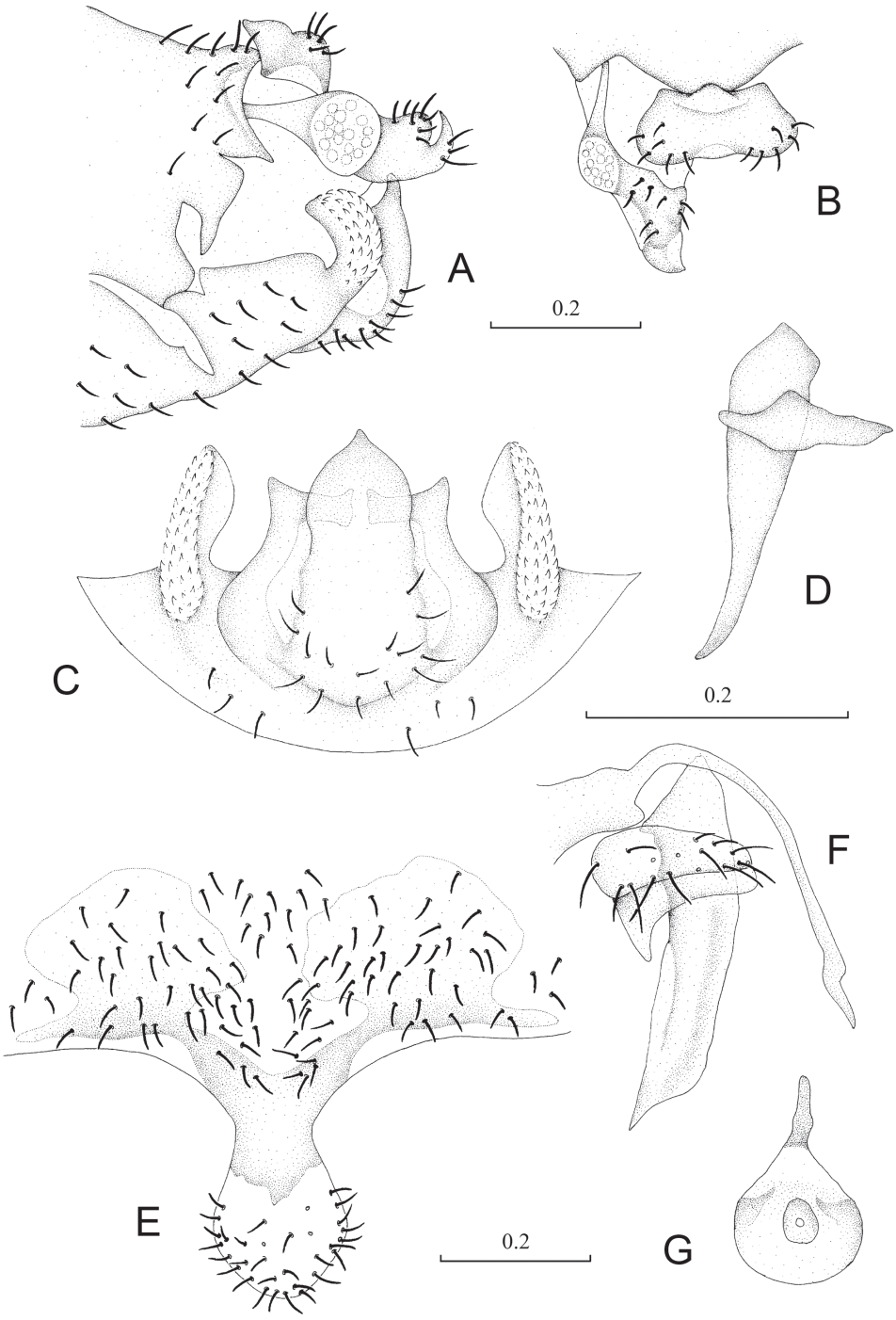

Figure 6. Terminalia of *Neopsocopsis flavida*. **A** terminalia, lateral view **B** terminalia, dorsal view **C** hypandrium, posterior view **D** phallosome, lateral view **E** subgenital plate, ventral view **F** gonapophyses **G** internal plate, ventral view. Scales in mm. **AB, CD, E–G** to common scale.

Prov., Leishan Co., Leigongshan Natural Reserve, 16.iv.2005 (Y Tang); 1♂, Fujian Prov., Nanping C., Wuyishan Reg., 4.vii.2009 (XS Yang); 4♀6♂, Hunan Prov., Hengyang C., Nanyue D., 20.vi.1963 (CK Yang); 1♂, Shanxi Prov., Wutai Co., Wutaishan Reg., 24.vii.1981 (FS Li); 1♂, Guangxi Prov., Longzhou Co., Nonggang Natural Reserve, 21.v.1982 (CK Yang); 1♀, Jiangxi Prov., Jiujiang C., Lushan Reg., 6.ix.1959 (CK Yang); 1♀1♂, Shaanxi Prov., Pingxiang C., Wugongshan Reg., 22.vii.1962 (CK Yang); 3♀3♂, Anhui Prov., Huangshan C., Huangshan Reg., 18.vii.1977 (FS Li).

Redescription. Male. Head brownish, with dark brown markings; compound eyes grayish black, ocelli black with grayish black ocellar field; antennae and labrum brown, maxillary palpi brown with distal segments dark colored. Thorax brown with dark brown spots dorsally; legs pale brown, with tarsi dark brown. Fore wing (Fig. 1E) hyaline with yellowish tinge, pterostigma and veins brown, except for Rs fork and M-Cu_{1a} fusion hyaline. Venation: Rs and M fused for short distance; distal margin of discoidal cell straight; first section of Cu_{1a} little longer than the second section, diverging at angle about 120°. Hind wing hyaline; veins brown.

Abdomen. Male genitalia: 8th sternum strongly sclerotized and fused to hypandrium. Clunium (Fig. 6A) with posterior margin convex medially. Epiproct (Fig. 6AB) swollen, unsclerotized medially, with round projection at middle of anterior margin. Paraproct broad. Hypandrium (Fig. 6C) 5-lobed, lateral lobes carinate with outer surface covering denticles; posteromedian lobe forming dorsal-curved structure, with distal margin convex tapering to point; internal lobes tortuous forming right-angle and distally not forked. Phallosome (Fig. 6D) free posteriorly, distally broadened and paired with parameres.

Female genitalia: Subgenital plate (Fig. 6E) with egg guide round distally, basally invaginated and sclerotized at basal 1/3; pigment arms forming flat V-shaped regions and expanded laterally. Gonapophyses (Fig. 6F) with ventral valve distally tapering to slender tip; dorsal valve long and narrow with pointed distal process; outer valve oval, with posterior lobe narrow and well pointed. Internal plate (Fig. 6G) with brown coloration around spermathecal opening and marginally, with rod-like dark brown sclerotization anteriorly.

Measurements. Male: Body length 2.1–2.9 mm; fore wing length 2.6–3.6 mm; hind wing length 2.0–2.7 mm. Female: Body length 2.6–3.3 mm; fore wing length 3.1–3.8 mm; hind wing length 2.4–2.9 mm.

Distribution. China (Anhui, Fujian, Guangxi, Guizhou, Hunan, Jiangxi, Shaanxi, Shanxi).

Discussion. These three species were very similar according to Li (1990, 2002). *Neopsocopsis flavida* was described based on the holotype specimen from Huaxi (Guiyang), with distribution range in central and southeast China. *Blastopsocidus pini* was described based on specimens from Bagongli (Guiyang), and could be differentiated from *N. flavida* by the fore wing veins M<M_{1+2} and by a smaller outer valve of the gonapophyses (Li, 1990). In 2002, Li described *Pentablaste lanceolata* based on 3 males which were formerly named under *B. pini*, with different character states of the postclypeus, paraproct and parameres. By our reexamination

of all these species, there are only minor differences among *N. flavida*, *B. pini* and *P. lanceolata*, and it is hardly possible to distinguish them from each other by the genitalic characters. Therefore, we consider *B. pini* and *P. lanceolata* to be new junior synonyms of *N. flavida*. The species is distinguished from the other species by the posteromedian lobe of the male hypandrium convex tapering to a point, by the pigmented pattern of the female subgenital plate and by the narrow dorsal valve of the gonapophyses.

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We would like to thank Xiu-Shuai Yang, Yan-Lin Tian, Si-Pei Liu, Jian-Xin Cui , Wei-Hai Li, Yi Tang and Shao-Guang Liang for their help collecting field materials, and not least thanks are due to Professor Xin-Li Wang for giving experimental equipment assistance. We are also much indebted to Professor Ding Yang and Associate Professor Xing-Yue Liu for their kind help. KY thanks Yasuo Hoshino for supplying the specimens of *N. hirticornis* which were collected from Japan for the first time. This research was supported by the National Natural Science Foundation of China (No. 31071962) and Foundation of the Ministry of Agriculture of China (No. 201103022)

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RESEARCH ARTICLE

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A key to known species of *Episcapha* (subgenus *Ephicaspa* Chûjô) (Coleoptera, Erotylidae, Megalodacnini), with the description of two new species

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Abstract

Two new species *Episcapha* (*Ephicaspa*) *lushuiensis* **sp. n.** and *Episcapha* (*Ephicaspa*) *quadriconcava* **sp. n.** are described and illustrated from China. A key to known species of subgenus *Ephicaspa* is provided. A map of the collecting sites is given.

Keywords

Coleoptera, Erotylidae, Megalodacnini, *Episcapha, Ephicaspa*, key, new species

Introduction

To date, 3 subgenera of the genus *Episcapha* Lacordaire, 1842 have been known (Lacordaire, 1842; Heller 1918; Chûjô 1969). Among them, subgenus *Ephicaspa* was elected by Chûjô for *Episcapha asahinai* Chûjô, 1936 as the type species. The subgenus *Ephicaspa* only included 3 species worldwide. *Episcapha* (*Ephicaspa*) *asahinai* Chûjô was described from China (Taiwan) to Japan (Chûjô 1936; Araki 1941; Chûjô 1969). *Episcapha* (*Ephicaspa*) *lewisi* Nakane was reported from Japan (Nakane 1950; Nakane 1955). *Episcapha* (*Ephicaspa*) *yunnanensis* Li & Ren was described from Yunnan Province, China (Li and Ren 2006).

In the current work, two new species of the subgenus *Ephicaspa* are described and illustrated. One new species, *Episcapha* (*Ephicaspa*) *lushuiensis* sp. n., was collected from Yunnan Province, China. The other new species, *Episcapha* (*Ephicaspa*) *quadriconcava* sp. n., was collected from Guangxi Zhuang Autonomous Region, China. A key to species of subgenus *Ephicaspa* is provided. A map (Fig. 23) of the collecting sites is given.

Methods

The specimens were collected by chopping deadwood in forests. They were killed with ethyl acetate and dried. The morphological examinations were carried out with a stereomicroscope. For an examination of the male or female genitalia, the last three abdominal segments were detached from the body after softening in hot water. For clearing, it was boiled for 5 minutes in 5% solution of potassium hydroxide, and then, washed in distilled water. Morphological figures were prepared using a Nikon SMZ1500 stereomicroscope. All measurements are given in millimetres. The habitus photos were taken with a Leica M205A camera. Holotypes and paratypes are deposited in the Museum of Hebei University (MHU), Hebei, P. R. China.

Morphological terminology predominantly follows Wegrzynowicz (1997) with changes according to Skelley and Leschen (2007).

The measurements of proportions are abbreviated as follows:

bl/bw – body length/width ratio;

pl/pw – pronotum length/width ratio.

Descriptions

***Episcapha* (*Ephicaspa*) *lushuiensis* sp. n.**

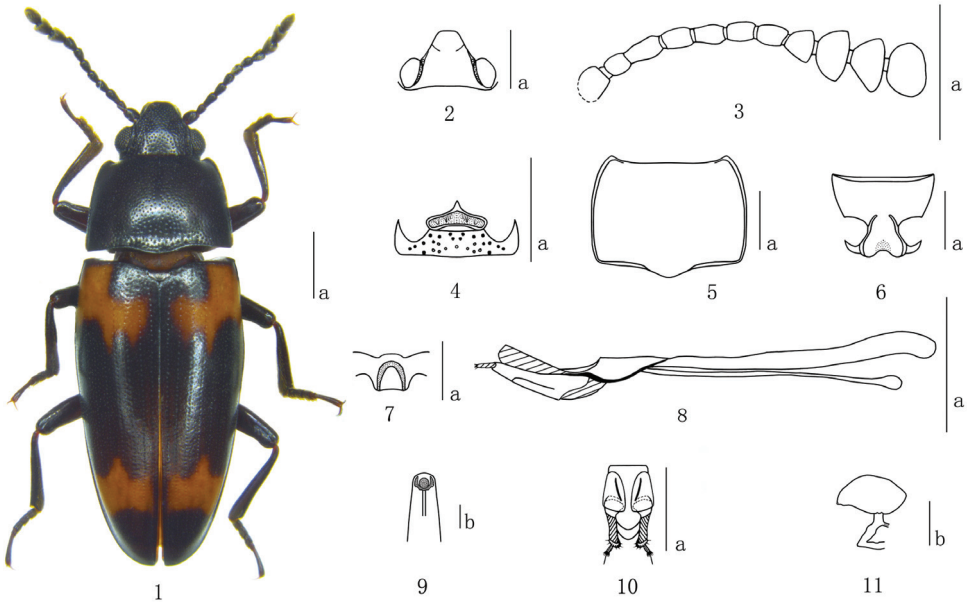
urn:lsid:zoobank.org:act:DFA4FEBC-E3BC-4C29-945C-D500E8093F0B

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

Type material. Holotype. male, CHINA: Yunnan Province, Lushui County, 25.9667°N, 98.8167°E, 11 May 2004, Zi-Zhong.YANG leg (MHU). Paratypes. 2 males, 8 females, same data as holotype (MHU).

