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Nine new species of *Psyllipsocus* Selys-Longchamps, 1872 (Psocodea: 'Psocoptera': Psyllipsocidae) from Southeast Asia

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Abstract: Nine new *Psyllipsocus* species are described and illustrated. Three species from the Greater Sunda Islands: *P. hollieri* sp. nov. (Indonesia: Sumatra), *P. uncinatus* sp. nov. (Malaysia: Borneo: Sabah), *P. bauensis* sp. nov. (Malaysia: Borneo: Sarawak), and six species from Thailand: *P. fusciceps* sp. nov., *P. prominens* sp. nov., *P. simplex* sp. nov., *P. cluniopilosus* sp. nov., *P. bidentatus* sp. nov., *P. quadridentatus* sp. nov. They belong to four small groups of species which are each characterized by at least one striking autapomorphy (e.g. a novel possibly proprioceptive male abdominal organ). One of these species groups includes also *P. disparunguis* Lienhard, only known from the United Arab Emirates. The number of *Psyllipsocus* species known from the Oriental Region is herewith augmented to 26, 17 of them recorded from Southeast Asia.

Keywords: Insecta - Trogiomorpha - Psyllipsocetae.

INTRODUCTION

The present paper is the second contribution of a planned series of studies on *Psyllipsocus* Selys-Longchamps, 1872 from Southeast Asia based on specimens deposited in the Muséum d'histoire naturelle of Geneva, most of them collected by the Thailand Inventory Group for Entomological Research (TIGER project). For general information about this genus and for a checklist of the *Psyllipsocus* species known from the Oriental Region see the first contribution by Lienhard *et al.* (2022). The number of *Psyllipsocus* species known from the Oriental Region is herewith augmented to 26, 17 of them recorded from Southeast Asia.

While the six Southeast Asian species treated by Lienhard *et al.* (2022) are characterized by patterned forewing membranes, the nine species described in the present paper have completely hyaline wings. However, from a taxonomic point of view, they don't represent a homogeneous complex of species, but form four small species groups each characterized by at least one striking morphological autapomorphy (see Discussion).

MATERIAL AND METHODS

The type material of the new species is deposited in the Queen Sirikit Botanical Gardens, Mae Rim, Chiang Mai

Province, Thailand (QSBG) and in the Muséum d'histoire naturelle of Geneva, Switzerland (MHNG). Material from the TIGER project is indicated by T-numbers for samples. Dissection and slide-mounting was performed according to the methods described by Lienhard (1998). The pilosity of wing veins is usually heavily damaged in the material studied. For the drawings it was reconstructed from the insertion points of the hairs, which are always visible in slide-mounted wings, and the few hairs on each wing which were not lost. The length of these hairs was considered as representative for the pilosity of the entire wing, based on the observation that in *Psyllipsocus* the length of wing ciliation is usually uniform over the whole wing. General pilosity of hypandrium and maxillary palp and microtrichia of pretarsal claws are not usually figured in the drawings, except in cases where they are of taxonomic importance.

Abbreviations: AP = areola postica (the marginal cell in forewing formed by veins CuA1 and CuA2); APR = April; a.s.l. = above sea level; AUG = August; BL = body length (in alcohol); DEC = December; F = hind femur (length); FEB = February; FW = forewing (length); FWw = forewing (greatest width); HW = hindwing (length); IO/D = shortest distance between compound eyes divided by longitudinal diameter of compound eye in dorsal view of head; JAN = January; JUL = July; JUN = June; MAR

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= March; NP = National Park; NOV = November; OCT = October; P2 = second article of maxillary palp; P4 = fourth (terminal) article of maxillary palp; SEP = September; T = hindtibia (length); t1, t2, t3 = tarsomeres of hind tarsus (length, measured from condyle to condyle); v1, v2, v3 = first (ventral), second (dorsal) and third (external) ovipositor valvula respectively. Abbreviations of wing veins are used according to Yoshizawa (2005).

TAXONOMIC PART

Psyllipsocus hollieri sp. nov.

Fig. 1

Holotype: MHNG; male (slide-mounted); Indonesia, Sumatra Island, Sumatera Barat, Pakan Sinayan (2 km from Payakumbuh), cave “Ngalau Indah” (especially in entrance zone of the cave), 530 m a.s.l.; 24.NOV.1985; leg. B. Hauser and C. Lienhard (samples Sum-85/53+54).

Paratypes: MHNG (some of them slide-mounted, the others in alcohol); 17 males, 10 females (one of them labelled as allotype), 3 nymphs; same data as for holotype.

Diagnosis: This species belongs to a small group of three new species characterized by the presence of a postero-ventral paraproctal process in the male, a character unique in the genus (Fig. 1G). The other two species of this group are *P. uncinatus* sp. nov. and *P. bauensis* sp. nov. *P. hollieri* sp. nov. differs clearly from these species by the relatively short hindwings, the male phallosome and the presence of a rigid (basally non-articulated) anal spine; the other two species have a stout, basally articulated seta in place of the spine.

Etymology: The collectors dedicate this species to their colleague and friend John Hollier of the MHNG in recognition of his valuable help and kind support during many years of collaboration.

Description

General characters: Usually slightly brachypterous (Fig. 1B), rarely macropterous (e.g. female allotype, Fig. 1A), hindwing much shorter than forewing, also in macropterous form, with aberrant venation (Fig. 1A, B). Body whitish to slightly light brown, wings hyaline. Ocelli absent, compound eyes well developed but very small (IO/D 3.2-3.8). Head capsule lacking particular sculpture. Maxillary palp lacking clearly differentiated conical sensillum on P2, P4 moderately hatchet shaped (Fig. 1D). Lacinial tip trifold (Fig. 1E). Antennae damaged in all specimens examined, basal flagellomeres with indistinct secondary annulation. Pretarsal claws simple, symmetrical, with small preapical denticle (Fig. 1C). Hind leg with well-developed coxal organ. Forewing of macropterous form as in Fig. 1A, in brachypterous form venation often slightly aberrant (e.g. R1-Rs crossvein

absent and Sc' more or less reduced, see Fig. 1B, or occasionally Rs and M fused for a length). Forewing with relatively long hairs on veins (except CuP), hindwings bare, at most with few very short marginal hairs in radial fork.

Male terminalia: Clunium and epiproct simple (epiproct as shown in Fig. 2G). Paraproct (Fig. 1G) with a curved postero-ventral process (with a very long seta near its base), a sensorium of four trichobothria on vague basal florets, a rigid anal spine (not articulated at its base), a much shorter stout seta ventrally to the anal spine and a tiny setal sensillum near this seta. Hypandrium and phallosome as in Fig. 1F, rather elongate and ventrally bulging (may easily be deformed by slide-mounting of dissected terminalia).

Female terminalia: Clunium and epiproct simple. Paraproct similar as in male but lacking postero-ventral process (Fig. 1I). Subgenital plate simple, with long marginal hairs (Fig. 1H). Ovipositor valvulae as in Fig. 1H, v1 membranous (difficult to observe), v2 slender, with a sclerotized central rod, v3 large and elongate, forming the main part of the ovipositor (often ventrally prominent in alcohol preserved females). Spermatheca (Fig. 1J) membranous, with some sclerotizations near origin of duct; spermathecal sac containing several parts of tube-like structures (broken spermatophores?). Spermapore plate triangular, almost completely membranous and colourless (Fig. 1K).

Measurements: *Male* (holotype, slightly brachypterous): BL = 1.10 mm; FW = 0.92 mm; FWw = 0.32 mm; HW = 0.33 mm; F = 315 μ m; T = 535 μ m; t1 = 226 μ m; t2 = 47 μ m; t3 = 54 μ m; IO/D = 3.2. *Female* (allotype, macropterous): BL = 1.12 mm; FW = 1.17 mm; FWw = 0.37 mm; HW = 0.55 mm; F = 342 μ m; T = 552 μ m; t1 = 237 μ m; t2 = 49 μ m; t3 = 56 μ m; IO/D = 3.5.

Distribution: Indonesia, Sumatra (only known from the type locality: “Ngalau Indah” cave near Payakumbuh).

Remarks: This is one of the smallest known species of *Psyllipsocus*. The almost complete absence of pigmentation, reduced length of forewing in most specimens and strongly reduced length of hindwings together with strong reduction of compound eyes and absence of ocelli may indicate that this species is somewhat adapted to its cavernicolous mode of life. The species belongs to the *uncinatus* group (see remarks on *Psyllipsocus uncinatus* sp. nov., below).

Psyllipsocus uncinatus sp. nov.

Fig. 2A-K

Holotype: MHNG; male (slide-mounted); East Malaysia, Sabah, Tawau Residency, Gunong Pidtong, surroundings of “Madai Cave”, beating vegetation, 10 m a.s.l.; 26.MAR.1983; leg. C. Lienhard (sample Pal-83/58).

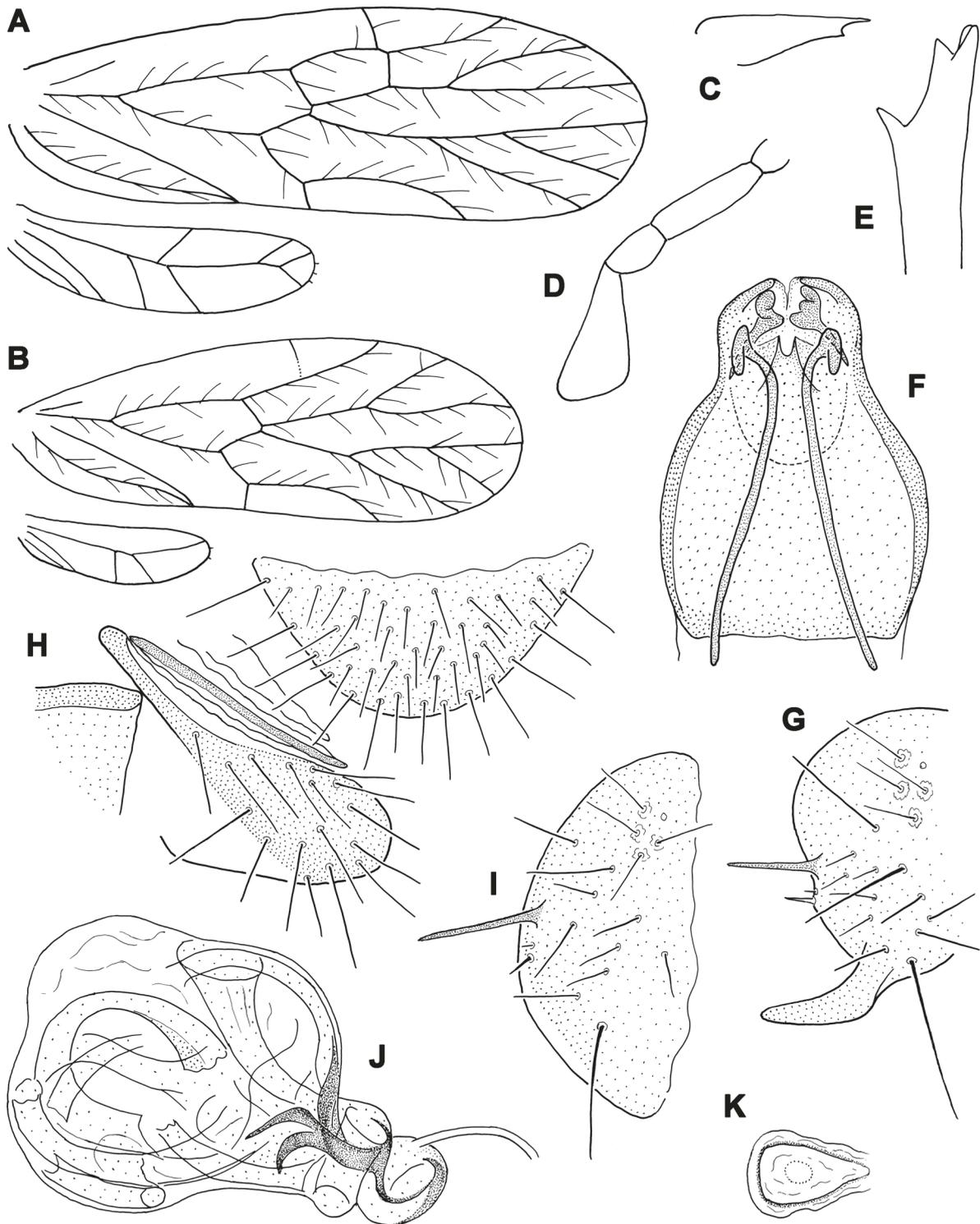


Fig. 1. *Psyllipsocus hollieri* sp. nov. (A) Forewing and hindwing, macropterous female. (B) Forewing and hindwing, brachypterous male (same magnification as A). (C) Pretarsal claw. (D) Maxillary palp. (E) Lacinial tip. (F) Hypandrium and phallosome, dorsal (internal) view. (G) Right paraproct, male. (H) Subgenital plate, right ovipositor valvulae and hind corner of clunium, female. (I) Right paraproct, female. (J) Spermatheca, female. (K) Spermapore plate, female (anterior part left in figure).

Paratypes: MHNG; 1 female allotype (slide-mounted), 1 male (in alcohol); same data as for holotype.

Diagnosis: Together with *P. hollieri* sp. nov. and *P. bauensis* sp. nov. this species belongs to a small group characterized by the presence of a postero-ventral paraproctal process in the male. *P. uncinatus* sp. nov. is most closely related to *P. bauensis* sp. nov. but differs from it by the apical structures of the hypandrium. Both species clearly differ from *P. hollieri* sp. nov. by the fully developed hindwings, the much larger compound eyes, the male genitalia and the presence of a basally articulated stout marginal seta on paraproct replacing the rigid anal spine of *P. hollieri* sp. nov.

Etymology: The species epithet, derived from the Latin word *uncinatus*, *-a*, *-um* (hooked), makes allusion to the hook-shaped process of the male paraproct.

Description

General characters: Macropterous (Fig. 2A), hindwing of normal length in relation to forewing (Fig. 2B). Body light to medium brown, wings hyaline, frons whitish (lighter than brown vertex), posterior half of abdomen dorsally and laterally brown, darker than anterior half of abdomen, terminalia brown. Ocelli well developed, compound eyes very large (IO/D 0.77-0.83). Head capsule lacking particular sculpture. Maxillary palp lacking clearly differentiated conical sensillum on P2, P4 hatchet shaped (Fig. 2C). Lacinial tip trifold (Fig. 2E). Antennae damaged, flagellomeres finely annulated. Pretarsal claws simple, symmetrical, with a small preapical denticle (Fig. 2D). Hindleg with well-developed coxal organ. Forewing venation as in Fig. 2A, AP long and flat. Hindwing as in Fig. 2B, anal vein bifurcate, some very short hairs present on apical wing margin.

Male terminalia: Epiproct (Fig. 2G) and clunium simple. Paraproct (Fig. 2G) with a curved postero-ventral process (with a very long seta near its base), a sensorium of six trichobothria on vague basal florets, a stout marginal seta, a somewhat finer stout seta ventrally to it and a tiny setal sensillum near the latter. Hypandrium and phallosome as in Fig. 2F, broad distal margin of hypandrium laterally slightly prominent, bearing on each side a slender digitiform process.

Female terminalia: Clunium and epiproct simple. Paraproct similar as in male but lacking postero-ventral process (Fig. 2J). Subgenital plate simple, with long marginal hairs (Fig. 2K). Ovipositor valvulae as in Fig. 2K, v1 membranous (difficult to observe), v2 slender,

with a sclerotized central rod, v3 broad. Spermatheca (Fig. 2I) membranous, with some sclerotizations near origin of its thin-walled duct; thin-walled spermathecal sac containing a thick-walled spermatophore enclosing a globular sperm packet connected to the small circular opening of the spermathecal duct by a relatively thick-walled curled duct-like structure. Spermapore plate with a horseshoe-shaped sclerotization (Fig. 2H).

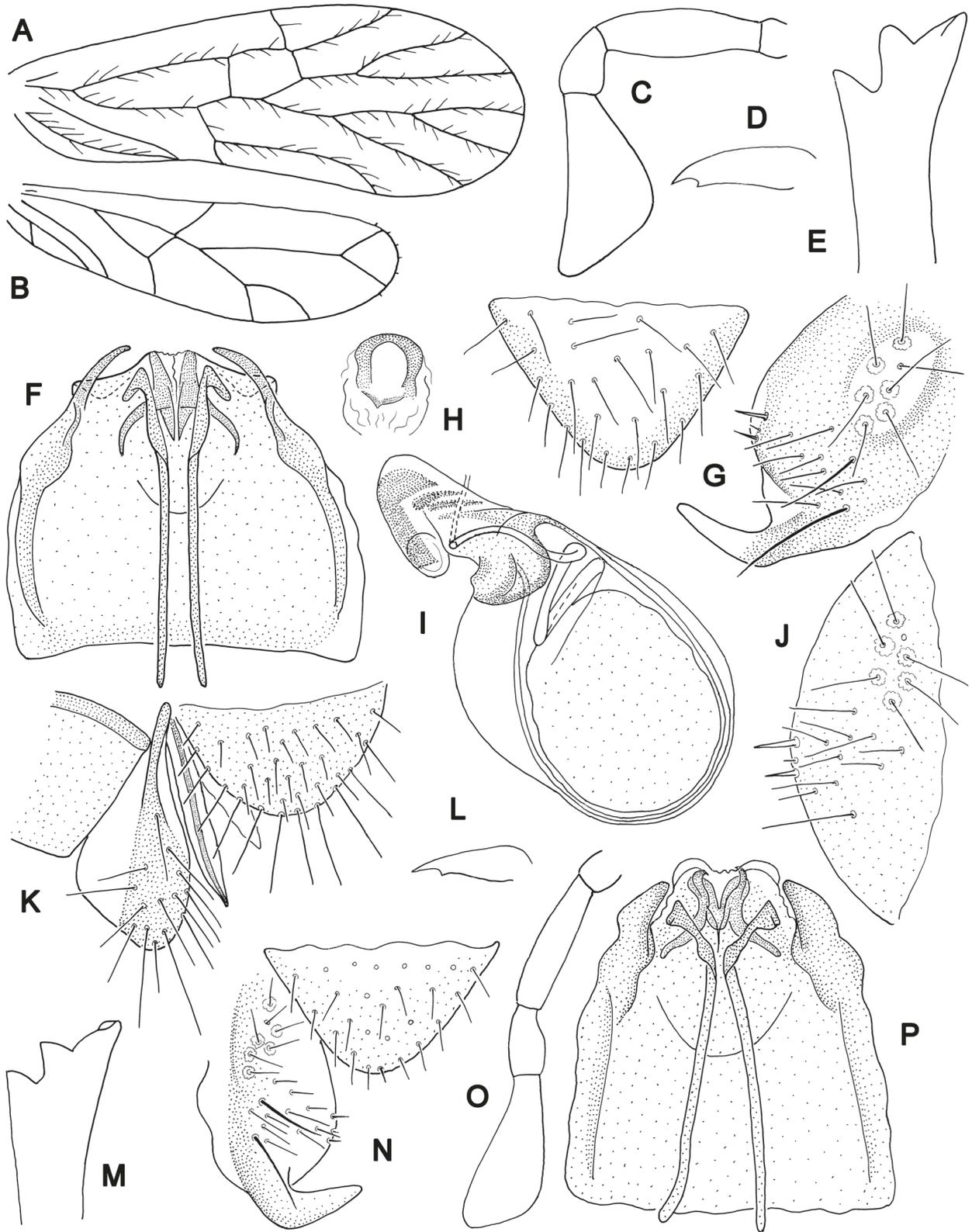
Measurements: *Male* (holotype): BL = 1.55 mm; FW = 1.59 mm; FWw = 0.58 mm; HW = 1.27 mm; F = 342 µm; T = 677 µm; t1 = 243 µm; t2 = 54 µm; t3 = 58 µm; IO/D = 0.77. *Female* (allotype): BL = 1.52 mm; FW = 1.61 mm; FWw = 0.60 mm; HW = 1.30 mm; F = 348 µm; T = 691 µm; t1 = 254 µm; t2 = 54 µm; t3 = 56 µm; IO/D = 0.77.

Distribution: East Malaysia, Sabah (only known from the type locality: Gunong Pidtong, surroundings of “Madai Cave”).

Remarks: As indicated in the diagnosis, this species forms together with *P. hollieri* sp. nov. and *P. bauensis* sp. nov. a small species group within the genus *Psyllipsocus*, here called the *uncinatus* group. It is characterized by the presence, in the male, of a curved postero-ventral paraproctal process (Figs 1G; 2G, N), a character unique in the suborder Trogiomorpha and thus a striking autapomorphy of this species group. However, a similar but clearly homoplasious structure is known in the suborder Psocomorpha, where it can be considered as an autapomorphy of the infraorder Psocetae (Mockford, 1993). It is interesting that in a Brazilian species of *Psyllipsocus*, *P. falcifer* Lienhard, 2014 (in Lienhard & Ferreira, 2014), two sickle-shaped sclerotized spines have been observed in the same position on the male paraproct. These spines are probably transformed setae and therefore not homologous to the paraproctal processes of the *uncinatus* group. Although these sexually dimorphic paraproctal structures in the *uncinatus* group, *P. falcifer* and Psocetae are not homologous, they may have similar functions in all these taxa.