Description. Body (Fig. 1) strongly elongate, length: 6.5–8.0mm; width: 2.3–3.0mm (bl/bw = 2.59–2.72; average = 2.63); general color black, moderately shining; mouthparts and tarsi brown to reddish brown. Each elytron with 2 orange bands; anterior band extending obliquely from humerus to near the suture, abruptly narrowed in middle, with 3 teeth on anterior border, reaching the base at the humeral angle; posterior band at four fifths length of elytron, extending from the suture to near the lateral border, with 3 teeth at anterior border, with posterior border slightly curved.

Head (Fig. 2) strongly and sparsely punctured on vertex, with ocular lines. Clypeus finely and closely punctured, with anterior border nearly straight, with a fovea



Figures 1–11. *Episcapha* (*Ephicaspa*) *lushuiensis* sp. n. **1** habitus **2** head **3** antenna **4** mentum **5** Pronotum **6** prosternum **7** mesoventrite **8** aedeagus in lateral views **9** anterior end of internal sac in anterodorsal view **10** female genitalia in ventral view **11** female spermatheca Scale bars: **a** = 1mm, **b** = 0.1mm.

on each side of the base. Eyes large, moderately prominent laterally. Antennae (Fig. 3) long, extending a little behind posterior border of pronotum; antennomere III about 1.3 times as long as IV; antennomere VIII slightly wider than VII, about 1.2 times as wide as long; antennomeres IX hemispherical; antennomere X almost asymmetrical triangular; antennomere XI roundly quadrate, slightly constricted in middle; relative lengths of antennomeres II–XI: 8.0: 14.5: 11.5: 12.0: 11.0: 12.0: 10.0: 12.0: 12.0: 15.0. Mentum (Fig. 4) pentagonal, pointed apically, with coarse punctures and setae; submentum roundly and roughly punctured.

Pronotum (Fig. 5) widest at base (pl/pw = 0.72–0.80; average = 0.75); sides almost parallel on posterior half, and slightly narrowing toward apex. Pronotum distinctly punctured on median area, slightly decreasing in size and increasing in density toward lateral areas. Anterior angles roundly projected; posterior angles nearly rectangulate. Prosternum (Fig. 6) strongly and rather closely punctured on the lateral areas, strongly and sparsely punctured on median area, with a longitudinal depression in the middle of base area. Prosternal process dilated apically; strongly emarginated at apical border. prosternal femoral lines convergent anteriorly.

Scutellum broadly pentagonal, finely and sparely punctured.

Elytra widest near base, then gradually narrowing to apex; each elytron with 8 striae; intervals with fine and sparse punctures, which are much finer than those in striae.

Mesoventrites (Fig. 7) finely and sparsely punctured, with an n-shaped depression medially.

Aedeagus (Fig. 8) slightly curved; median lobe narrow, with apex truncate in lateral view; median strut long, about 2.0 times as long as median lobe. Anterior end of internal sac as in Fig. 9.

Female genitalia (Fig. 10) with styli most narrow at base; proctigeral lobe acuminate apically; female spermatheca (Fig. 11) with head almost spindle shaped.

Distribution. Known only from the type locality (China: Yunnan Province, Lushui County).

Diagnosis. This new species is closest to *Episcapha* (*Ephicaspa*) *asahinai* Chûjô, 1936 due to similar form and color of the body. The new species can be distinguished from *Episcapha* (*Ephicaspa*) *asahinai* by antennomere III more than 1.8 times as long as II, prosternal femoral lines convergent anteriorly, body beneath with golden pubescence. *Episcapha* (*Ephicaspa*) *asahinai* with antennomere III about 1.5 times as long as II, prosternal femoral lines almost straight and parallel in front of the prosternal cavity, body beneath covered with grayish pubescence.

Etymology. The specific name derives from the type locality: Lushui County.

***Episcapha* (*Ephicaspa*) *quadriconcava* sp. n.**

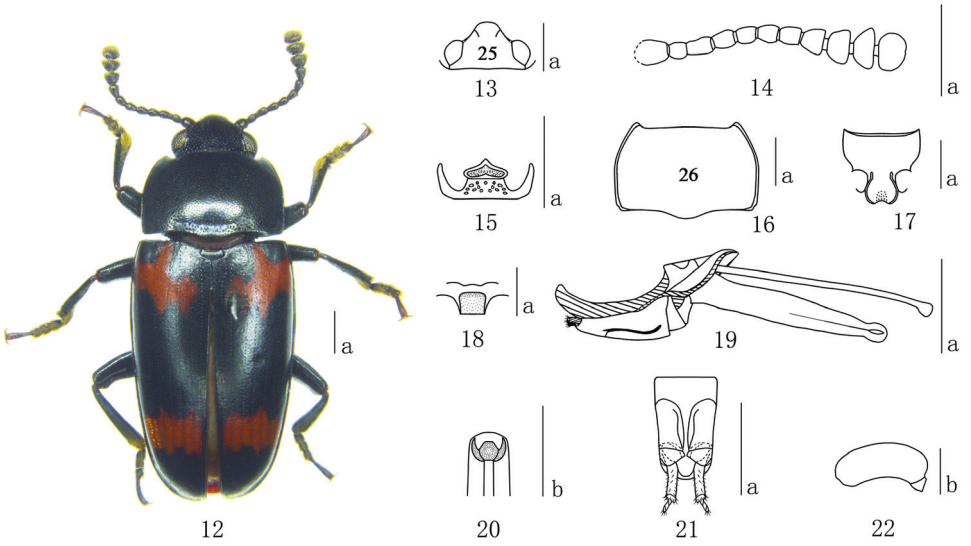
urn:lsid:zoobank.org:act:A1331079-C03F-4211-B836-94E12041B86E
http://species-id.net/wiki/Episcapha_quadriconcava

Type material. Holotype. female, CHINA: Guangxi Zhuang Autonomous Region, Leye County, 24.7833°N, 106.5666°E, 26 VII 2004, Yang YU and Chao GAO (MHU). Paratypes. 1 male and 4 females, same data as holotype (MHU).

Description. Body (Fig. 12) elongate, length: 8.5–9.1 mm; width: 3.3–3.6 mm (bl/bw = 2.53–2.58; average = 2.56); general color black and shining; mouthparts and tarsi brown. Each elytron with 2 orange bands; anterior band extending obliquely from humerus to the middle of striae I and II, with 3 teeth at anterior and posterior borders, not reaching base at humeral angle; posterior band at four fifths length of elytron, almost quadrate, extending from the suture to near the lateral border.

Head (Fig. 13) strongly and sparsely punctured on vertex, without ocular lines. Clypeus finely and closely punctured, with anterior border nearly straight, with a fovea on each side of the base. Eyes large, prominent laterally. Antennae (Fig. 14) long, extending behind posterior border of pronotum; antennomere III about 1.2 times as long as IV; antennomere VIII slightly wider than VII, about 1.2 times as wide as long; antennomere IX blow-shaped; antennomere X almost asymmetrical triangular; antennomere XI almost pentagonal; relative lengths of antennomeres II–XI: 8.0: 12.0: 10.0: 9.0: 9.0: 10.0: 10.0: 11.0: 10.0: 13.0. Mentum (Fig. 15) pentagonal, pointed apically, with fine punctures and short setae; submentum with sparse coarse punctures.

Pronotum (Fig. 16) widest at middle (pl/pw = 0.59–0.63; average = 0.61); sides almost parallel on posterior half, and narrowing toward apex. Pronotum distinctly punctured on median area; finely and closely punctured on the lateral areas; with a transverse depression at base. Anterior angles projected; posterior angles obtuse. Prosternum



Figures 12–22. *Episcapha* (*Ephicaspa*) *quadriconcava* sp. n. **12** habitus **13** head **14** antenna **15** Mentum **16** pronotum **17** prosternum **18** mesoventrite **19** aedeagus in lateral views **20** anterior end of internal sac in anterodorsal view **21** female genitalia in ventral view **22** female spermatheca Scale bars: **a** = 1mm, **b** = 0.2mm.

(Fig. 17) coarsely and densely punctured on lateral areas, almost confluent and forming oblique rugae; surface with golden pubescence. Prosternal process dilated apically; strongly emarginated at apical border; distinctly depressed in the middle. Prosternal femoral lines extended a little in front of the prosternal cavity, almost straight and parallel.

Scutellum pentagonal, with fine and spare punctures.

Elytra widest at one fourth from base, then gradually narrowing to apex; each elytron with 7 striae; intervals with fine punctures.

Mesoventrite (Fig. 18) finely and sparsely punctured, with a median quadrate depression; surface with pubescence.

Aedeagus (Fig. 19) with median lobe moderately curved, narrowing to a point in lateral view; median strut long, about 1.5 times as long as median lobe. Anterior end of internal sac as in Fig. 20.

Female genitalia (Fig. 21) with styli most narrow at apex; proctigeral lobes rounded apically; female spermatheca (Fig. 22) with head almost kidney-shaped.

Distribution. Known only from the type locality (China: Guangxi Zhuang Autonomous Region, Leye County).

Diagnosis. *Episcapha* (*Ephicaspa*) *quadriconcava* is closest to *Episcapha* (*Ephicaspa*) *yunnanensis* Li & Ren, 2006, due to the similar form and color of the body in both species. The new species can be distinguished from *Episcapha* (*Ephicaspa*) *yunnanensis* by the head without ocular lines, pronotum widest at middle, mesoventrite with a median quadrate depression, aedeagus with median lobe narrowing to a point in lateral view. *Episcapha* (*Ephicaspa*) *yunnanensis* with ocular lines on head, pronotum widest at

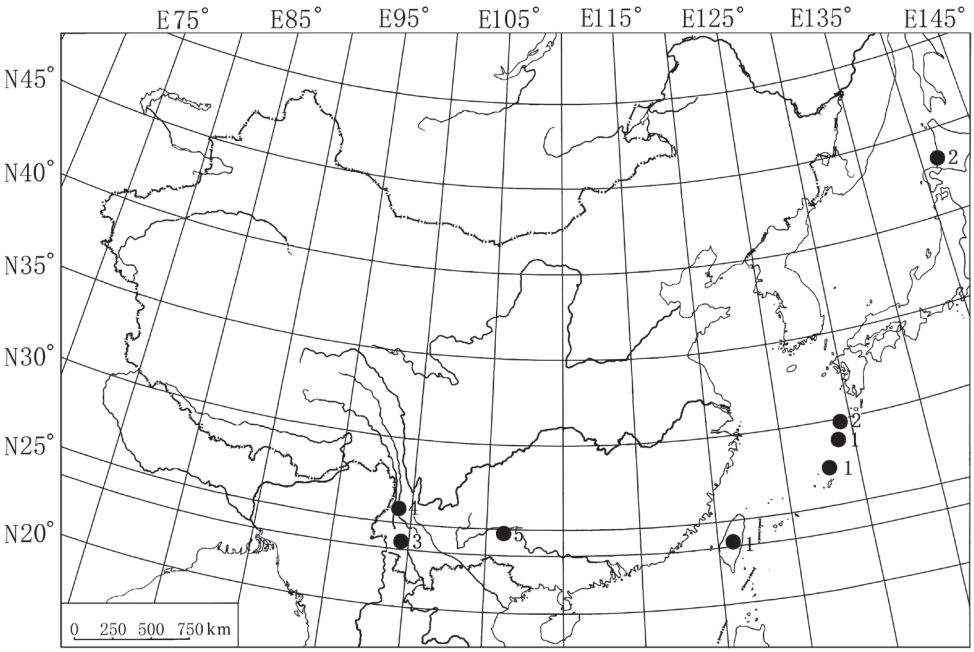


Figure 23. Map showing the collecting sites of the *Episcapha* (*Ephicaspa*) Chûjô. **1** *E.* (*E.*) *asahinai* Chûjô; **2** *E.* (*E.*) *lewisi* Nakane; **3** *E.* (*E.*) *yunnanensis* Li & Ren; **4** *E.* (*E.*) *lushuiensis* sp. n.; **5** *E.* (*E.*) *quadriconcava* sp. n.

base, mesoventrite with a median trapezoidal depression, aedeagus with median lobe hooked at apex in lateral view.

Etymology. The species is named with a quadrate depression on the median of mesoventrite.