Within the *uncinatus* group, the Bornean species *P. uncinatus* sp. nov. (from Sabah) and *P. bauensis* sp. nov. (from Sarawak) are most closely related to each other, while the Sumatran *P. hollieri* sp. nov. differs not only by some characters due to its cavernicolous mode of life (see remarks above), but also by the shape of the hypandrium and by the presence of an unarticulated anal

Fig. 2. *Psyllipsocus uncinatus* sp. nov. (A-K). (A) Forewing. (B) Hindwing (same magnification as A). (C) Maxillary palp. (D) Pretarsal claw. (E) Lacinial tip. (F) Hypandrium and phallosome, dorsal (internal) view. (G) Epiproct and right paraproct, male. (H) Spermapore plate, female (anterior part upwards in figure). (I) Spermatheca, containing one thick-walled spermatophore (opening of spermathecal duct circular, thin-walled hidden part of duct shown by broken lines, situated outside of spermathecal sac; the curled duct-like structure in the spermathecal sac is relatively thick-walled and belongs to the spermatophore, connecting the sperm-packet to the opening of the spermathecal duct). (J) Right paraproct, female. (K) Subgenital plate, right ovipositor valvulae and hind corner of clunium, female. – *Psyllipsocus bauensis* sp. nov. (L-P). (L) Pretarsal claw. (M) Lacinial tip. (N) Epiproct and left paraproct, male. (O) Maxillary palp. (P) Hypandrium and phallosome, dorsal (internal) view. ▶



spine on the paraproct in both sexes. This character is known from many species of the genus *Psyllipsocus*, in particular from the type species *P. ramburii* Selys-Longchamps, 1872. However, it is rather surprising that this character varies within this small group of closely related species.

Another difference between *P. hollieri* sp. nov. and *P. uncinatus* sp. nov. is the structure of the spermatheca and the spermatophores. In the latter species the spermatheca contains one large globular spermatophore (Fig. 2I) while in the former (three females examined, Fig. 1J) it contains structures that may be debris of several, more elongate, spermatophores. Unfortunately the female of *P. bauensis* sp. nov. is not known.

***Psyllipsocus bauensis* sp. nov.**

Fig. 2L-P

Holotype: MHNG; male (slide-mounted); East Malaysia, Sarawak, Bau, near “Fairy Caves”, 100 m a.s.l., beating vegetation; 3.DEC.1987; leg. C. Lienhard (sample Sar-87/41).

Diagnosis: See diagnosis of *P. uncinatus* sp. nov., above.

Etymology: The species epithet is derived from Bau, the type locality.

Description

General characters: Macropterous, wings and colouration as in *P. uncinatus* sp. nov., but posterior half of abdomen only slightly darker than anterior half. General morphology as indicated for *P. uncinatus* sp. nov., see Fig. 2L, M, O.

Male terminalia: Epiproct (Fig. 2N) and clunium simple. Paraproct (Fig. 2N) with a strongly curved postero-ventral process (with a very long seta near its base), a sensorium of six trichobothria on vague basal florets, two marginal setae being slightly stouter than ordinary hairs and, between them, a tiny setal sensillum. Hypandrium and phallosome as in Fig. 2P, distal margin of hypandrium not very broad, slightly bilobate and laterally not prominent; digitiform postero-lateral process of hypandrium thick and thumb shaped.

Female: Not known.

Measurements: *Male:* BL = 1.50 mm; FW = 1.55 mm; FWw = 0.56 mm; HW = 1.23 mm; F = 342 µm; T = 677 µm; t1 = 237 µm; t2 = 49 µm; t3 = 52 µm; IO/D = 0.82.

Distribution: East Malaysia, Sarawak (only known from the type locality: Bau, near “Fairy Caves”).

Remarks: This species belongs to the *uncinatus* group (see remarks on *P. uncinatus* sp. nov., above). It was collected together with *Psyllipsocus sarawakensis* Lienhard & Yoshizawa, 2022 (in Lienhard *et al.*, 2022),

a very distantly related species characterized by its patterned forewing membrane.

***Psyllipsocus fusciceps* sp. nov.**

Fig. 3

Psyllipsocus spec.; Lienhard, 2009: 50.

Holotype: MHNG; brachypterous male (slide-mounted); Thailand, Chiang Mai, Chiang Mai city, in house on bookshelf; 11.AUG.1980; leg. D. Burckhardt.

Paratypes: MHNG and QSBG (partly slide-mounted); 25 specimens from Thailand: 1 brachypterous male, 7 macropterous males, 16 macropterous females (one of them labelled as allotype), 1 nymph. – 1 brachypterous male and 1 nymph of the macropterous form; Chiang Mai, same data as for holotype. – 1 macropterous female; Chaityaphum, Pa Hin Ngam NP, Thung Dok Kra Jeow, in dry evergreen, 780 m a.s.l.; Malaise trap, 1-7.JAN.2007; leg. Katae Sa-nog & Buakaw Adnafai (T1454). – 1 macropterous female; Chaityaphum, Pa Hin Ngam NP, Thung Dok Kra Jeow, in dry evergreen, 780 m a.s.l.; Malaise trap, 19-25.JAN.2007; leg. Katae Sa-nog & Buakaw Adnafai (T1463). – 1 male, 1 female, both macropterous; Chaityaphum, Tat Tone NP, streamside at Tat Fah waterfall, 242 m a.s.l.; Malaise trap, 19-26.MAR.2007; leg. Tawit Jaruphan & Orawan Budsawong (T2352). – 2 males, 1 female (allotype), all macropterous; Chaityaphum, Tat Tone NP, officer house at Tat Fah waterfall, 242 m a.s.l.; Malaise trap, 19-26.MAR.2007; leg. Tawit Jaruphan & Orawan Budsawong (T2353). – 1 macropterous female; Chaityaphum, Tat Tone NP, water tank at Tat Fah waterfall, 245 m a.s.l.; Malaise trap, 26.MAR.-2.APR.2007; leg. Tawit Jaruphan & Orawan Budsawong (T2357). – 1 macropterous male; Chaityaphum, Tat Tone NP, entrance/Pha Eang waterfall, 297 m a.s.l.; pan trap, 7-8.APR.2007; leg. Tawit Jaruphan (T5182). – 1 macropterous female; Chaityaphum, Tat Tone NP, entrance/Pha Eang waterfall, 297 m a.s.l.; Malaise trap, 19-26.APR.2007; leg. Tawit Jaruphan (T5181). – 1 macropterous male; Ubon Ratchathani, Pha Taem NP, foot of Phu Kra Jeaw, 238 m a.s.l.; Malaise trap, 18-25.DEC.2006; leg. Thongcome & Pakdee (T1206). – 1 macropterous female; Ubon Ratchathani, Pha Taem NP, Don Rong pond, 250 m a.s.l.; pan trap, 4-5.FEB.2007; leg. Bunlu Subsiri (T1657). – 1 macropterous female; Ubon Ratchathani, Pha Taem NP, Don Rong pond, 250 m a.s.l.; Malaise trap, 3-10.FEB.2007; leg. Bunlu Subsiri (T1664). – 1 macropterous female; Ubon Ratchathani, Pha Taem NP, Pha Maun, 230 m a.s.l.; Malaise trap, 10-17.FEB.2007; leg. Bunlu Subsiri (T1666). – 2 macropterous females; Ubon Ratchathani, Pha Taem NP, Don Rong pond, 250 m a.s.l.; Malaise trap, 10-17.FEB.2007; leg. Bunlu Subsiri (T1667). – 2 macropterous females; Ubon Ratchathani, Pha

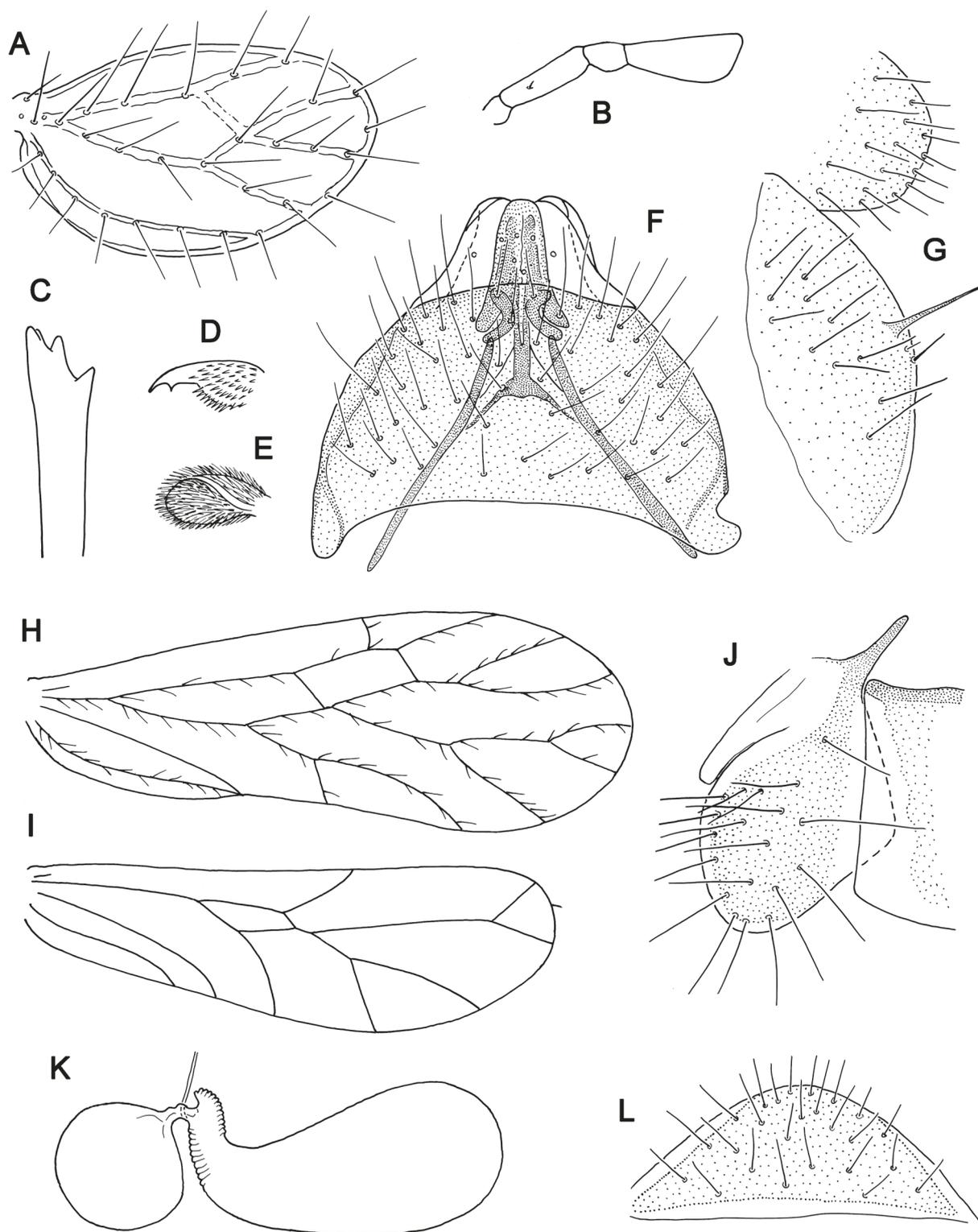


Fig. 3. *Psyllipsocus fusciceps* sp. nov., brachypterous male, holotype (A-G), macropterous male (H-I), macropterous female (J-L). (A) Right forewing (length 0.29 mm). (B) Maxillary palp (with tiny conical sensillum on P2). (C) Lacinial tip. (D) Posterior pretarsal claw of hindtarsus (internal view). (E) Anterior pretarsal claw of hindtarsus (internal view). (F) Hypandrium and phallosome (ventral view). (G) Epiproct and left paraproct. (H) Forewing. (I) Hindwing (same magnification as H). (J) Left ovipositor valvulae and hind corner of clunium. (K) Spermatheca. (L) Subgenital plate.

Taem NP, Don Rong pond, 250 m a.s.l.; Malaise trap, 17-24.FEB.2007; leg. Bunlu Subsiri (T1670). – 1 macropterous male; Ubon Ratchathani, Pha Taem NP, entrance of Huay Pok substation, 438 m a.s.l.; Malaise trap, 18-25.APR.2007; leg. Bunlu Sapsiri (T2169). – 1 macropterous female; Ubon Ratchathani, Pha Taem NP, Huay Pok waterfall, 419 m a.s.l.; Malaise trap, 18-25.APR.2007; leg. Bunlu Sapsiri (T2171). – 1 macropterous male; Ubon Ratchathani, Pha Taem NP, Huay Pok waterfall, 419 m a.s.l.; Malaise trap, 25.APR.-2.MAY.2007; leg. Bunlu Sapsiri (T2174). – 1 macropterous female; Ubon Ratchathani, Pha Taem NP, first level - Huay Sa-nhom waterfall, 230 m a.s.l.; Malaise trap, 2-9.MAY.2007; leg. Sorawit Mingman (T2185). – 1 macropterous female; Ubon Ratchathani, Pha Taem NP, first level - Huay Sa-nhom waterfall, 230 m a.s.l.; pan trap, 7-8.MAY.2007; leg. Sorawit Mingman (T2182).

Diagnosis: This species is closely related to *P. disparunguis* Lienhard, 2009 and two new species from Thailand described below, *P. prominens* sp. nov. and *P. simplex* sp. nov. These species are characterized by the presence of strongly asymmetric pretarsal claws (Fig. 3D, E), the anterior claw of each leg being bulbous and covered with fine microtrichia. This character is unique in the genus *Psyllipsocus*. These species are also characterized by the absence of paraproctal trichobothria, not only in brachypterous but also in macropterous specimens. The four species can be distinguished by their male terminalia. *P. fusciceps* sp. nov. is additionally characterized by its dark brown head, in contrast to the much lighter coloration in the three other species.

Etymology: The species epithet, a noun in apposition, refers to the dark brown colour of the head (from Latin *fuscus* = dark and *-ceps*, derived from *caput* = head).

Description

General characters: Usually macropterous with well-developed hindwing (Fig. 3H, I), rarely strongly brachypterous (Fig. 3A) with hindwing almost completely absent (reduced to a microscopical veinless lobe); brachyptery only known in male, all known females macropterous. Head medium brown to dark brown (clearly darker than thorax), remaining body whitish to light brown, occasionally thorax and abdomen with some reddish-brown hypodermal pigment, wings hyaline. Ocelli well developed in macropterous specimens, absent in brachypterous males; compound eyes rather large (IO/D 1.2-1.5), also in brachypterous males. Head capsule lacking particular sculpture. Maxillary palp (Fig. 3B) with a weakly differentiated, small and relatively slender conical sensillum on P2, P4 moderately hatchet shaped. Lacinal tip trifid (Fig. 3C). Antennae damaged in most specimens, one intact antenna observed (21-segmented), flagellomeres with secondary annulation. Pretarsal

claws strongly asymmetric: anterior claw of each leg bulbous, its surface covered with fine microtrichia except for a narrow oblique hyaline band on inner surface of the claw, running from base towards apex (Fig. 3E), posterior claw with a small preapical tooth, similar to a normal claw of *Psyllipsocus*, but its microtrichia-bearing basal part slightly swollen (Fig. 3D). Hind leg with well-developed coxal organ. Forewing of macropterous form as in Fig. 3H, with relatively short hairs on veins (except CuP); hindwing bare, at most with few very short marginal hairs in radial fork (Fig. 3I). In brachypterous form forewing veins strongly reduced, with relatively long hairs (Fig. 3A).

Male terminalia: Clunium, epiproct and paraproct simple (Fig. 3G). Paraproct lacking trichobothria, with a rigid anal spine (not articulated at its base), a much shorter stout seta ventrally to it and a tiny setal sensillum between them. Hypandrium and phallosome as in Fig. 3F, basal struts of the phallosome strongly diverging anteriorly.

Female terminalia: Clunium, epiproct and paraproct as in male. Subgenital plate simple, without particularly long marginal hairs (Fig. 3L). Ovipositor valvulae as in Fig. 3J: v1 absent, v2 short and membranous, v3 broadly rounded, partly sclerotized and pilose. Spermatheca (Fig. 3K) membranous, origin of its duct situated between a globular accessory vesicle and the larger main spermathecal sac (the latter often larger after slide mounting than shown in Fig. 3K). Spermapore not observed.

Measurements: *Brachypterous male* (holotype): BL = 1.35 mm; FW = 0.29 mm; F = 276 µm; T = 430 µm; t1 = 177 µm; t2 = 43 µm; t3 = 49 µm; IO/D = 1.4. – *Macropterous male* (paratype): BL = 1.20 mm; FW = 1.41 mm; FWw = 0.51 mm; HW = 1.18 mm; F = 337 µm; T = 552 µm; t1 = 232 µm; t2 = 52 µm; t3 = 54 µm; IO/D = 1.2. – *Macropterous female* (allotype): BL = 1.40 mm; FW = 1.49 mm; FWw = 0.49 mm; HW = 1.27 mm; F = 342 µm; T = 574 µm; t1 = 237 µm; t2 = 49 µm; t3 = 56 µm; IO/D = 1.3.

Distribution: Apparently a rather common species in central (Chaiyaphum) and eastern (Ubon Ratchathani) Thailand. In northern Thailand (Chiang Mai, the type locality) it is only known from a domestic population.

Remarks: *P. fusciceps* sp. nov. does not only live in natural biotopes, especially dry evergreen forests, but has once been collected in a human dwelling (Chiang Mai city). The brachypterous form is only known from this domestic population. However, the absence of flightless specimens in natural biotopes is likely due to the fact that all material was collected by flight interception traps. Macropterous specimens seem to have somewhat longer hind legs than the brachypterous holotype. However, in view of their identical coloration and morphology of male terminalia, this difference is not sufficient to consider the two forms as separate species.

P. fusciceps sp. nov. belongs to a small group of species including *P. disparunguis* Lienhard, 2009, only known from the United Arab Emirates (Lienhard, 2009), and two new species from Thailand described below, *P. prominens* sp. nov. and *P. simplex* sp. nov. These species are characterized by the presence of strongly asymmetric pretarsal claws, the anterior claw of each leg being bulbous and covered with fine microtrichia (Fig. 3E). This character is unique in the genus *Psyllipsocus* and is here considered as an autapomorphy of the *disparunguis* species group. *P. fusciceps* sp. nov. can be distinguished from the other three species by the structure of the male terminalia and the dark brown colouration of the head (versus light brown in the other species). Due to its simple paraproct in male, lacking trichobothria and special sclerotizations, *P. fusciceps* sp. nov. is more closely related to *P. disparunguis* than to the two other Thai species. In *P. prominens* sp. nov. and *P. simplex* sp. nov. the male paraproct also lacks trichobothria but bears a sclerotized dorso-ventral band, straight in the latter species (Fig. 5E), ventrally curved in the former (Fig. 4G). In the female the *disparunguis* group is also characterized by the absence of paraproctal trichobothria and, additionally, by the strong reduction of v1 and v2. In *P. disparunguis* and *P. fusciceps* sp. nov. the spermatheca bears an accessory vesicle near the opening of the spermathecal duct (Fig. 3K and Lienhard, 2009: fig. 8), in *P. prominens* sp. nov. a complex spiral-shaped structure is present in this region of the spermatheca (Fig. 4J). The spermatheca of *P. simplex* sp. nov. is not known.

In the genus *Psyllipsocus* the pretarsal claws are generally simple and symmetrical. Beyond the four species of the *disparunguis* group, only the Mexican *P. regiomontanus* Mockford, 2011 has strongly modified pretarsal claws. In that species both claws of each pretarsus are foliaceous, with a rounded membranous pad enclosing each a regular claw, the pointed tip of the latter extruding from the pad (Mockford, 2011: p. 28 and fig. 77). *P. regiomontanus* clearly differs from the species of the *disparunguis* group by the wing venation and terminalia of both sexes. Thus, the modified structure of the pretarsal claws does not indicate particularly close relationship between these taxa.

***Psyllipsocus prominens* sp. nov.**

Fig. 4

Holotype: QSBG; male (slide-mounted); Thailand, Phetchabun, Khao Kho NP, view point at Khla Stream, 246 m a.s.l.; Malaise trap, 12-19.MAR.2007; leg. Somchai Chachumnan & Saink Singtong (T2413).