Key to the species of subgenus *Ephicaspa* Chûjô

1 Elytron with the anterior band wholly occupying the latero-basal area including humerus **2**

– Elytron with the anterior band extending towards the basal border at each side of humerus **3**

2 Prosternal femoral lines almost straight and parallel in front of the prosternal cavity ..... ***E.* (*E.*) *asahinai* Chûjô**

– Prosternal femoral lines convergent anteriorly in front of the prosternal cavity (Fig. 6) ..... ***E.* (*E.*) *lushuiensis* sp. n.**

3 Scutellum broad triangular ..... ***E.* (*E.*) *lewisi* Nakane**

– Scutellum broad pentagonal **4**

4 Mesoventrites with a median obtrapeziform depression; aedeagus with median lobe hooked at apex in lateral view ..... ***E.* (*E.*) *yunnanensis* Li & Ren**

– Mesoventrite with a median quadrate depression (Fig. 18); aedeagus with median lobe narrowing to a point in lateral view (Fig. 19) ....***E.* (*E.*) *quadriconcava* sp. n.**

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RESEARCH ARTICLE

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Description of *Crassolabium persicum* sp. n. (Nematoda, Dorylaimida, Qudsianematidae), an interesting species from Iran

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Abstract

A new species of the genus *Crassolabium, C. persicum* **sp. n.**, collected from Arasbaran rangelands of Iran, is described and illustrated. It is characterized by its body 1.92–2.40 mm long, lip region offset by constriction and 17–19 µm wide, odontostyle 16–19 µm long with aperture occupying less than one–third (27–30%) its length, neck 428–690 µm long, pharyngeal expansion 369–390 µm long or occupying 54–56% of total neck length, female genital system amphidelphic, uterus bipartite and 162–218 µm long or 2.3–3.5 times as long as body diameter, *pars refringens vaginae* well developed, *V* = 54–57.5, vulva longitudinal, prerectum bearing a blind sac, tail conical with rounded tip to co-

noid (25–36 µm, *c*=60–69, *c'*=0.5–0.9), spicules 68–72 µm long, precloacal pair of supplements far (22–27 µm) from cloacal aperture, and 13–17 shortly spaced ventromedian supplements with hiatus. The new taxon is compared in depth to its relatives in *Crassolabium* as well as other similar species of *Aporcelaimellus* and *Amblydorylaimus*.

Keywords
Crassolabium, description, Dorylaimida, Iran, morphology, nematodes, new species, taxonomy

Introduction

The genus *Crassolabium* Yeates, 1967 (syn. *Thonus* Thorne, 1974) is a highly diverse and worldwide distributed dorylaimid taxon. According to the recent compendium provided by Peña-Santiago and Ciobanu (2011), it includes 33 valid species known to occur in 47 countries, islands and archipelagos. It is a rather heterogeneous nematode group, whose differentiation from the genera *Aporcelaimellus* Heyns, 1965 (syn. *Takamangai* Yeates, 1967) and *Labronema* Thorne, 1939 is occasionally intricate.

The dorylaimid fauna of Iran has not traditionally received much attention. This situation has significantly changed during recent years, when a series of contributions – see, for instance, Pedram et al. (2011) and the references cited therein – have revealed it is rich in species, many of them previously unknown. Concerning presence of the genus *Crassolabium*, in Iran, Mowlavi et al. (2012) very recently reported the presence of *C. rhopalocercum* (de Man, 1876) Peña-Santiago and Ciobanu 2008, but there is no other available information.

During a general nematological survey in natural and cultivated areas, a few female and male specimens belonging to this genus were collected. Its study revealed this material belongs to a non-described and interesting species, which is the matter of this contribution.

Material and methods

Soil samples were collected from Mahmood Abad, Arasbaran rangelands, northwest Iran, during 2009–2010. The nematodes were extracted by a modified combined sieving and centrifugation flotation method (Jenkins 1964), processed to anhydrous glycerine following De Grisse's (1969) technique, and mounted on permanent glass slides for handling. Morphometric data were obtained using a drawing tube attached to an Olympus BX 41 light microscope. Morphometrics included de Man's indices and other measurements traditionally diagnostic for the group. Some of the best-preserved specimens were photographed with a Nikon Eclipse 80i microscope and a Nikon DS digital camera. Raw photographs were edited using Adobe® Photoshop® CS. Drawings were made using a *camera lucida* attached to Nikon Eclipse 80i microscope.

Taxonomy

***Crassolabium persicum* sp. n.**
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http://species-id.net/wiki/Crassolabium_persicum
Figures 1, 2

Material examined. Five females and four males, in excellent state of preservation.

Measurements. See Table 1.

Description. *Adult.* Slender nematodes of medium size, 1.92–2.40 mm long. Body cylindrical, slightly tapering towards both ends. Habitus more or less curved ventrad upon fixation, adopting an open 'C' shape. Cuticle dorylaimoid, with very fine transverse striation, sometimes difficult to distinguish; 3.5–5.0 µm thick in anterior region, 5.5–8.0 µm at mid–body and 8–13 µm on tail. Lateral chord 10–18 µm wide at mid–body, occupying 15–30% of mid–body diameter; lateral pores readily visible, arranged in two rows along both margins of lateral chord. Lip region truncate, somewhat angular, offset by marked constriction, 3.0–4.0 times as broad as high and 25–36% of body diameter at neck base; lips moderately separated; labial and cephalic papillae protruding. Amphid fovea funnel–like, its opening occupying 10–11 µm or three–fifths (60%) of lip region diameter. Odontostyle quite robust, wider than adjacent cuticle, 4–6 times as long as wide, 1.0–1.1 times the lip region diameter and 0.8–1.1% of body length; aperture occupying less than one–third (27–30%) its length. Guiding ring simple but distinct, at 10–12 µm or 0.5–0.7 times the lip region diameter from anterior end. Odontophore rod–like, lacking any differentiation, 1.1–1.4 times the odontostyle length. Pharynx consisting of a slender but muscular anterior portion enlarging gradually; basal expansion 9–11 times as long as broad, 5.3–6.0 times longer than body diameter at neck base, and occupying more than half (54–56%) of total neck length; pharyngeal gland nuclei situated as follows: DO = 46–50%, DN = 48–53%, S_1N_1 = 72–76%, S_1N_2 = 76–81%, S_2N = 87–90%. Of note, S_1N are significantly smaller than S_2N. Nerve ring located at 155–187 µm or 32–41% of total neck length. Cardia tongue–like, 12–19 x 11–16 µm and surrounded by intestinal wall.

Female. Genital system didelphic-amphidelphic, with both branches well and equally developed, the anterior 364–476 µm long or 15–18% of total body length, and the posterior 358–395 µm long or 14–16% of total body length. Ovaries reflexed, moderately developed, sometimes reaching and surpassing the sphincter level; the anterior 114–131 µm, the posterior 101–127 µm long; oocytes arranged distally in several rows and then proximally in a single row. Oviduct joining ovary, 88–130 µm long or 1.3–1.8 body diameters and consisting of a tubular part and a moderately developed *pars dilatata* with small lumen. Oviduct-uterus junction marked by a distinct sphincter. Uterus 162–218 µm long or 2.3–3.5 times the corresponding body diameter, bipartite, *i.e.,* consisting of two sections with variable length: a wider proximal region with distinct lumen containing abundant sperm cells, and a distal part with narrow lumen and globular walls surrounded

Table 1. Morphometric data of *Crassolabium persicum* sp. n. Measurements in µm except L in mm, and in the form: mean ± standard deviation (range).

	Holotype	Paratypes	Paratypes
Character n	♀	**5**♀♀	**4**♂♂
L	2.33	2.22±0.19 (1.92–2.40)	2.24±0.09 (2.13–2.34)
a	34	31.9±1.4 (30–34)	34.2±2.4 (32–38)
b	3.5	4.0±0.36 (3.5–4.2)	4.0±0.4 (3.7–4.7)
c	68	64.8±3.5 (60–69)	69.5±3.1 (63–72)
c’	0.7	0.74±0.14 (0.5–0.9)	0.75±0.09 (0.6–0.8)
V	57	57±1.75 (54–57.5)	–
Lip region diameter	17.5	17.8±0.6 (17–19)	18.2±2.5 (17–19)
Odontostyle length	19	17.5±0.9 (16–19)	18.6±1.2 (18–20)
Odontophore length	27.5	28.5±1.4 (26–31)	28.6±1.9 (27–31)
Guiding ring – anterior end	10	11.0±1.3 (10–12)	11.2±0.5 (11–12)
Neck length	690	428–690	542–569
Pharyngeal expansion length	380	369–390	308–315
Body diameter at neck base	65	68±2.1 (58–71)	62.6±7.6 (57–64)
mid–body	69	69.5±3.5 (63–74)	65.5±4.0 (61–69)
anus/cloaca	43	42.2±2.0 (38–44)	40.1±1.8 (39–43)
Rectum length	34	35.1±6.5 (29–40)	35.0±0.9 (34–36)
Prerectum length	68	67.5±11.5 (57–102)	70±9.0 (62–112)
Tail length	33	34.3±2.5 (25–36)	31.6±4.6 (25–35)
Spicule**s** length	–	–	70.1±1.3 (68–72)
Ventromedian supplements	–	–	(13–17)

by circular muscles. Vagina extending inwards 32–45 µm or less than half (36–44%) of the corresponding body diameter; *pars proximalis* longer than wide, 26–40 × 19–22 µm, with slightly sigmoid walls and surrounded by moderately developed musculature; *pars refringens* with (in lateral view) two distinct, trapezoidal, closely-spaced pieces, measuring 6–8 × 8–11 µm and with a combined width of 17–21 µm; *pars distalis* very short, with two small sclerotizations close to the *pars refringens*. Vulva a post–equatorial longitudinal slit appearing in lateral view as a short longitudinal depression. Prerectum 1.3–2.1 anal body diameters long, with a well developed blind sac. Rectum 0.9–1.3 times the anal body diameter. Tail short, conical with rounded tip to conoid, ventrally nearly straight, dorsally more convex. Two pairs of caudal pores, one subdorsal, other lateral or subventral.

Male. Genital system diorchic, with opposite testes. In addition to the adcloacal pair, situated at 22–27 µm from cloacal aperture, there is a series of 13–17 shortly and regularly spaced (11–16 µm apart) ventromedian supplements, outside the range of spicules; posterior-most ventromedian supplement located at 47–53 µm from adcloacal pair. Spicules strongly curved ventrad and moderately robust, 4.0–5.0 times as long as wide and 1.6–1.7 anal body diameter long. Lateral guiding pieces short and robust, 11–16 µm long, 2.5–4.0 times as long as wide, with

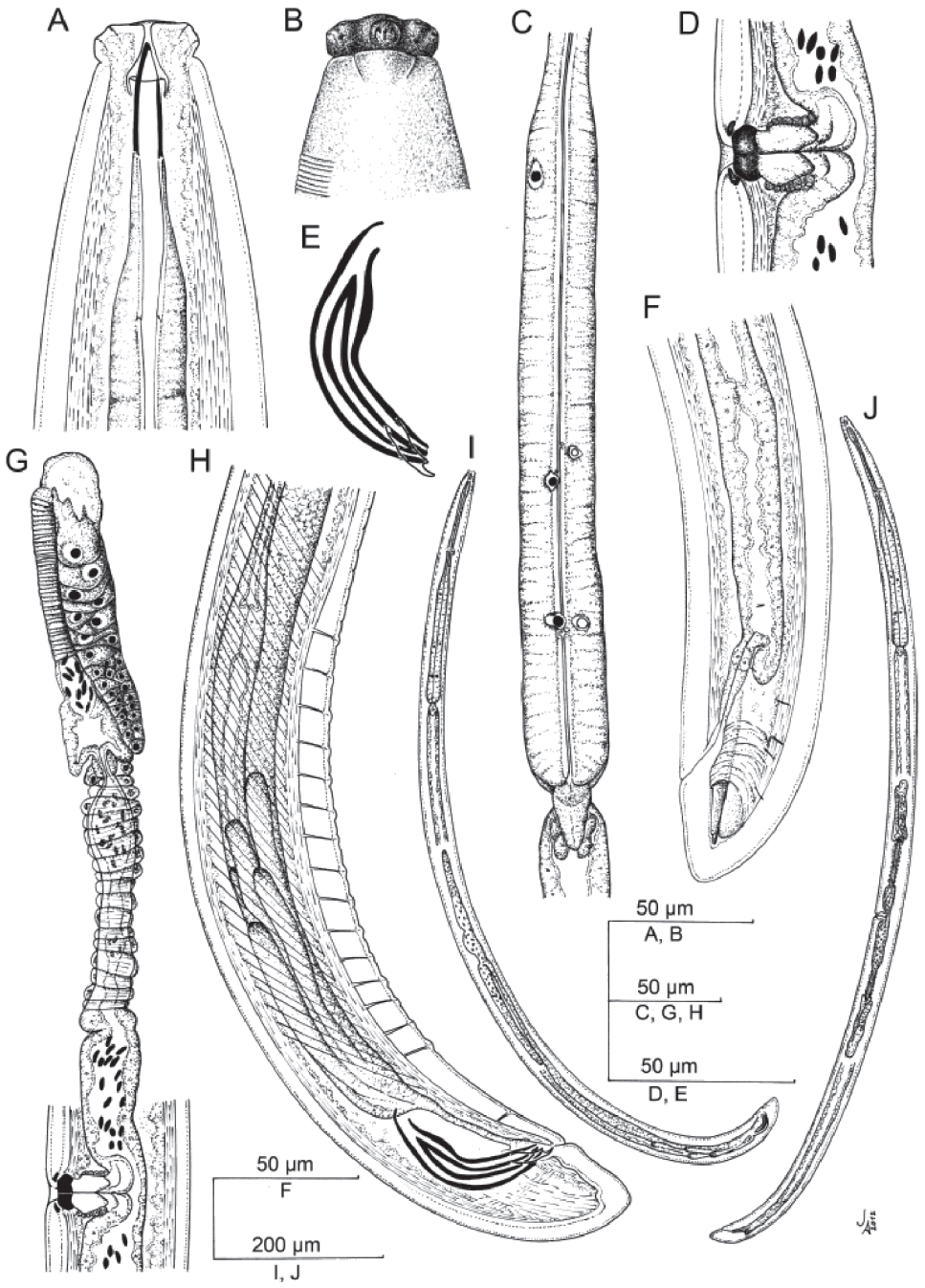

Figure 1. *Crassolabium persicum* sp. n. (all images are in lateral view) **A** Anterior region **B** Lip region and amphid fovea in surface **C** Pharyngeal expansion **D** Vagina **E** Spicules and lateral guiding piece **F** Female, posterior body region **G** Female, anterior genital branch **H** Male, posterior body region **I** Male, entire **J** Female, entire.