Paratypes: MHNG and QSBG (partly slide-mounted); 32 males and 42 females (one of them labelled as allotype) from Thailand. – 1 male, 2 females; Phetchabun, Khao Kho NP, mixed deciduous forest at

Ta Phoi river, 242 m a.s.l.; pan traps, 5-6.NOV.2006 (T961) and 10-11.Nov.2006 (T966); leg. Somchai Chachumnan & Saink Singtong. – 2 males; Phetchabun, Khao Kho NP, mixed deciduous near office, 230 m a.s.l.; Malaise trap, 19-26.FEB.2007 (T1607) and 26.FEB.-5.MAR.2007 (T1610); leg. Somchai Chachumnan & Saink Singtong. – 1 male, 1 female; Phetchabun, Nam Nao NP, Heliport, 890 m a.s.l.; pan trap, 20-21.DEC.2006; leg. Noopean Hongyothi & Leng Janteab (T1427). – 1 male, 5 females (one of them allotype); Chaiyaphum, Pa Hin Ngam NP, dry dipterocarp forest at Lan Hin Nor, 681 m a.s.l.; Malaise trap, 9-15.MAR.2007 (T2330) and 15-21.MAR.2007 (T2333); leg. Katae Sa-nog & Buakaw Adnafal. – 5 males, 4 females; Chaiyaphum, Pa Hin Ngam NP, dry evergreen forest at Lan Hin Nor, 673 m a.s.l.; Malaise trap, 3-9.MAR.2007 (T2326) and 21-27.MAR.2007 (T2335); leg. Katae Sa-nog & Buakaw Adnafal. – 4 females; Chaiyaphum, Pa Hin Ngam NP, Nature trail at Lan Hin Nor, 668 m a.s.l.; Malaise trap, 3-9.MAR.2007; leg. Katae Sa-nog & Buakaw Adnafal (T2325). – 2 males, 1 female; Chaiyaphum, Pa Hin Ngam NP, ecotone between mix deciduous and dipterocarp forest, 700 m a.s.l.; Malaise trap, 1-7.FEB.2007 (T1642) and 13-19.FEB.2007 (T1648); leg. Katae Sa-nog & Buakaw Adnafal (T2325). – 2 males; Chaiyaphum, Pa Hin Ngam NP, dipterocarp forest, 698 m a.s.l.; Malaise trap, 1-7.FEB.2007 (T1644) and 7-13.FEB.2007 (T1647); leg. Katae Sa-nog & Buakaw Adnafal. – 1 female; Chaiyaphum, Pa Hin Ngam NP, deciduous, 398 m a.s.l.; Malaise trap, 26.DEC.2006-2.JAN.2007; leg. Katae Sa-nog & Buakaw Adnafal (T1354). – 1 female; Chaiyaphum, Pa Hin Ngam NP, car park at Thung Dok Kra Jeow, 750 m a.s.l.; Malaise trap, 13-19.JAN.2007; leg. Katae Sa-nog & Buakaw Adnafal (T1459). – 1 male, 2 females; Chaiyaphum, Tat Tone NP, by the stream, 280-305 m a.s.l.; Malaise trap, 5-12.JAN.2007 (T1558 and T1559) and 12-19.JAN.2007 (T1561); leg. Tawit Jaruphan & Orawan Budsawong. – 1 female; Chaiyaphum, Tat Tone NP, Nursery at head water area, 257 m a.s.l.; Malaise trap, 12-19.FEB.2007; leg. Tawit Jaruphan & Orawan Budsawong (T1731). – 1 male; Chaiyaphum, Tat Tone NP, officer house at Tat Fah waterfall, 242 m a.s.l.; Malaise trap, 19-26.MAR.2007; leg. Tawit Jaruphan & Orawan Budsawong (T2353). – 2 males, 1 female; Chaiyaphum, Tat Tone NP, water tank at Tat Fah waterfall, 245 m a.s.l.; Malaise trap, 5-12.MAR.2007 (T2348) and 12-19.MAR.2007 (T2351); leg. Tawit Jaruphan & Orawan Budsawong. – 1 female; Chaiyaphum, Tat Tone NP, streamside at Tat Fah waterfall, 242 m a.s.l.; Malaise trap, 5-12.MAR.2007; leg. Tawit Jaruphan & Orawan Budsawong (T2346). – 2 females; Chaiyaphum, Tat Tone NP, watershed station 2, 271 m a.s.l.; Malaise trap, 12-19.APR.2007 (T5193) and 19-26.APR.2007 (T5190); leg. Tawit Jaruphan. – 2 females; Loei, Phu Kradueng NP, mixed deciduous forest north (T1075) and south

(T1080) of Na Noy Forest Unit, 275 m a.s.l.; Malaise trap, 14-20.Nov.2006 (T1075) and 26.Nov.-2.DEC.2006 (T1080); leg. Suthin Gong-Iasae. – 1 female; Loei, Phu Kradueng NP, forest protection unit Loei 5 (Phakbung), 406 m a.s.l.; pan trap, 8-9.FEB.2007; leg. Noo Kerdlom (T1489). – 2 females; Loei, Phu Kradueng NP, forest protection unit Loei 5 (Phakbung), 406 m a.s.l.; Malaise trap, 7-13.FEB.2007; leg. Suthin Gong-Iasae (T1495 and T1496). – 4 males; Loei, Phu Kradueng NP, forest protection unit Loei 5 (Phakbung), 412 m a.s.l.; Malaise trap, 13-19.FEB.2007 (T1500) and 19-25.FEB.2007 (T1503); leg. Wuthicahi Kwanjam & Noo Kerdlom. – 2 males, 1 female; Loei, Phu Kradueng NP, forest protection unit Loei 5 (Phakbung), 406 m a.s.l.; Malaise trap, 25.FEB.-1.MAR.2007; leg. Sonkgran Kamtue (T1504, T1505, T1506). – 1 female; Sakon Nakhon, Phu Phan NP, mixed deciduous forest at foot hill forest unit, 239 m a.s.l.; Malaise trap, 25-31.OCT.2006; leg. Winlon Kongnara (T707). – 1 male; Sakon Nakhon, Phu Phan NP, West of well, 322 m a.s.l.; pan trap, 11-12.JAN.2007; leg. Sailom Tongboonchai (T1515). – 1 female; Sakon Nakhon, Phu Phan NP, North of well, 312 m a.s.l.; Malaise trap, 23-30.JAN.2007; leg. Sailom Tongboonchai (T1525). – 2 females; Sakon Nakhon, Phu Phan NP, behind forest protection unit at Huay Wien Prai, 376 m a.s.l.; Malaise trap, 4-10.FEB.2007 (T1685) and 10-17.FEB.2007 (T1688); leg. Winlon Kongnara. – 2 males; Sakon Nakhon, Phu Phan NP, behind forest protection unit at Huay Wien Prai, 318 m a.s.l.; Malaise trap, 4-10.FEB.2007; leg. Winlon Kongnara (T1684). – 1 male, 1 female; Ubon Ratchathani, Pha Taem NP, Huay Pok waterfall, 419 m a.s.l.; Malaise trap, 11-18.APR.2007 (T2168) and 18-25.APR. 2007 (T2171); leg. Bunlu Sapsiri. – 1 male, 2 females; Ubon Ratchathani, Pha Taem NP, Don Rong pond, 250 m a.s.l.; Malaise trap, 3-10.FEB.2007 (T1664), 10-17.FEB. 2007 (T1667) and 24.FEB.-3.MAR.2007 (T1673); leg. Bunlu Subsiri. – 1 male; Ubon Ratchathani, Pha Taem NP, Rong Hi Noy, 240 m a.s.l.; Malaise trap, 1-7.JAN.2007; leg. Thongkam & Pakdee (T1476). – 2 females; Ubon Ratchathani, Pha Taem NP, Rong Hi, 246 m a.s.l.; Malaise trap, 14-21.JAN.2007; leg. Thongkam & Pakdee (T1480). – 2 males, 1 female; Ubon Ratchathani, Pha Taem NP, East of Thung Luang in Dipterocarpus forest, 238 m a.s.l.; Malaise trap, 14-21.JAN.2007 (T1481) and 21-28.JAN.2007 (T1484); leg. Thongkam & Pakdee.

Diagnosis: See diagnosis of *P. fusciceps* sp. nov., above.

Etymology: The species epithet, an invariable Latin present participle, refers to the medio-ventrally prominent lobe of the hypandrium.

Description

General characters: Both sexes macropterous (Fig. 4A, B). Body whitish to light brown (head not darker than thorax), wings hyaline. Ocelli well developed, compound eyes rather large (IO/D 1.3-1.5). Head capsule lacking

particular sculpture. Maxillary palp (Fig. 4E) with a weakly differentiated slender conical sensillum on P2, P4 moderately hatchet shaped. Lacinal tip trifid (Fig. 4D), exceptionally outer tine somewhat shortened (Fig. 4C). Antennae damaged in all specimens, flagellomeres (at least basal ones) with secondary annulation. Pretarsal claws strongly asymmetric, as described for *P. fusciceps* sp. nov. (see above). Hind leg with well-developed coxal organ. Wings as in Fig. 4A, B.

Male terminalia: Clunium and epiproct simple (Fig. 4G). Paraproct lacking trichobothria, bearing a ventrally curved sclerotized dorso-ventral band, with a rigid anal spine (not articulated at its base), a much shorter stout seta ventrally to it and a tiny setal sensillum between them (Fig. 4G). Hypandrium and phallosome as in Fig. 4F, hypandrium with a striking bilobed medioventral prominence, basal struts of the phallosome strongly diverging anteriorly.

Female terminalia: Clunium and epiproct as in male. Paraproct as in male but lacking vertical sclerotized zone (Fig. 4H). Subgenital plate simple, without particularly long marginal hairs. Ovipositor valvulae as in Fig. 4I: v1 absent, v2 short and membranous, v3 broadly rounded, partly sclerotized and pilose. Spermatheca consisting of a thinwalled sac and a complex spiral-shaped part near the origin of its duct (Fig. 4J) bearing some sclerotized structures, fields of microtrichia and granulations or fine ridges. Spermatopore not observed.

Measurements: *Male* (holotype): BL = 1.36 mm; FW = 1.59 mm; FWw = 0.56 mm; HW = 1.27 mm; F = 342 µm; T = 580 µm; t1 = 221 µm; t2 = 43 µm; t3 = 49 µm; IO/D = 1.4. – *Female* (allotype): BL = 1.42 mm; FW = 1.52 mm; FWw = 0.58 mm; HW = 1.24 mm; F = 337 µm; T = 552 µm; t1 = 199 µm; t2 = 43 µm; t3 = 52 µm; IO/D = 1.4.

Distribution: Apparently a common species in central (Chaiyaphum, Phetchabun, where Khao Kho NP, the type locality, is located, and Loei) and eastern (Sakon Nakhon, Ubon-Ratchathani) Thailand.

Remarks: The species belongs to the *disparunguis* species group (see remarks on *P. fusciceps* sp. nov., above). It is closely related to *P. simplex* sp. nov. (see below). However, it differs clearly from the latter by the male terminalia: shape and structure of the hypandrium, details of apical structures of the phallosome and shape of the sclerotized vertical zone of the paraproct. The most striking difference is the absence, in *P. simplex* sp. nov., of a medio-ventral hypandrial prominence, present in *P. prominens* sp. nov. and unique in the genus. Due to the presence of a sclerotized vertical zone on the male paraproct these species form a small sub-group within the *disparunguis* species group.

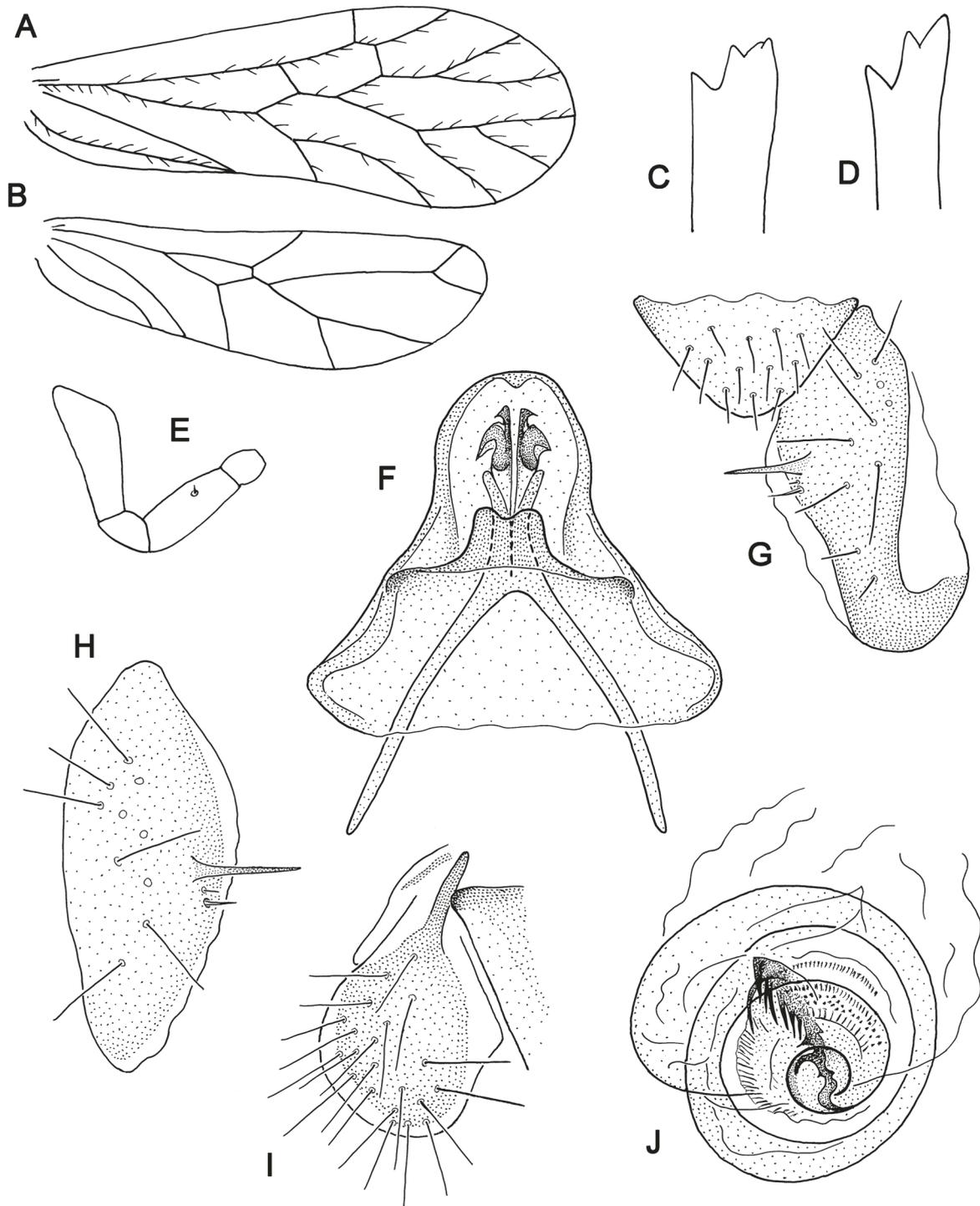


Fig. 4. *Psyllipsocus prominens* sp. nov. (A) Forewing. (B) Hindwing (same magnification as A). (C) Lacinial tip, male holotype. (D) Lacinial tip, male paratype. (E) Maxillary palp (with tiny conical sensillum on P2). (F) Hypandrium and phallosome (ventral view). (G) Epiproct and right paraproct, male. (H) Left paraproct, female. (I) Left ovipositor valvulae and hind corner of clunium. (J) Spermathecal structures close to spermathecal duct (duct itself not visible).

Psyllipsocus simplex sp. nov.

Fig. 5

Holotype: QSBG; male (slide-mounted); Thailand, Suphanburi, Pu Thoei NP, Protection Unit 2/Pu Krathing, 220 m a.s.l.; Malaise trap, 14-21.MAR.2000; leg. Wangkum, P. (T4636).

Diagnosis: See diagnosis of *P. fusciceps* sp. nov., above.

Etymology: The species epithet, an invariable Latin adjective, refers to the simple hypandrium, lacking the medio-ventral prominence present in the closely related species *P. prominens* sp. nov. (see above).

Description

General characters: As in *P. prominens* sp. nov., see above. See also Fig. 5A, B, D. Maxillary palps and antennal flagella lacking (one remaining basal flagellomere with secondary annulation). Compound eye particularly large (IO/D 1.0).

Male terminalia: Clunium and epiproct simple (Fig. 5E). Paraproct lacking trichobothria, bearing a straight sclerotized dorso-ventral band, with a rigid anal spine (not articulated at its base), a much shorter stout seta ventrally to it and a tiny setal sensillum between them (Fig. 5E). Hypandrium and phallosome as in Fig. 5C, hypandrium simple, lacking medio-ventral prominence, basal struts of the phallosome strongly diverging anteriorly.

Female: Not known.

Measurements: *Male* (holotype): BL = 1.24 mm; FW = 1.32 mm; FWw = 0.46 mm; HW = 1.13 mm; F = 320 µm; T = 546 µm; t1 = 204 µm; t2 = 47 µm; t3 = 54 µm; IO/D = 1.0.

Distribution: Thailand, Suphanburi (only known from the type locality: Pu Thoei NP).

Remarks: The species belongs to the *disparunguis* species group and is closely related to *P. prominens* sp. nov. (see remarks on *P. fusciceps* sp. nov. and *P. prominens* sp. nov., above).

Psyllipsocus cluniopilosus sp. nov.

Fig. 6

Holotype: MHNG; male (slide-mounted); Thailand, Chiang Mai, Chiang Mai District, Doi Suthep, 1000 m a.s.l.; pitfall trap, 18.MAR.-22.APR.1986; leg. P. Schwendinger.

Diagnosis: This species is closely related to *P. bidentatus* sp. nov.; both species are characterized by the strongly asymmetric bifid lacinial tip (Fig. 6F), the sclerotized band separated from the main part of the postero-lateral lobe of the clunium by a membranous zone (especially well developed in the male, Figs 6H, 7B), and by the presence, in the male, of a particular basi-ventral abdominal organ (Fig. 6C, D).

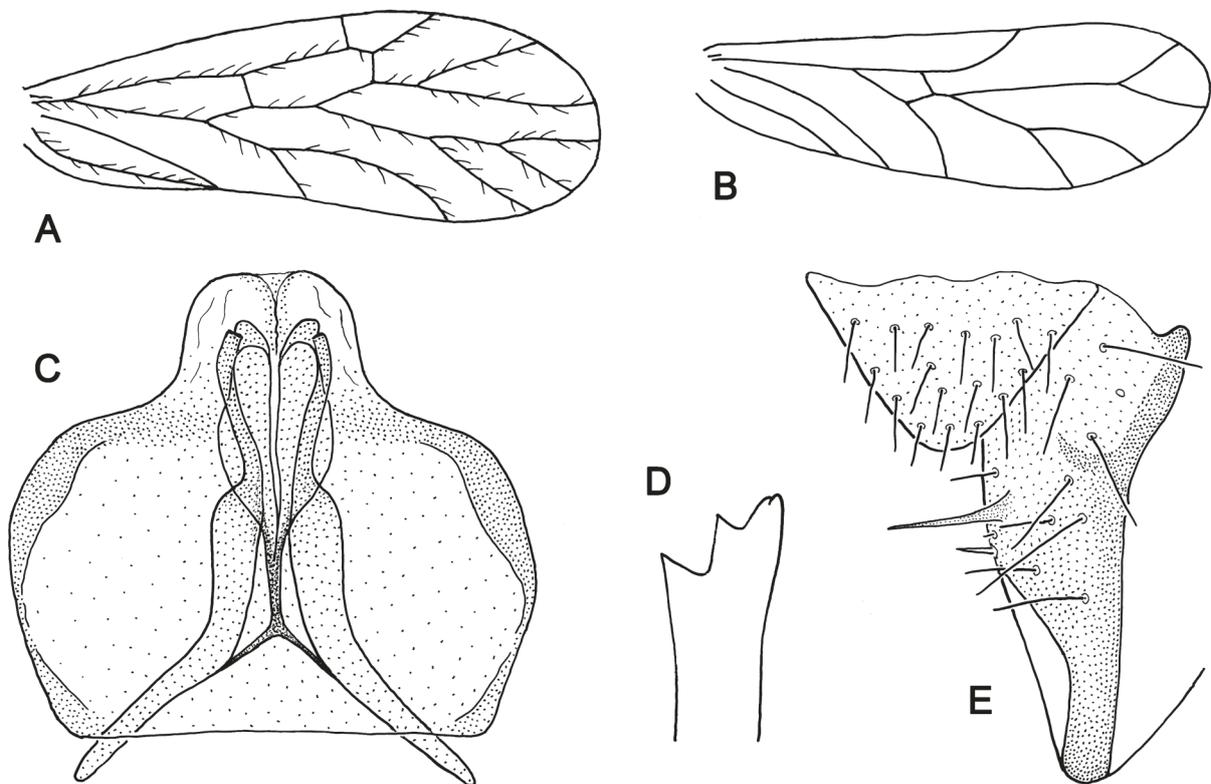


Fig. 5. *Psyllipsocus simplex* sp. nov., male. (A) Forewing. (B) Hindwing (same magnification as A). (C) Hypandrium and phallosome (ventral view). (D) Lacinial tip. (E) Epiproct and right paraproct.