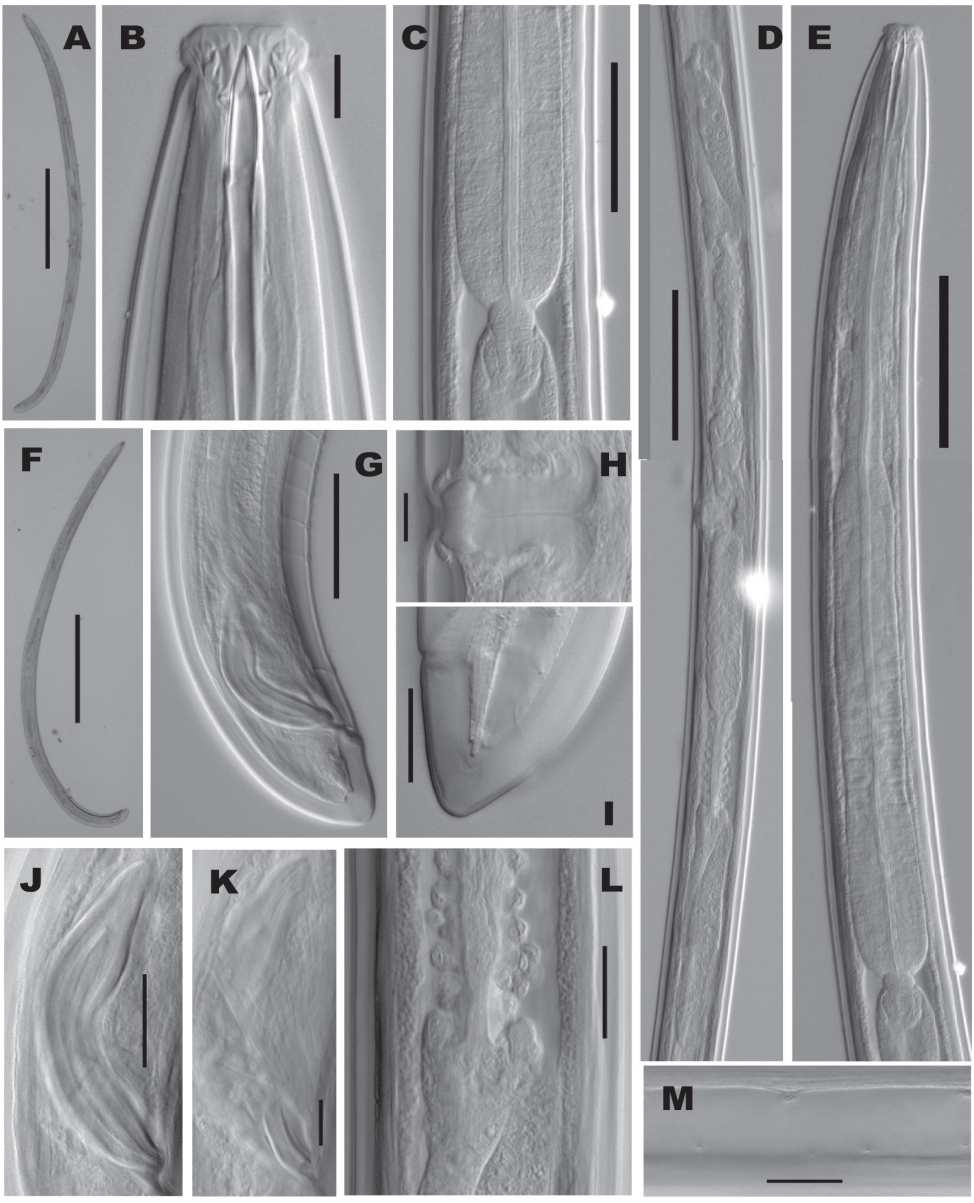

Figure 2. *Crassolabium persicum* sp. n. (light micrographs all in lateral view). **A** Female, entire **B** Anterior region **C** Pharyngo–intestinal junction **D** Female, genital system **E** Neck region **F** Male, entire **G** Male, posterior region **H** Vagina **I** Female, caudal region **J** Spicules **K** Lateral guiding piece **L** Oviduct–uterus junction **M** Lateral chord and pores. (Scale bars: **A, F –** 500 μm; **B, H, K –** 10 μm; **C, G –** 50 μm; **D, E –** 100 μm; **I, J, L, M –** 20 μm).

bifurcate terminus in which the posterior arm is visibly longer than the anterior one. Prerectum length 1.7–2.3 times the anal body diameter. Tail somewhat more conoid than that of female.

Diagnosis. The new species is characterized by body length of 1.92–2.40 mm , lip region offset by constriction and 17–19 µm wide, odontostyle 16–19 µm long with aperture occupying less than one-third (27–30%) its length, neck 428–690 µm long, pharyngeal expansion 369–390 µm long or occupying 54–56% of total neck length, female genital system amphidelphic, uterus bipartite and 162–218 µm long or 2.3–3.5 times as long as body diameter, *pars refringens vaginae* well developed, *V* = 54–57.5, vulva longitudinal, prerectum bearing a blind sac, tail conical with rounded tip to conoid (25–36 µm, *c* = 60–69, *c'* = 0.5–0.9), spicules 68–72 µm long, precloacal pair of supplements well far (22–27 µm) from cloacal aperture, and 13–17 shortly spaced ventromedian supplements with hiatus.

Relationships. The general pattern of this species fits well with that of the genus *Crassolabium*. It resembles *C. diversum* (Ciobanu, Popovici, Abolafia & Peña-Santiago, 2007) Peña–Santiago and Ciobanu 2008*, C. major* (Thorne, 1974) Peña-Santiago and Ciobanu 2008*, C. montanum* (Ciobanu, Popovici, Abolafia & Peña-Santiago, 2007) Peña-Santiago and Ciobanu 2008 and *C. vietnamense* Vu, Ciobanu, Abolafia & Peña-Santiago, 2010. It differs from *C. diversum* in its larger body (*vs L* = 1.19–1.96 mm), longer pharyngeal expansion (*vs* 350–410 µm long or 40–48% of total neck length), vulva longitudinal (*vs* transverse), longer tail (*vs* 18–23 µm), longer spicules (*vs* 46–54 µm) and higher number of ventromedian supplements (*vs* 4–7). From *C. major* in its larger body (*vs L* = 1.5 mm), longer odontostyle (*vs* 13 µm long), vulva longitudinal (*vs* transverse), female tail more conical (*vs* rounded), longer spicules (*vs* about 50 µm) and higher number of ventromedian supplements (*vs* 9). From *C. montanum* in its larger body (*vs L* = 1.56–1.90 mm), lip region offset by constriction (*vs* continuous or offset by depression), shorter odontostyle (*vs* 20–22 µm), longer and bipartite uterus (*vs* 1.0–1.5 times the body diameter and simple), tail lacking (*vs* abundant) blister–like structures, and male as frequent as female (*vs* absent). From *C. vietnamense* in its larger body (*vs L* = 1.55–1.88 mm), shorter odontostyle (*vs* 19–22 µm), uterus bipartite (*vs* tripartite, with a distal, spherical region), vulva longitudinal (*vs* transverse), longer spicules (*vs* 53–55 µm), higher number of ventromedian supplements (*vs* 8–9), and hiatus present (*vs* two ventromedian supplements within the range of spicules).

The new species is also comparable to *Aporcelaimellus index* (Thorne, 1939) Andrássy 1986, in its general morphology and morphometry as well as the peculiar shape of lateral guiding pieces being short, robust and with bifurcate terminus in which the posterior arm is visibly longer than the anterior one, forming digitations, hence the specific name *index* as stated by Thorne (1939). *Aporcelaimellus index* is a very atypical member of *Aporcelaimellus* Heyns, 1965 because the odontostyle aperture is distinctly shorter than half its total length, making its identity questionable, and indicating further studies for its elucidation. It was originally described on the base of only one male specimen from Utah (U.S.A.), and later reported, also with only one male specimen, from Mongolia by Andrássy (1964). The new species herein described differs from *A. index* in the position of the pre-cloacal pair of male genital papillae (*vs* closer to cloacal aperture) and in the number (*vs* 25–27) and arrangement (*vs* contiguous) of ventromedian supplements.

Finally, in the location of the pre-cloacal pair of male genital papillae - comparatively far from cloacal aperture, indeed a very unusual feature in dorylaims -the new species is reminiscent of the genus *Amblydorylaimus* Andrássy, 1998, with the type and only species *A. isokaryon* (Loof, 1975) Andrássy 1998, but it differs from this in the nature of odontostyle (*vs* weakly sclerotized and longer, 31–35 µm long), S_1N much smaller than DN and S_2N (*vs* equally sized all of them), and hiatus present (*vs* absent).

Type habitat and locality. The soil samples were collected from Mahmood Abad region (GPS coordinates: 38°48'N, 46°51'E), Arasbaran rangelands, East Azarbaijan province, north-west Iran.

Type material. Female holotype, two female paratypes and three male paratypes are deposited in Nematode Collection, Faculty of Agriculture, University of Tabriz, Tabriz, Iran. One female paratype and one male paratype with nematode collection of Departamento de Biología Animal, Biología Vegetal y Ecología, Universidad de Jaén, Spain.

Etymology. The specific epithet refers to the geographical area where the new species was collected from.

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Water mites (Acari, Hydrachnidia) from Baishih River drainage in Northern Taiwan, with description of two new species

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Abstract

New records of water mites (Acari: Hydrachnidia) from Baishih River drainage of north Taiwan, are presented. Twelve species are recorded, of which ten are new for Taiwan; two of them, *Torrenticola projectura* and *Hygrobates taiwanicus* are described as new for science.

Keywords

Acari, water mites, new species, running waters, Baishih River drainage, Taiwan

Introduction

Taiwan is a large island (35, 881 km^2) located in the Asian Pacific region. As the Tropic of Cancer bisects the Island, the climate changes from subtropical to tropical from the northern to southern parts of the island. The climate of Taiwan is

heavily influenced by monsoons and typhoons which bring an annual rainfall of ~ 2150 mm, with 80% of precipitation concentrated in the summer (or wet season), i.e. May–October. As there is a central mountain range extending from the north to the south of the island with surrounding plateau and hills, two third of the island is covered by mountainous area with an elevation 100–>3000 m. All rivers in Taiwan are characterized by short length and steep gradient with rapid flows and small drainage basins associated with the steep terrain. Such diverse patterns of geographical typology and hydrology result in the high levels of habitat heterogeneity and aquatic biodiversity of the Taiwan rivers (Shih et al. 2007).

Water mites are one of the most ubiquitous components of the lotic communities. However, detailed investigation on their taxonomy, distribution and ecology is generally lacking in the Asian Pacific region. Furthermore, the water mite fauna of Taiwan is very incompletely known. Recently, we published the results of the first collection of water mites from Taiwan, listing three species of the family Torrenticolidae, two of them were new to science (Pešić et al. 2011). During 2009–2010, in our study of the ecological responses of aquatic macrozoobenthos to land-use and environmental disturbances in Baishih River from the northern Taiwan (Fig. 1), we conducted a bimonthly biodiversity survey at the six study sites located in this drainage network. The present samples of water mites were collected in this survey.

Baishih River system is located in the northern Taiwan. It is one of the major upstream feeder tributary of the urbanised Xindian River which runs into Danshui River in the New Taipei City. Baishih River originates from both Mount Sanfonsun and Mount Yingtzuling, and drains southwestward into Feitsui Reservoir which provides water supply for the population of the Taipei metropolitan area. Baishih River is ~50 km long and the catchment area is about 310 km^2. The present study focused on two major tributaries Chinkualiao Stream and Diyu Stream of Baishih River drainage. All study sites are relatively undisturbed by human activities as both Chinkualiao Stream and Diyu Stream are located within the protected area. The riparian area is dominated by natural forest with discontinuous distribution of cultivated land owned by local villagers.