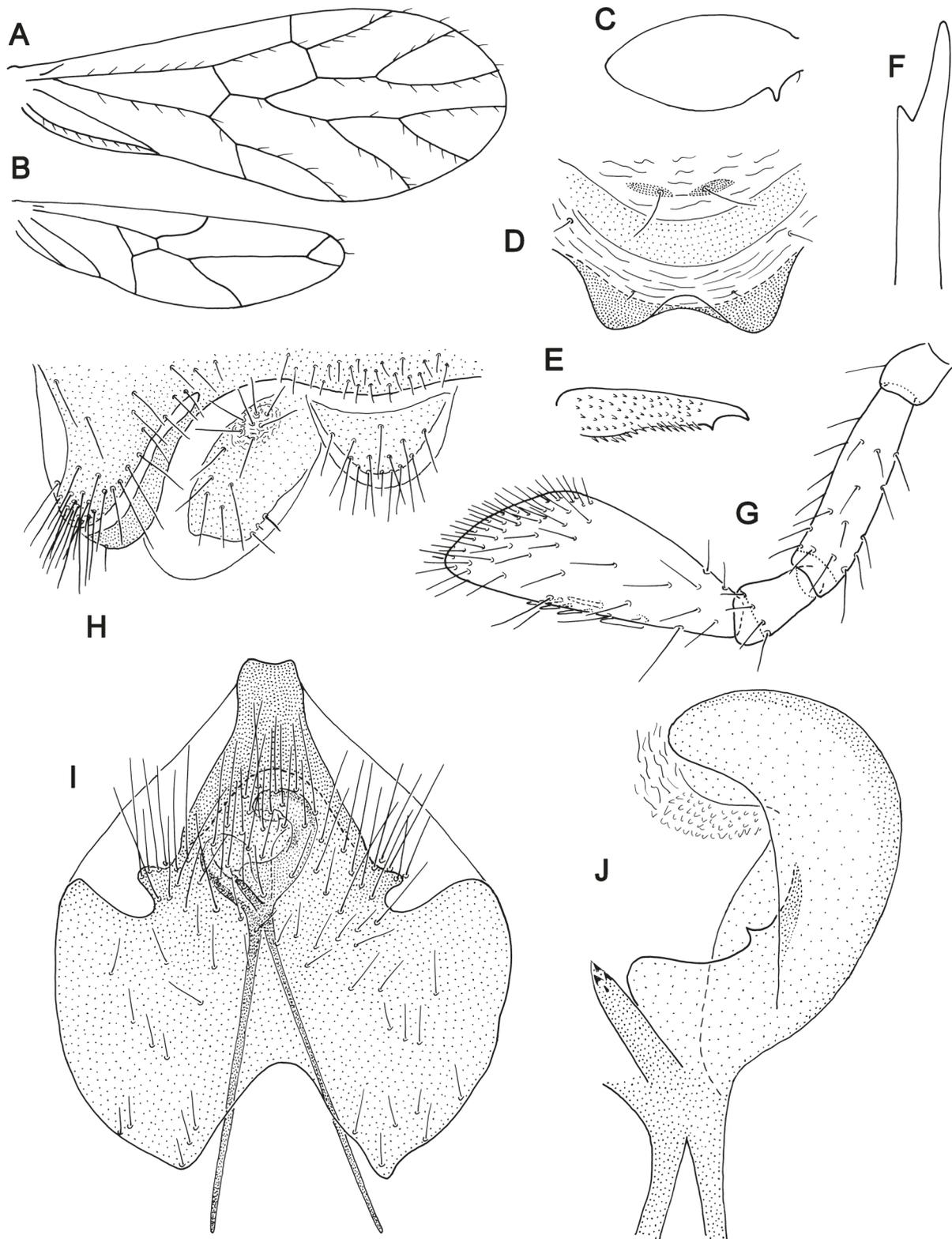


Fig. 6. *Psyllipsocus cluniopilosus* sp. nov., male. (A) Forewing. (B) Hindwing (same magnification as A). (C) Abdomen in schematic lateral profile (apex on the left side) showing the relative positions of the prominent part of the basi-ventral organ and the basal hair sensillum. (D) Bilobed basi-ventral abdominal organ (antero-ventral view), with basal pair of hair sensilla inserted on small sclerotized plates. (E) Pretarsal claw. (F) Lacinial tip. (G) Maxillary palp. (H) Posterior parts of clunium, left paraproct and epiproct. (I) Hypandrium and phallosome (ventral view, phallosome slightly asymmetrical due to squashing by slide-mounting). (J) Detail of right posterior part of phallosome.

P. cluniopilosus sp. nov. can be distinguished from *P. bidentatus* sp. nov. by the presence of numerous long hairs distally on the main part of the postero-lateral lobe of the male clunium and by details of the hypandrium and the phallosome.

Etymology: The species epithet, derived from the abdominal clunium and the Latin adjective *pilosus*, *-a*, *-um*, refers to the densely pilose postero-lateral lobe of the male clunium.

Description

General characters: Macropterous (Fig. 6A, B), wings hyaline. Body medium brown, vertical suture black, frontal suture much lighter, maxillary palp whitish. Abdomen light brown with much reddish-brown hypodermal pigment in basal half. Ocelli well developed, compound eyes rather large (IO/D 1.2). Head capsule lacking particular sculpture. Maxillary palp (Fig. 6G) lacking conical sensillum on P2, P4 strongly hatchet shaped. Lacinial tip asymmetrically bifid, inner tine very short, outer tine slender and elongate (Fig. 6F). Flagellum of both antennae slightly damaged but antennae still very long, bearing 30 and 28 flagellomeres with secondary annulation. Pretarsal claws elongate, with a small preapical denticle (Fig. 6E). Hindleg with coxal organ, but coxal rasp relatively weakly developed. Wings as in Fig. 6A, B. Abdomen medially with a characteristic basi-ventral organ consisting of a prominent bilobed and slightly sclerotized structure and, basally to it, a pair of hair sensilla inserted on small sclerotized plates (Fig. 6C, D).

Male terminalia: Main part of the postero-lateral lobe of the clunium (clunium corner) distally heavily pilose, on its internal side with a sclerotized band separated by a membranous zone from the pilose main part, this band only bearing one distal sensory hair (Fig. 6H). Epiproct simple, paraproct with a well-developed sensorium bearing seven trichobothria and with two relatively stout setae on posterior margin and a tiny setal sensillum between them (Fig. 6H). Hypandrium and phallosome as in Fig. 6I, J, hypandrium with a relatively broad and distally slightly bilobate sclerotized posterior part bearing several long setae (almost all lateral long setae inserted on small lateral lobes at the base of the sclerotized posterior part of the hypandrium), indentation of anterior hypandrial margin V-shaped. Basal struts of phallosome diverging anteriorly, fused posteriorly in an acute angle, zone of fusion prolonged by an apically pointed postero-medial prominence bearing some small denticles (Fig. 6J). Posterior parts of phallosome symmetrical, only right half shown in Fig. 6J, slightly distorted.

Female: Not known.

Measurements: *Male* (holotype): BL = 2.2 mm; FW = 2.20 mm; FWw = 0.87 mm; HW = 1.51 mm; F = 733 μ m; T = 1128 μ m; t1 = 430 μ m; t2 = 61 μ m; t3 = 77 μ m; IO/D = 1.2.

Distribution: Northern Thailand (only known from the type locality: Chiang Mai, Doi Suthep).

Remarks: See *P. bidentatus* sp. nov., below.

Psyllipsocus bidentatus sp. nov.

Fig. 7A-C

Holotype: QSBG; male (slide-mounted); Thailand, Kanchanaburi, Khuean Srinagarindra NP, Huay Mae Kamint/Headquarter, 240 m a.s.l.; Malaise trap, 16-23. APR.2009; leg. Somboon & Daorueng (T4783).

Diagnosis: See diagnosis of *P. cluniopilosus* sp. nov. (above).

Etymology: The species epithet, derived from the Latin adjective *bidentatus*, *-a*, *-um*, refers to the bidentate lacinial tip.

Description

General characters: Generally as described above for the male of *P. cluniopilosus* sp. nov. Body relatively dark brown, especially basal half of abdomen (the latter also with reddish-brown cuticular pigmentation and sharply delimited against lighter posterior tergites), terminalia dark brown. Basi-ventral abdominal organ well developed as in male of *P. cluniopilosus* sp. nov. Specimen damaged: antennae, maxillary palps, right wings and left hind leg lacking.

Male terminalia: Main part of postero-lateral lobe of clunium (clunial corner) distally only with a few hairs, on its internal side with sclerotized band separated by membranous zone from main part, this band only bearing one distal sensory hair (Fig. 7B). Epiproct and paraproct (Fig. 7B) as described for *P. cluniopilosus* sp. nov. Hypandrium and phallosome as in Fig. 7C, hypandrium with relatively slender and distally rounded sclerotized posterior part, most of long hypandrial setae inserted on membranous zone on each side of sclerotized posterior part, indentation of anterior hypandrial margin broadly U-shaped. Basal struts of phallosome diverging anteriorly, fused posteriorly in rounded arch, zone of fusion prolonged by short and apically rounded postero-medial prominence bearing small denticle (Fig. 7C). Posterior parts of phallosome symmetrical, similar to *P. cluniopilosus* sp. nov. (details not visible in Fig. 7C, but checked during slide-mounting).

Female: Not known, but see description of females of *Psyllipsocus* spec. (cf. *bidentatus* sp. nov.), below.

Measurements: *Male* (holotype): BL = 2.0 mm; FW = 2.10 mm; FWw = 0.79 mm; HW damaged; F = 705 μ m; T = 1072 μ m; t1 = 397 μ m; t2 = 63 μ m; t3 = 80 μ m; IO/D = 1.3.

Distribution: Western Thailand (only known from the type locality: Kanchanaburi, Kuean Srinagarindra NP).

Remarks: This species is closely related to *P. cluniopilosus* sp. nov. (see above). Within the genus

Psyllipsocus these two species form a small species group, the *bidentatus* group, characterized by the following autapomorphies: lacinial tip bifid but strongly asymmetric (Fig. 7A); male abdomen with a particular basi-ventral organ of possibly proprioceptive function (Fig. 6C, D; see Discussion); clunium corner with a sclerotized band separated from the main part of the postero-lateral clunial lobe by a membranous zone (Fig. 7B). These species are the largest known species of the genus *Psyllipsocus* and have particularly long legs.