The paper aims to describe the diversity and distribution pattern of water mites from the northern Taiwan. In the present study, twelve species are identified, two of them are new to science. Descriptions of these species are given in this paper.

Material and methods

In this study, water mites were collected at six sampling sites (Table 1; Figs 1, 2A–F) using standard Surber sampling method with WaterMark® Surber Type Stream Bottom Sampler (500 μm mesh). Water mites were sorted in the laboratory with the aid of a stereo microscope and preserved in 90% ethanol. All the material has been collected by Rita Yam and this is not repeated in the text. Holotypes and paratypes of the new species are deposited in the National Museum of Natural Science (NMNS), Taichung, Taiwan. Other materi-

Table 1. List of the sampling sites in the present study.

Site code	Latitude	Longitude	Catchment	Subcatchment	Altitude (m asl)
BA-1	121.656242°E	24.882695°N	Baishih River	Chinkualiao Stream	365
BA-2	121.656328°E	24.883970°N	Baishih River	Chinkualiao Stream	343
BA-3	121.674029°E	24.924912°N	Baishih River	Chinkualiao Stream	250
BA-4	121.701640°E	24.908065°N	Baishih River	Diyu Stream	232
BA-5	121.697561°E	24.915911°N	Baishih River	Diyu Stream	210
BA-6	121.696603°E	24.933962°N	Baishih River	Diyu Stream	190

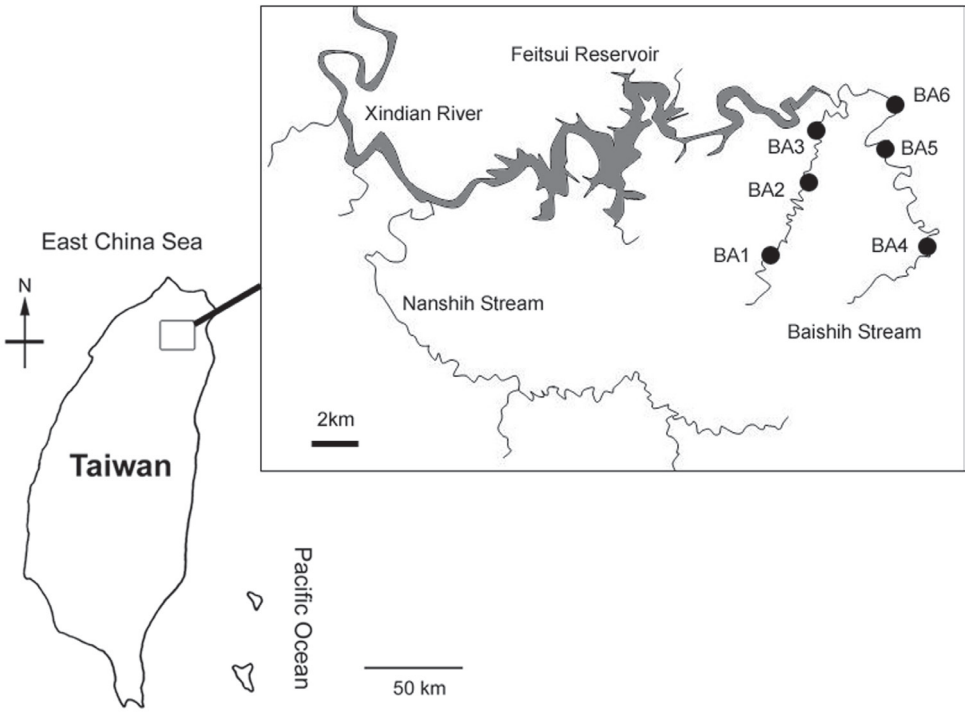

Figure 1. Map of study area showing location of the six sampling sites.

als are kept in the collections of the Ecology and Conservation Laboratory, Department of Bioenvironmental Systems Engineering, National Taiwan University (ECL).

In the section 'Material examined', the sampling site codes were derived from the geographical database Rita Yam (see Table 1). The composition of the material is given as: males/females/deutonymphs or adults/deutonymphs. All measurements are given in μm. The following abbreviations are used: asl = above sea level, Cx-I = first coxae, Cxgl-4 = coxoglandularia of fourth coxae, dL = dorsal length, H = height, L = length, W = width, I-L-6 = Leg 1, sixth segment (tarsus), mL = medial length, n = number of specimens examined, P-1 = palp, first segment, Vgl-2 = ventroglandulare 2.

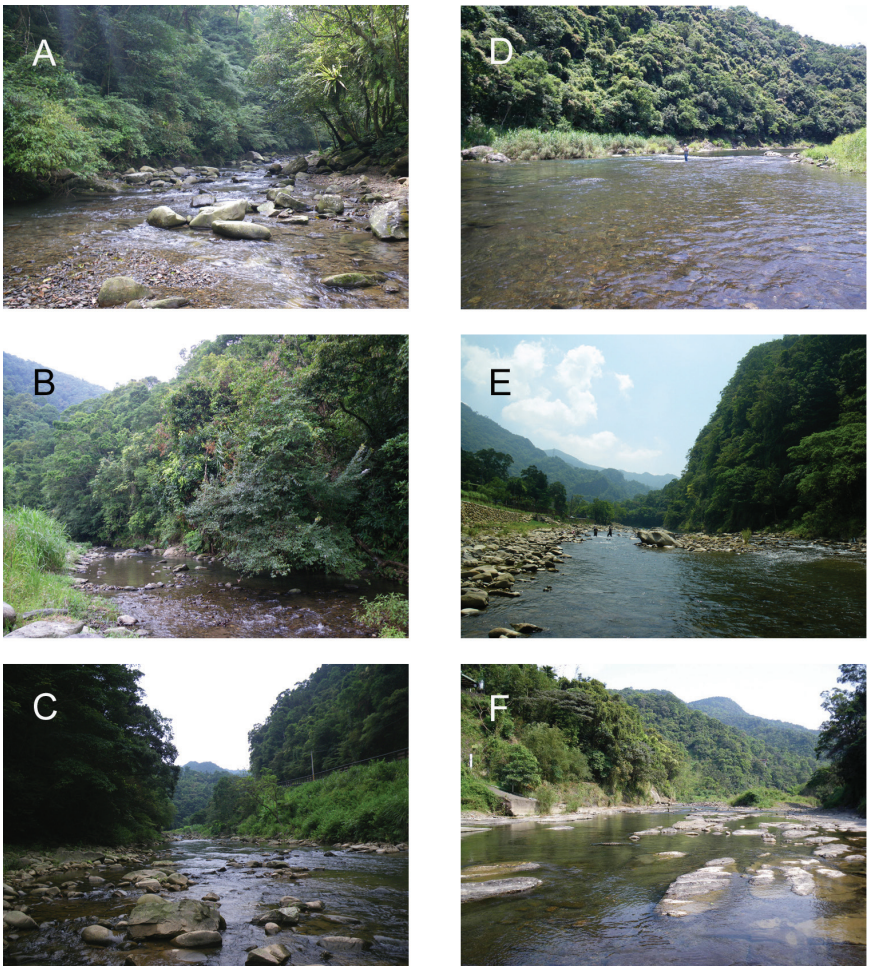

Figure 2. Photographs of the six study sampling sites in the present study. **A** = BA-1 **B** = BA-2 **C** = BA-3 **D** = BA-4 **E** = BA-5 **F** = BA-6.

Systematics

Family Hydrodromidae K. Viets
Genus *Hydrodroma* Koch, 1837

***Hydrodroma* cf. *rheophila* Cook, 1967**
http://species-id.net/wiki/Hydrodroma_rheophila
Fig. 3A

Material examined. ECL-BA-1: 01.vii.2010 0/1/0 (mounted).

Remarks. Due to the presence of a single, short swimming hair on segments four and five of the third and fourth legs and the shape of palp (Fig. 3A), the single

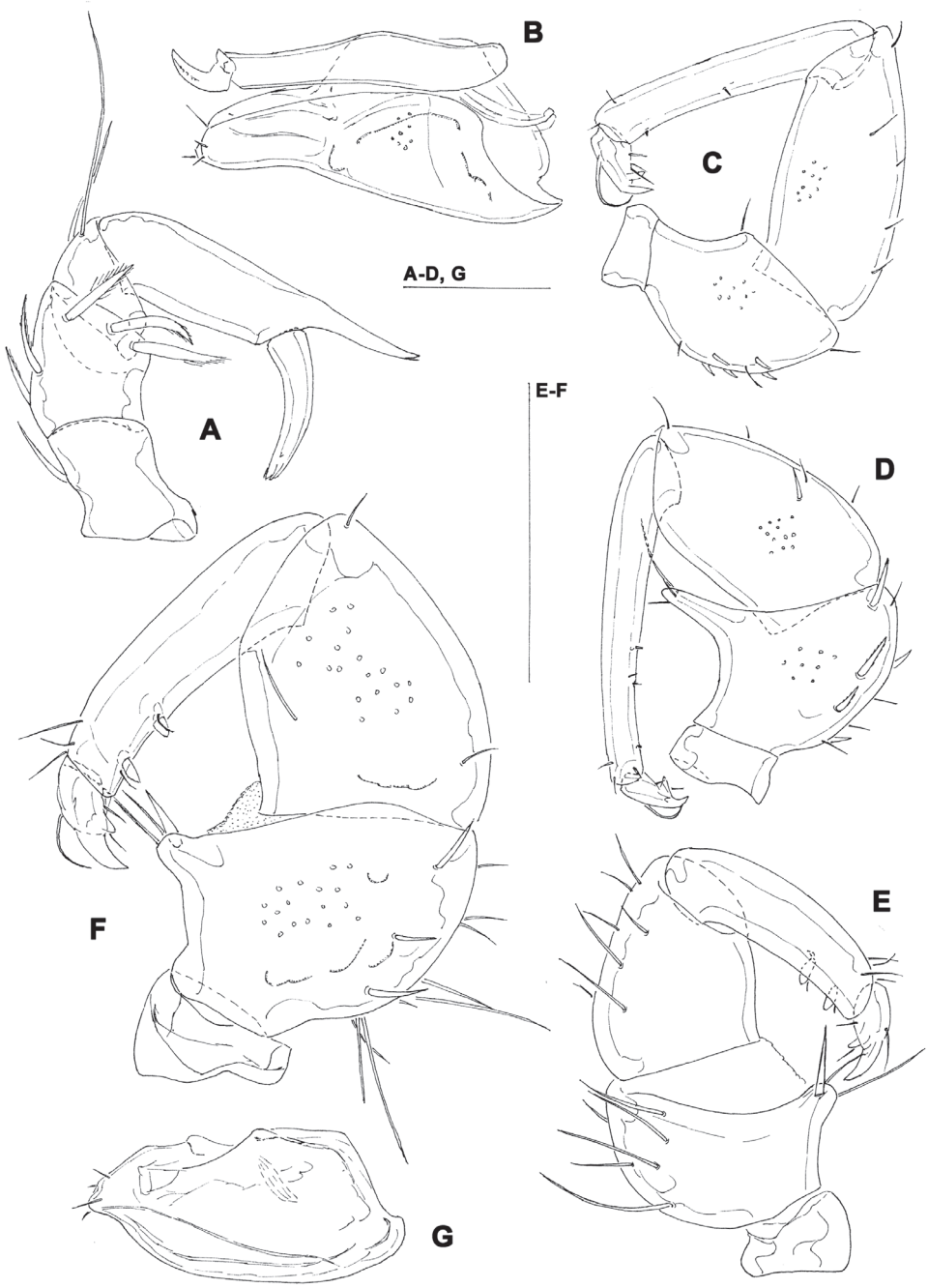

Figure 3. A *Hydrodroma cf. rheophila* Cook, 1967, female: palp. **B–C** *Sperchon rostratus* Lundblad, 1969, female: **B** = palp **C** = capitulum and chelicera **D** *Sperchon* cf. *gracilipalpis* Lundblad, 1941, female: palp **E–G** *Sperchon cornutoides* Lundblad, 1941 (**F–G** = female, **E** = male) **E–F** = palp **G** = capitulum. Scale bars = 100 μm.

specimen from the Chinkualiao stream shows general conformity with *Hydrodroma rheophila*. As Pešić et al. (2010) noted the variability of additional populations tentatively assigned to *H. rheophila* (e.g. from Greece and Oman, see Pešić et al. 2010 and Smit and Pešić 2010, respectively) from different regions of the whole distribution area needs to be examined to clarify the taxonomy. This probably will require the use of molecular approach to examine the degree of genetic differentiation among the geographical populations.

Distribution. India, Indonesia, Iran, Oman, Balkan. New for Taiwan.

Family Sperchontidae Thor
Genus *Sperchon* Kramer, 1877

Sperchon (*Hispidosperchon*) *rostratus* Lundblad, 1969

http://species-id.net/wiki/Sperchon_rostratus
Figs 3B–C

Material examined. ECL-BA-3: iii.2010 0/1/0 (mounted). ECL-BA-5: iii.2010 0/1/0.

Remarks. The two females examined in the present study fit well the description of *Sperchon rostratus* Lundblad, 1969. Figures 3B–C show some morphological details of the specimen from Chinkualiao stream.

Distribution. Burma, China (Guizhou Province), Turkey, Iran. New for Taiwan.

Sperchon (*Hispidosperchon*) cf. *gracilipalpis* Lundblad, 1941

http://species-id.net/wiki/Sperchon_gracilipalpis
Fig. 3D

Material examined. ECL-BA-2: iii.2010 1/1/0. ECL-BA-3: vi.2010 0/1/0 (mounted). ECL-BA-4: iii.2010 5/0 1/0/0 (mounted); iv.2010 0/1/0; 27.vii.2010 1/1/0. ECL-BA-5: iii.2010 1/1/0; iv.2010 0/1/0. ECL-BA-6: iv.2010 0/2/0.

Remarks. The specimens from Baishih River drainage are provisionally assigned to the Oriental species *Sperchon gracilipalpis* Lundblad, 1941. However, they resemble both *Sperchon gracilipalpis* and the Palaearctic *S. hispidus* Koenike, 1895 (common character state: dorsum of both sexes with seven paired and one unpaired (occasionally paired) muscle attachment plates; III/IV-L-3-5 with numerous pinnate dorsal setae; similar shape of palp (Fig. 3D) and male ejaculatory complex). The diagnostic differences separating these two species have never been discussed. More material of *S. gracilipalpis* from the type area should be investigated in order to get an insight on further diagnostic differences.

Distribution. SE Asia, China (Guizhou Province). New for Taiwan.

***Sperchon cornutoides* Lundblad, 1941**
http://species-id.net/wiki/Sperchon_cornutoides
Figs 3E–G

Material examined. ECL-BA-1: 10.viii.2009 0/1/0; iii.2010 0/1/0; 01.vii.2010 0/1/0 (mounted); 02.vii.2010 0/2/0; 30.x.2010 1/0/0. ECL-BA-2: 27.vii.2010 2/0/0 (1/0/0 mounted). ECL-BA-3: 23.ix.2009 0/1/0; iii.2010 0/1/0. ECL-BA-4: iii.2010 0/1/0; 27.vii.2010 1/2/0 (1/1/0 mounted). ECL-BA-5: iv.2010 0/1/0. ECL-BA-6: iii.2010 0/1/0.

Remarks. The specimens examined from Baishih River drainage agrees with the description of *Sperchon cornutoides* Lundblad, 1941, a species known only from Java (Lundblad 1936, 1971). This species closely resembles to *Sperchon cornutus* K. Viets, 1935, which can be easily distinguished by the claws bearing two clawlets instead of a claw with one clawlet in *S. cornutoides*. *Sperchon xiaoqikongensis* Zhang & Jin, 2012, a species recently described from mainland China (Guizhou Province, Zhang et al. 2012) resemble the both aforementioned species due to shape of palp and capitulum. According to the original description (Zhang et al. 2012) this species differs from *S. cornutoides* in the absence of muscle attachment plates, shorter peg-like seta on P-2 ventral projection and the presence of peg-like setae on P-2 and P-3 (as shown by figure of Zhang et al. 2012, Fig. 18). It is possible, especially in the case of weakly sclerotized specimens or due the clearing treatment with lactic acid, that muscle attachment plates could easily have been unobserved. The taxonomic state and relationships of this species should be investigated with further specimens from the type area.

Distribution. Indonesia. New for Taiwan.

Family Torrenticolidae Piersig
Genus *Monatractides* K. Viets, 1926

***Monatractides* cf. *circuloides* (Halík, 1930)**
http://species-id.net/wiki/Monatractides_circuloides

Material examined. ECL-BA-1: 07.vii.2009 1/1/0; 23.ix.2009 2/0; iv.2010 13/0; 01.vi.2010 1/0; vii.2010 29/0; 27.vii.2010 2/1/0. ECL-BA-2: 02.ix.2009 11/2(1juvenile)/0; ii.2010 57/0; iii.2010 3/1/1; iv.2010 0/2/0; vi.2010 2/2/0; 27.vii.2010 17/0; 29.ix.2010 5/0; 30.x.2010 1/0. ECL-BA-3: 01.vii.2009 1/0/0; 23.vii.2009 1/0/0; ii.2010 4/11/0; ii.2010 10/0; iv.2010 0/1/0; 27.vii.2010 1/0/0. ECL-BA-4: 02.vii.2009 1/0/0; ii.2010 2/1/0; iii.2010 6/4/0; iv.2010 0/1/0; vi.2010 1/0/0; vii.2010 19/0; 27.vii.2010 5/0/0; 30.x.2010 1/0. ECL-BA-5: iii.2010 1/1/0; 01.vi.2010 4/0/0; vii.2010 11/0; 07.vii.2010 1/0/0; 30.x.2010 1/0/0. ECL-BA-6:

17.vi.2009 3/0; iii.2010 2/9/0; vi.2010 0/1/0; 01.vii.2010 1/0/0; 27.vii.2010 1/0/0; 29.ix.2010 1/0.

Remarks. It is the most abundant species in our material. For an analysis of diagnostic characters of populations from Taiwan tentatively assigned to *M. circuloides* see: Pešić et al. (2011).

Distribution. Malaysia, Thailand, Taiwan.

Genus *Torrenticola* Persig, 1896

Torrenticola taiwanicus Pešić, Semenchenko, Chatterjee, Yam & Chan, 2011

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

Material examined. ECL-BA-1: 07.vii.2009 1/0/0. ECL-BA-3: 27.vii.2010 1/4/0. ECL-BA-4: 02.vii.2009 0/2/0; ii.2010 0/1/0; iii. 2010 0/4/0; iv.2010 0/1/0 (mounted); vi.2010 1/1/0; 27.vii.2010 0/1/0; ECL-BA-5: 21.vii.2009 1/0/0; iii.2010 0/2/0; 01.vi.2010 1/1/0; 07.vii.2010 0/1/0. ECL-BA-6: ii.2010 1/0/0; iii. 2010 0/6/0; 27.vii.2010 0/1/0; 29.ix.2010 3/0.

Remarks. The studied material was collected from February to September. For an analysis of diagnostic characters of *T. taiwanicus* see: Pešić et al. (2011).

Distribution. Taiwan.

Torrenticola projectura sp. n.

urn:lsid:zoobank.org:act:41E5931A-EFE2-42B6-B0D5-A86EB897B9FF
http://species-id.net/wiki/Torrenticola_projectura
Figs 4A–E

Type series. Holotype male (NMNS-6894-002), dissected and slide mounted, Taiwan, BA-1, Baishih River drainage, Chinkualiao Stream, 27.vii.2010. Paratype: one male, same data as holotype; one male, dissected and slide mounted, BA-2, Chinkualiao Stream, 02.ix.2009.

Diagnosis. Male (female unknown). Cx-IV extending posterior to genital field; excretory pore posterior to line of primary sclerotization, Vgl-2 slightly posterior to excretory pore; capitulum with a short rostrum; medial suture line of Cx-II+III short; P-2 ventrodistal projection cone-shaped, pointed towards distal, P-3 ventrodistal projection larger than projection of P-2, P-3 with a long tapering ventral protrusion which curves distally.

Description. Male (holotype, in parentheses measurements of paratype, n = 1) — Idiosoma (ventral view: Fig. 4B) L 788 (738), W 675 (625); dorsal shield (Fig. 4A) L 709 (658), W 544 (525), L/W ratio 1.3 (1.25); dorsal plate 663 (614); shoulder plate L 197-200 (189), W 78-82 (71-75), L/W ratio 2.4-2.6 (2.5-2.7); frontal plate L 163 (154-158), W 71-76 (70-72), L/W ratio 2.1-2.3 (2.1-2.3); shoulder/frontal plate L

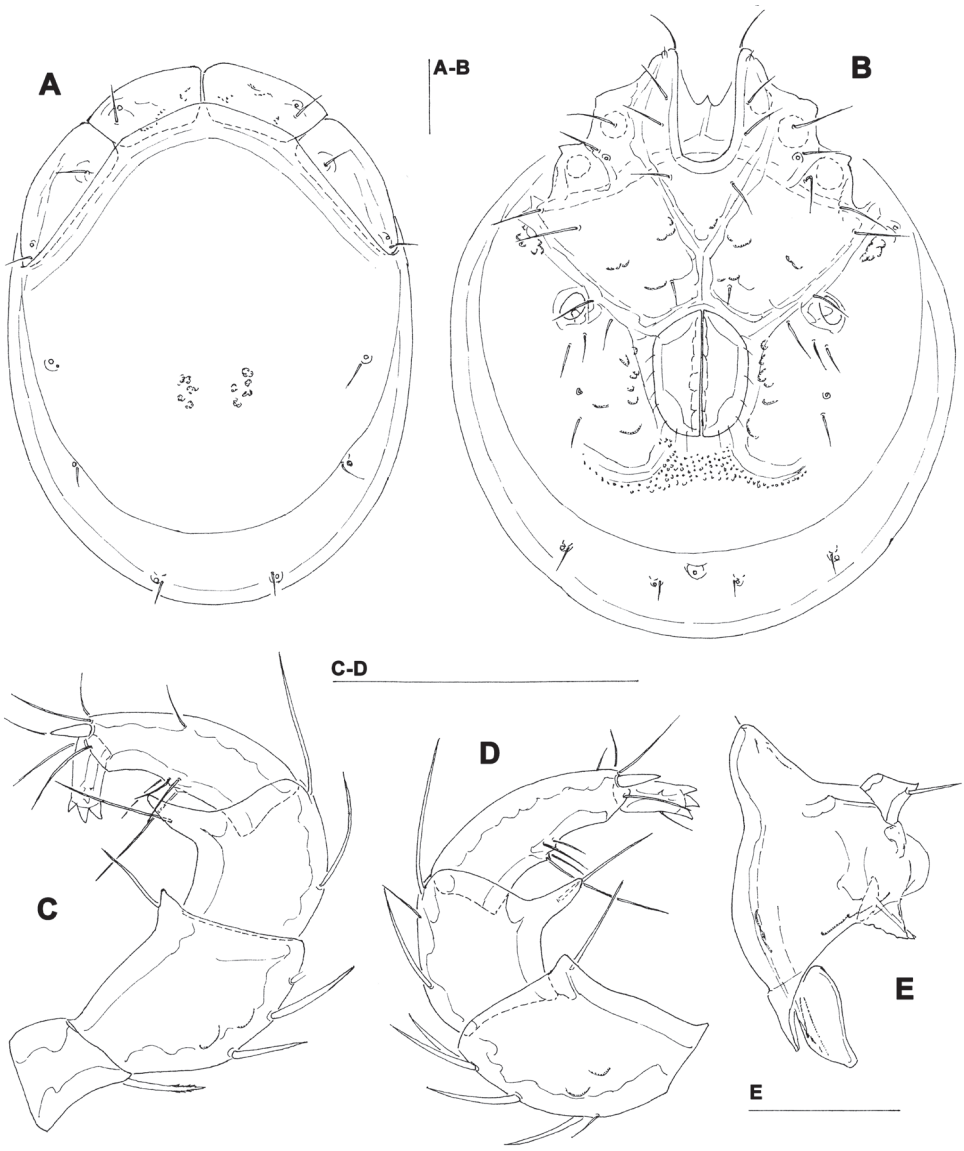

Figure 4. *Torrenticola projectura* sp. n., male: **A** = dorsal shield **B** = idiosoma, ventral view **C** = palp, medial view **D** = palp (P-1 missing), medial view **E** = capitulum. Scale bars = 100 μm.

ratio 1.2 (1.2). Capitular bay L 150 (153), Cx-I total L 270 (263), Cx-I mL 119 (109), Cx-II+III mL 80 (70); ratio Cx-I L/Cx-II+III mL 3.4 (3.8); Cx-I mL/Cx-II+III mL 1.5 (1.6). Genital field L/W 156 (159)/124 (128), L/W ratio 1.26 (1.24); ejaculatory complex normal in shape, L 239 (211); distance genital field-excretory pore 180 (150), genital field-caudal idiosoma margin 272 (234). Capitulum (Fig. 4E) ventral L 231 (225); chelicera total L 275 (269), claw L 65 (65), basal segment L 212 (214), L basal

segment/claw ratio 3.3 (3.3); palp (Figs 4C-D) total L 257 (256), dL: P-1, 35 (34); P-2, 72 (70); P-3, 52 (53); P-4, 72 (72); P-5, 26 (27); dL P-2/P-4 ratio 1.0 (0.97); P-2 ventrally slightly convex, dorsally convex in the proximal, straight in the distal part, ventrodistal projection cone-shaped, pointed towards distal, P-3 with a long tapering ventral protrusion which curves distally, P-4 distally slightly tapering, slightly curved, ventral setae (one long and three short) on flat hump.

Etymology. The species is named after the distinctive shape of ventrodistal projection of P-3; '*projectura*' - Latinised form of 'projection'.

Remarks. The shape of ventrodistal projection of P-3 of the new species is very distinctive and can separate it from all other *Torrenticola* species.

Distribution. Taiwan.

Family Hygrobatidae Koch
Genus *Hygrobates* Koch, 1837

Hygrobates (*Hygrobates*) *taiwanicus* sp. n.

urn:lsid:zoobank.org:act:8A67823A-EC83-418D-80B8-2934848B1D9D
http://species-id.net/wiki/Hygrobates_taiwanicus
Figs 5–6

Type series. Holotype female (NMNS-6894-001), dissected and slide mounted, Taiwan, BA-3, Chinkualiao Stream, vi.2010. Paratypes: 0/1/0, same data as holotype; 1/1/0 (mounted), BA-1, Chinkualiao Stream, iii. 2010; 0/3/0, BA-4, Diyu Stream, iii.2010; 0/1/0, BA-5, Diyu Stream, iv.2010.

Diagnosis. Idiosoma L > 750; acetabula arranged in an obtuse angle; female pregenital sclerite with four setae, its anterior margin extending beyond anterior margin of genital plates; female genital plates longer than gonopore; posterior end of female genital plates posterior to postgenital sclerite; P-2 ventrodostal projection elongate, cone-shaped; proximoventral seta on P-4 longer and thicker than distoventral seta.

Description. Female (holotype, in parentheses paratype). Idiosoma L 775 (778), W 613 (706); integument soft, with very fine striation. Capitulum broadly fused with Cx-I. Coxae (Fig. 5A): coxal field L 322 (359), Cx-III W 472 (500), posterior end of anterior coxal group rounded-truncate, Cx-I+II L/W 238 (259)/319 (344), posterolateral apodemes extending slightly beyond sclerotization. Suture line of Cx-III and Cx-IV nearly straight, incomplete, extending to near Cxgl-IV; medial margin of Cx-IV rounded-triangular. Genital field (Fig. 5A-B): L/W 181 (213)/173 (203), acetabular plates with smooth border, L 143-147 (175); acetabula arranged in an obtuse triangle, L Ac-1-3: 55-56 (66), 55-58 (72), 44 (66-68); pregenital sclerite with four setae, its anterior margin extending beyond anterior margin of genital plates. Excretory pore smooth. Palp (Fig. 5E): total L 358 (423), dL: P-1, 26 (34); P-2, 98 (111); P-3, 70 (85); P-4, 121 (136); P-5, 43 (57); dL P-2/P-4 ratio, 0.81 (0.82); chelicera (Fig. D) total L 250 (319), basal segment L 157 (200), claw L 100 (125), L ratio basal segment/claw 1.6 (1.6). Legs:

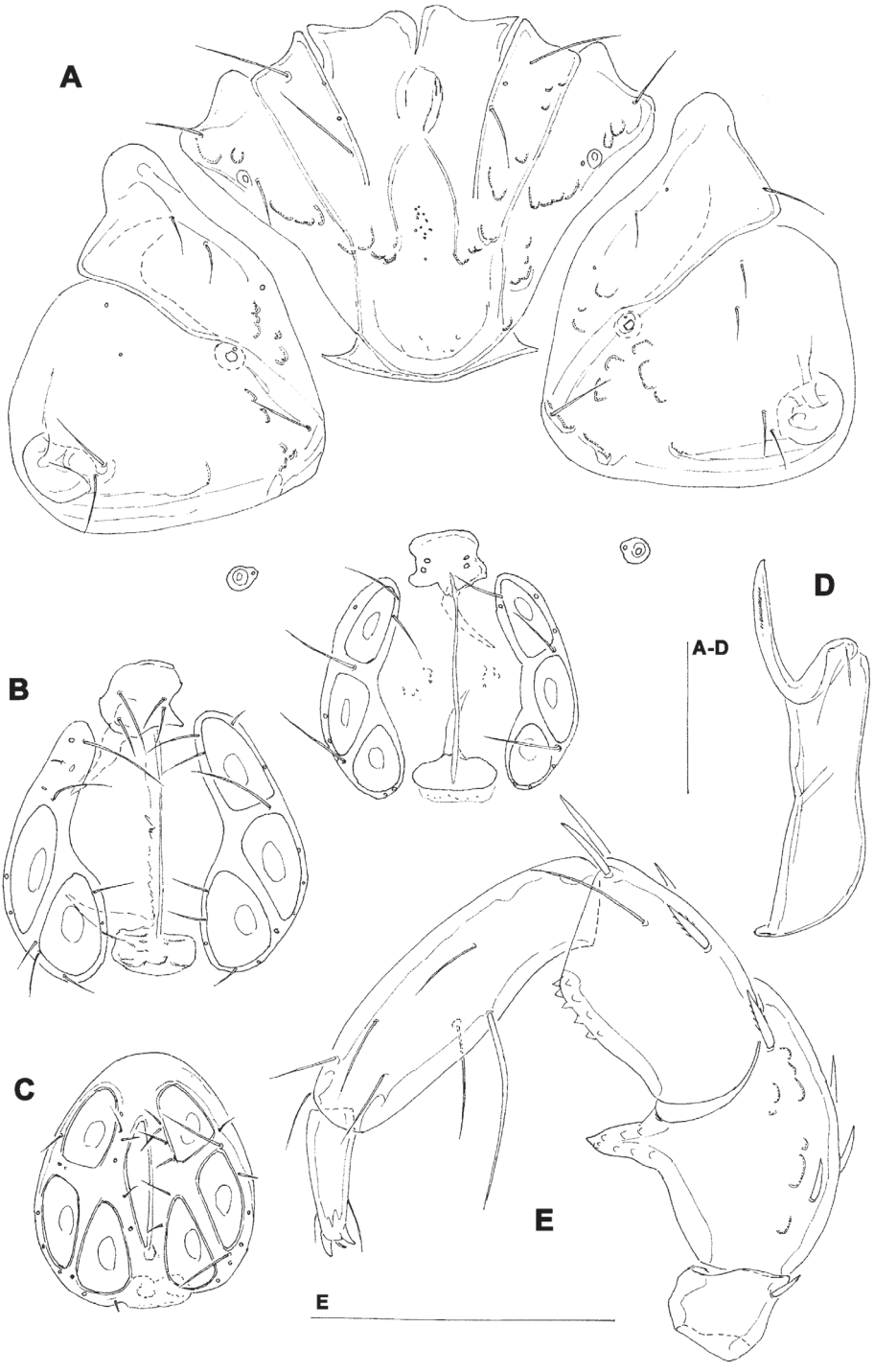

Figure 5. *Hygrobates taiwanicus* sp. n. (**A–B, D–E** = female; **C** = male): **A** = coxal and genital field **B–C** = genital field (paratypes) **D** = chelicera **E** = palp. Scale bars = 100 μm.

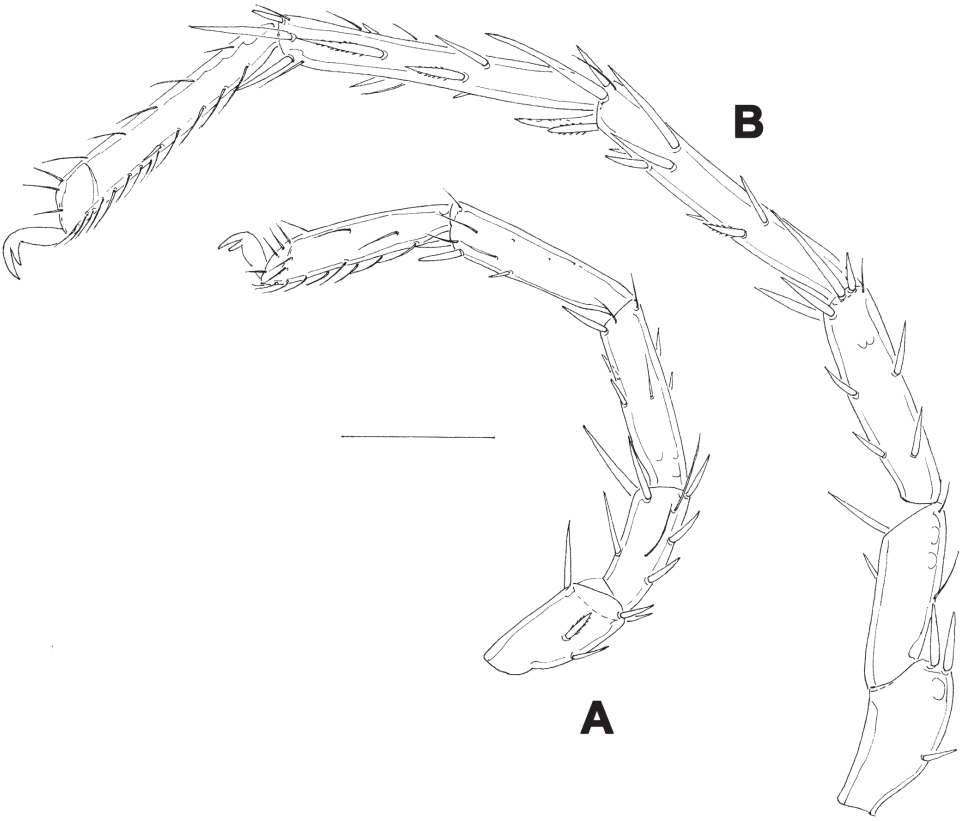

Figure 6. *Hygrobates taiwanicus* sp. n., female: **A** = I-L-2-6 **B** = IV-L. Scale bar = 100 μm.

dL of I-L-2-6 (Fig. 6A): 69 (89), 90 (109), 131 (156), 134 (159), 138 (161); dL of IV-L (Fig. 6B): 108 (128), 103 (128), 151 (184), 213 (263), 225 (272), 193 (234).

Males (n = 2): similar to female, except for genital field. Idiosoma L 775-794, W 625-656; coxal field L 338, Cx-III W 463, Cx-I+II L/W 231/334; genital field L/W 160-170/148-151, anterior margin convex, L Ac-1-3: 51-58, 63-66, 63-66; ejaculatory complex L 169. Palp (Fig. 5C): total L 365-373, dL: P-1, 28; P-2, 99-100; P-3, 71-75; P-4, 119-123; P-5, 48-47; dL P-2/P-4 ratio, 0.81-0.83; chelicera: basal segment L 194, claw L 103, L ratio basal segment/claw 1.9. Legs: dL of I-L-2-6: 74, 91-97, 138-141, 139-141, 142-144; dL of IV-L: 114, 106, 156, 228, 232, 203.

Etymology. The species is named for its occurrence in Taiwan.

Remarks. The new *Hygrobates* species belong to the group of the species characterized byt the presence of two or three setae upon, and inside the margin of, the female pregenital sclerite and proximoventral seta on P-4 longer and thicker than distoventral seta. This group includes three species (Matsumoto et al. 2005), all known only from middle Honshu (Japan), i.e., two lacustrine species, *Hygrobates biwaensis* Tuzovskij, 2003 and *H. rarus* Tuzovskij, 2003, which are known only from Lake Biwa, and one fluvial species, *H. capillus* Matsumoto Kajihara & Mawatari, 2005. Due to the elongate distoventral projec-

tion of P-2, *Hygrobates taiwanicus* sp. n. is most similar to *Hygrobates biwaensis* (in the following, in parentheses; data taken from Tuzovskij 2003) from which differs in the larger idiosoma dimensions (L 525-650 in both sexes), female genital plates longer (shorter) than gonopore, posterior end of female genital plates posterior (anterior) to postgenital sclerite and P-2 ventrodostal projection cone-shaped (more elongated and slender, finger-shaped).

Distribution. Taiwan.

Hygrobates (*Hygrobates*) cf. *longiporus* Thor, 1898

http://species-id.net/wiki/Hygrobates_longiporus
Figs 7A–D

Material examined. ECL-BA-3: 23.ix.2009 4/0; ii.2010 0/3/0; vi.2010 2/0. ECL-BA-4: 17.vi.2009 1/0/0. ECL-BA-5: iv.2010 1/0/0; 07.vii.2010 5/0; 27.vii.2010 19/0; 30.x.2010 0/2/0. ECL-BA-6: 17.vi.2009 3/2/0; 17.vi.2009 7/0; vi.2010 0/3/0; 01.vii.2010 2/0/0; 27.vii.2010 12/0 (0/1/0 mounted); 29.ix.2010 0/1/0.

Remarks. The most abundant *Hygrobates* species from the Baishih River drainage resemble to the Palaeractic *H. longiporus* Thor. In shape of coxal (Fig. 7A) and genital field (Figs 7B,D) and palp (Fig. 7C), no differences can be found to differentiate the specimens from Taiwan. Two additional species closely related to *H. longiporus* are described from Oriental part of China (Jin 1997), *H. neolongiporus* Jin 1997 (Guangxi, Guizhou) and *H. corimarginatus* Jin 1997 (Yunnan). According to the original description (Jin 1997), *Hygrobates neolongiporus* differs from *H. longiporus* in Cx-IV medial margins more closely approached to each other, more elongated Ac-3 and the triangular genital sclerites; *H. corimarginatus* differs in having a fewer denticles on the ventral side of P-2 and P-3 and genital field with more extended border of secondary sclerotization. However, all these characters are probably individually variable, and should be investigated with further specimens from the type area. For the time being, the populations from Taiwan are provisionally assigned to *H. longiporus*. However, for a judgement on the taxonomic state, the diagnostic features and taxonomic relationship of the Asian species of '*longiporus*' species group require further revision.

Distribution. Palaearctic. New for Taiwan.

Hygrobates (*Hygrobates*) *hamatus* K. Viets, 1935

http://species-id.net/wiki/Hygrobates_hamatus
Figs 8A–C

Material examined. ECL-BA-3, vi.2010 0/1/0 (mounted). ECL-BA-5, 20.viii.2009 0/1/0.

Remarks. The specimens from Taiwan are in a good agreement with description of the Oriental *Hygrobates hamatus*. This species is very similar to *H. soari* K. Viets, 1911, a species widspread in the Afrotropical region, reaching in its distribution to northern Oman (Smit and Pešić 2010). As noted by Pešić et al. (2012) additional material should

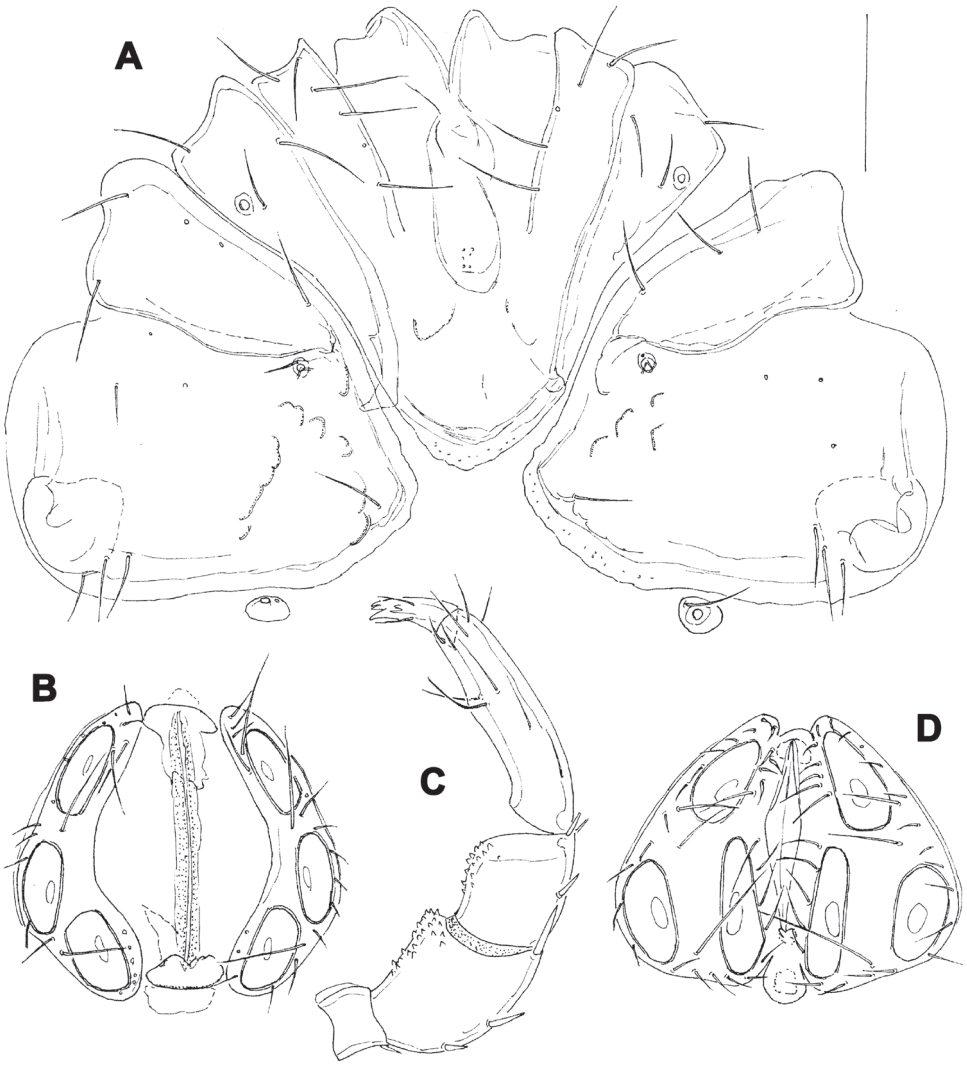

Figure 7. *Hygrobates* cf. *longiporus* Thor, 1898 (A-C = female, D = male): **A** = coxal field **C** = palp **B, D** = genital field. Scale bar = 100 μm.

be studied in order to get an insight into on further diagnostic differences of these two species, what probably will require the application of molecular techniques.

In addition, we gave some measurements of the specimen of *H. hamatus* from Baishih River drainage which represented the easternmost record finding of this species.

Female. Idiosoma L/W 881/625. Coxae (Fig. 8A): coxal field L 353, Cx-III W 463, Cx-I+II L/W 260/337. Genital field (Fig. 8B): L/W 145/182, acetabular plates L 101-105; L Ac-1-3: 35-37, 38-39, 29-32. Palp (Fig. 8C): total L 442, dL: P-1, 26; P-2, 118; P-3, 101; P-4, 163; P-5, 34; dL P-2/P-4 ratio, 0.72.

Distribution. SE Asia, India, New Guinea, Australia, Iran. New for Taiwan.

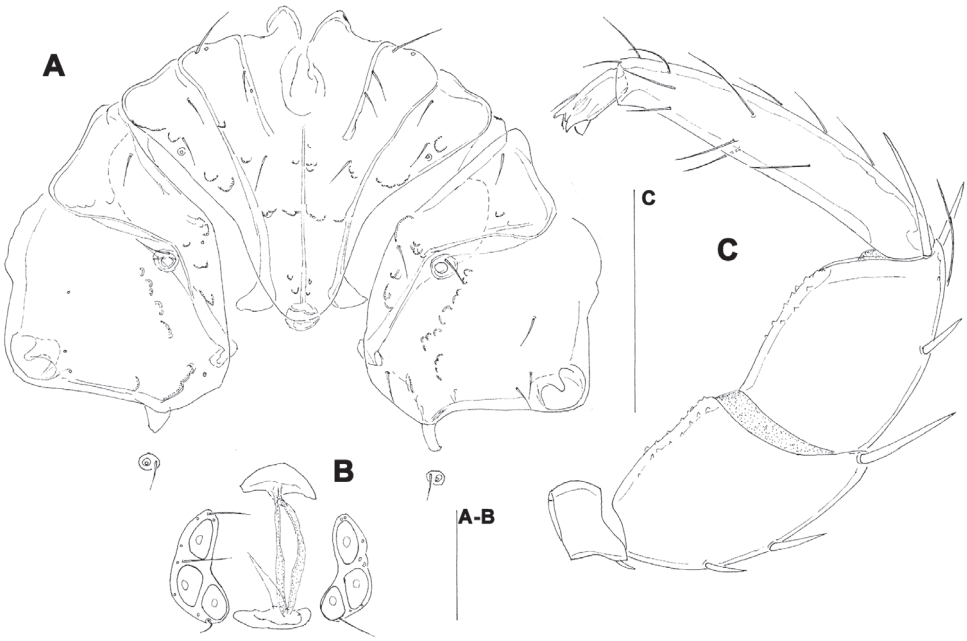

Figure 8. *Hygrobates hamatus* K. Viets, 1935, female: **A** = coxal field **B** = genital field **C** = palp. Scale bars = 100 μm.

Genus *Atractides* Koch, 1837

Atractides cf. *spatiosus* (K. Viets, 1935)

http://species-id.net/wiki/Atractides_spatiosus
Figs 9A, 10B

Material examined. ECL-BA-1: 01.vi.2009 0/1/0; 02.vii.2010 0/1/0. ECL-BA-2: iv.2010 0/2/0; vi.2010 0/1/0. ECL-BA-3: 03.ix.2009 0/3/0. ECL-BA-4: iii.2010 0/4/0 (0/1/0 mounted); iii.2010 0/1/0. ECL-BA-5: iv.2010 0/1/0; 07.vii.2010 0/4/0. ECL-BA-6: iii.2010 0/1/0; iv.2010 0/2/0; vi.2010 0/1/0; ix.2010 0/1/0.

Remarks. The examined female specimens from Baishih River system resemble Oriental *Atractides spatiosus* (K. Viets, 1935). A problem exists regarding the similarity between *Atractides spatiosus* and *A. cognatus* (K. Viets, 1935), a further taxon originally introduced as a subspecies and later elevated to species rank by Pešić and Smit (2009). However, the populations attributed by Pešić and Smit (2009) to *A. cognatus* differ from the original description of the later (see: K. Viets 1935) in the shape of excretory pore (surrounded by narrow sclerotized ring in original description of *A. cognatus*), and probably represented an undescribed species. For the time being, the sclerotization of the excretory pore (smooth in *A. spatiosus* vs. sclerotized in *A. cognatus*, as shown in Fig. 9D), more elongated P-3 (compare Figs 9A and –B) and the shape of I-L-5 and -6 (compare Figs 10A and –B) appear to be the characteristics most important for distin-

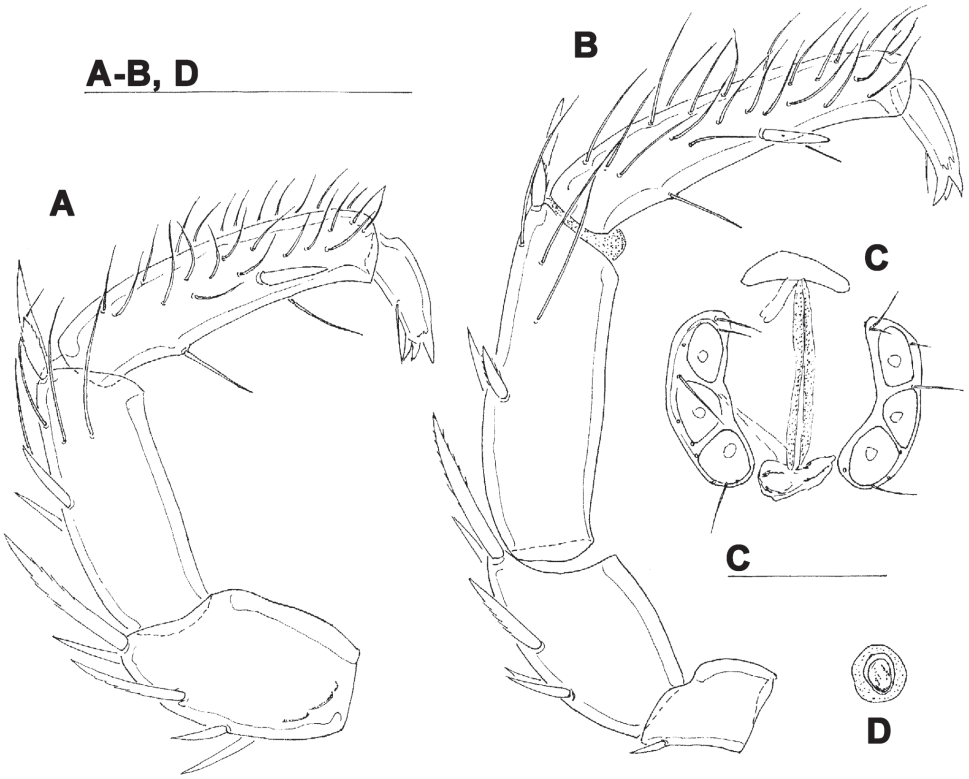

Figure 9. **A** *Atractides* cf. *spatiosus* (K. Viets, 1935), female: **A** = palp, medial view (P-1 missing) **B–D** *Atractides* cf. *cognatus* (K. Viets, 1935), female: **B** = palp, medial view **C** = genital field **D** = excretory pore. Scale bars = 100 μm.

guishing populations attributed to *A. spatiosus* and *A. cognatus*, respectively. However, our assignments to *A. spatiosus* and *A. cognatus* are difficult due to the lacking of males, and furthermore is based mainly on non-identity with alternative species.

Distribution. SE Asia. New for Taiwan.

Atractides cf. *cognatus* (K. Viets, 1935)

http://species-id.net/wiki/Atractides_cognatus
Figs 9B–D, 10A

Material examined. ECL-BA-1: 23.ix.2009 0/1/0. ECL-BA-4: 20.viii.2009 0/1/0; 27.vii.2010 0/2/0. ECL-BA-5: 27.vii.2010 0/3/0; x.2010 0/1/0. ECL-BA-6: 01.vii.2010 0/1/0; 27.vii.2010 0/1/0; 30.x.2010 0/1/0 (mounted).

Remarks. See discussion under *Atractides* cf. *spatiosus*.

Distribution. SE Asia. New for Taiwan.

Figure 10. A *Atractides* cf. *spatiosus* (K. Viets, 1935), female: **A** = I-L-5 and -6 **B** *Atractides* cf. *cognatus* (K. Viets, 1935), female: **B** = I-L-5 and -6. Scale bar = 100 μm.

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