***Psyllipsocus* spec. (cf. *bidentatus* sp. nov.)**

Fig. 7D-G

Material examined: QSBG and MHNG; 2 females (partly slide-mounted, with remains in alcohol); Thailand, Loei, Phu Kradueng NP, Forest Protection

Unit Loei 5 (Phakbung), 406 m a.s.l.; Malaise trap, 7-13.FEB.2007 (leg. Sutin Khonglasae, T1496) and 19-25.FEB.2007 (leg. Noo Kerdlom, T1502).

Description

General characters: As described above for the males of *P. bidentatus* sp. nov. and *P. cluniopilosus* sp. nov., but lacking the basi-ventral abdominal organ. Coloration as in male of *P. bidentatus* sp. nov. but somewhat lighter. All antennae heavily damaged.

Female terminalia: Separated sclerotized band on postero-lateral margin of clunium present but narrower than in males of *P. bidentatus* sp. nov. and *P. cluniopilosus* sp. nov. (Fig. 7G). Epiproct and paraproct as in these males. Subgenital plate simple, without long marginal hairs (Fig. 7D). Ovipositor valvulae as in Fig. 7G: v1 and v2 strongly reduced, membranous, v3 broadly rounded, partly sclerotized and pilose. Spermatheca consisting of a thin-walled sac and, near the origin of its duct, a partly

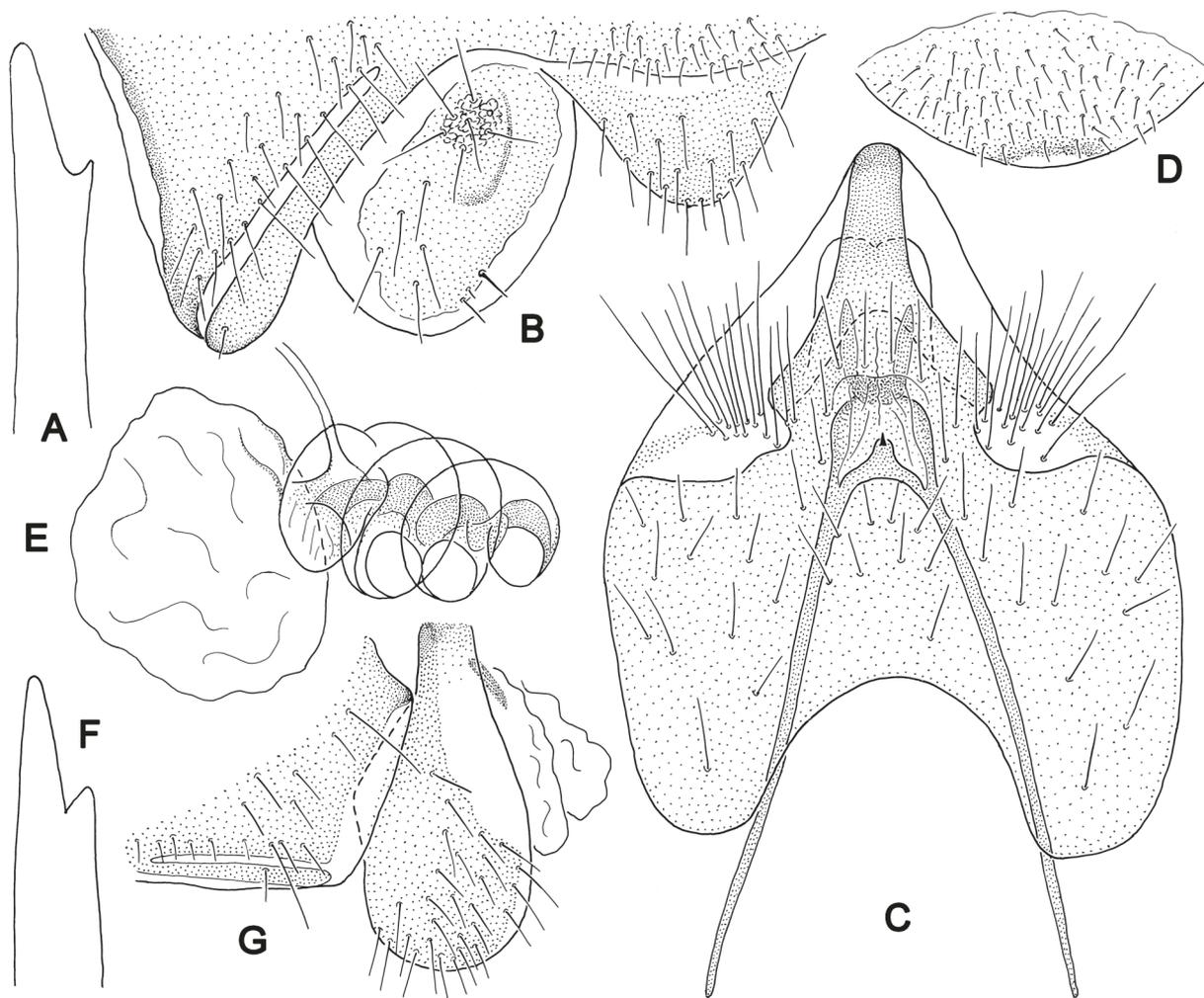


Fig. 7. *Psyllipsocus bidentatus* sp. nov., male (A-C). (A) Lacinial tip. (B) Posterior parts of clunium, left paraproct and epiproct. (C) Hypandrium and phallosome (ventral view). – *Psyllipsocus* spec. (cf. *bidentatus* sp. nov.), female (D-G). (D) Subgenital plate. (E) Spermatheca. (F) Lacinial tip. (G) Right ovipositor valvulae and hind corner of clunium.

sclerotized spiral-shaped structure subdivided into four parts (Fig. 7E). Region of spermapore membranous but relatively complex.

Measurements: *Female* (T1496): BL = 2.0 mm; FW = 2.12 mm; FWw = 0.86 mm; HW = 1.41 mm; F = 705 μ m; T = 1072 μ m; t1 = 386 μ m; t2 = 66 μ m; t3 = 77 μ m; IO/D = 1.4.

Remarks: These females clearly belong to the *bidentatus* group due to the overall similarity with the males of this species group. The absence of the basi-ventral abdominal organ in the female is here interpreted as sexual dimorphism. The general morphological differences of the clunium hind corner in males and females of the genus *Psyllipsocus* suggest that the sparse pilosity in these females (Fig. 7G) and in the male of *P. bidentatus* sp. nov. (Fig. 7B) should not be used as an indicator of conspecificity. The females of *P. cluniopilosus* sp. nov. may show a similar pilosity, though the clunium hind corner is densely pilose in the male of this species (Fig. 6H). Because the type localities of *P. cluniopilosus* sp. nov. (Chiang Mai) and *P. bidentatus* sp. nov. (Kanchanaburi) are situated far from the locality where the females were collected (Loei) I hesitate to assign them definitively to one of these species. An argument in favor of the assignment to *P. bidentatus* sp. nov. might be the fact that these females were collected in a Malaise trap at a similar altitude (406 m) as the male (240 m), while the male of *P. cluniopilosus* sp. nov. was collected in a pitfall trap at a higher altitude (1000 m). However, it is also not excluded that the females belong to an unnamed third species of the *bidentatus* group.

***Psyllipsocus quadridentatus* sp. nov.**

Fig. 8

Holotype: MHNG; male (slide-mounted); Thailand, Chiang Rai, Tham Luang Forest Park, Mae Sai District, 500 m a.s.l., evergreen hill forest on limestone; 29.OCT.1991; leg. P. Schwendinger.

Diagnosis: This species is unique in the genus *Psyllipsocus* due to the following autapomorphies: lacinial tip quadridentate (usually tri- or bidentate in *Psyllipsocus*) (Fig. 8F), P4 short and ovoid in shape (usually elongate and often hatchet shaped) (Fig. 8D), head with reticulate sculpture (usually at most finely granulate) (Fig. 8E), antenna with 19 segments (17 flagellomeres) (usually more than 20 segments), t1 not much longer than t2+t3 (usually t1 at least twice as long as t2+t3).

Etymology: The species epithet, derived from the Latin adjective *quadridentatus*, -a, -um, refers to the quadridentate lacinial tip.

Description

General characters: Macropterous (Fig. 8B, C), wings hyaline. Body dark brown, vertical suture black, frontal suture only visible as a break of sculpture (Fig. 8E), maxillary palp whitish, abdomen with much dark redbrown hypodermal pigment. Ocelli well developed, close together, compound eyes very small (IO/D 2.4). Head capsule with reticulate sculpture (Fig. 8E). Maxillary palp (Fig. 8D) with a well-developed conical sensillum on P2, P4 relatively short, ovoid in shape. Lacinial tip quadridentate (Fig. 8F). Both antennae intact (Fig. 8A), 19-segmented (i.e. 17 flagellomeres), flagellomeres with secondary annulation (partly weakly developed). Pretarsal claws elongate and slender, with a minute preapical denticle (Fig. 8G). Hind leg with coxal organ, but coxal rasp rather weakly developed. Wings as in Fig. 8B, C (one hindwing lost), relatively slender in shape.

Male terminalia: Clunium and epiproct simple, paraproct with a well-developed sensorium bearing seven trichobothria, two stout setae on posterior margin (the dorsal one thicker than the ventral one) and a tiny setal sensillum between them close to the ventral seta (Fig. 8H). Hypandrium and phallosome as in Fig. 8I, J, hypandrium apically rounded, basal struts of phallosome diverging anteriorly, posterior part of phallosome consisting of several sclerotized elements (Fig. 8J).

Female: Not known.

Measurements: *Male* (holotype): BL = 1.15 mm; FW = 1.20 mm; FWw = 0.39 mm; HW = 0.97 mm; F = 309 μ m; T = 497 μ m; t1 = 77 μ m; t2 = 36 μ m; t3 = 36 μ m; IO/D = 2.4.

Distribution: Northern Thailand (only known from the type locality: Chiang Rai, Tham Luang Forest Park).

Remarks: This very small species has an isolated position within the genus *Psyllipsocus* (see Diagnosis, above) and so it forms the monotypic *quadridentatus* species group.

DISCUSSION

Several morphological observations indicate that *Psyllipsocus* is a very heterogeneous genus, with some isolated species or small species groups characterized by striking autapomorphies (Lienhard *et al.*, 2022). The nine Southeast Asian species presented here belong to four probably monophyletic species groups each characterized by at least one striking autapomorphy: the *uncinatus* group (*uncinatus* sp. nov., *bauensis* sp. nov., *hollieri* sp. nov.) characterized by the presence of a postero-ventral paraproctal process in the male; the *disparunguis* group (*disparunguis* Lienhard, only known from the United Arab Emirates, *fusciceps* sp. nov., *prominens* sp. nov., *simplex* sp. nov.) characterized by the presence of strongly asymmetric pretarsal claws; the *bidentatus*

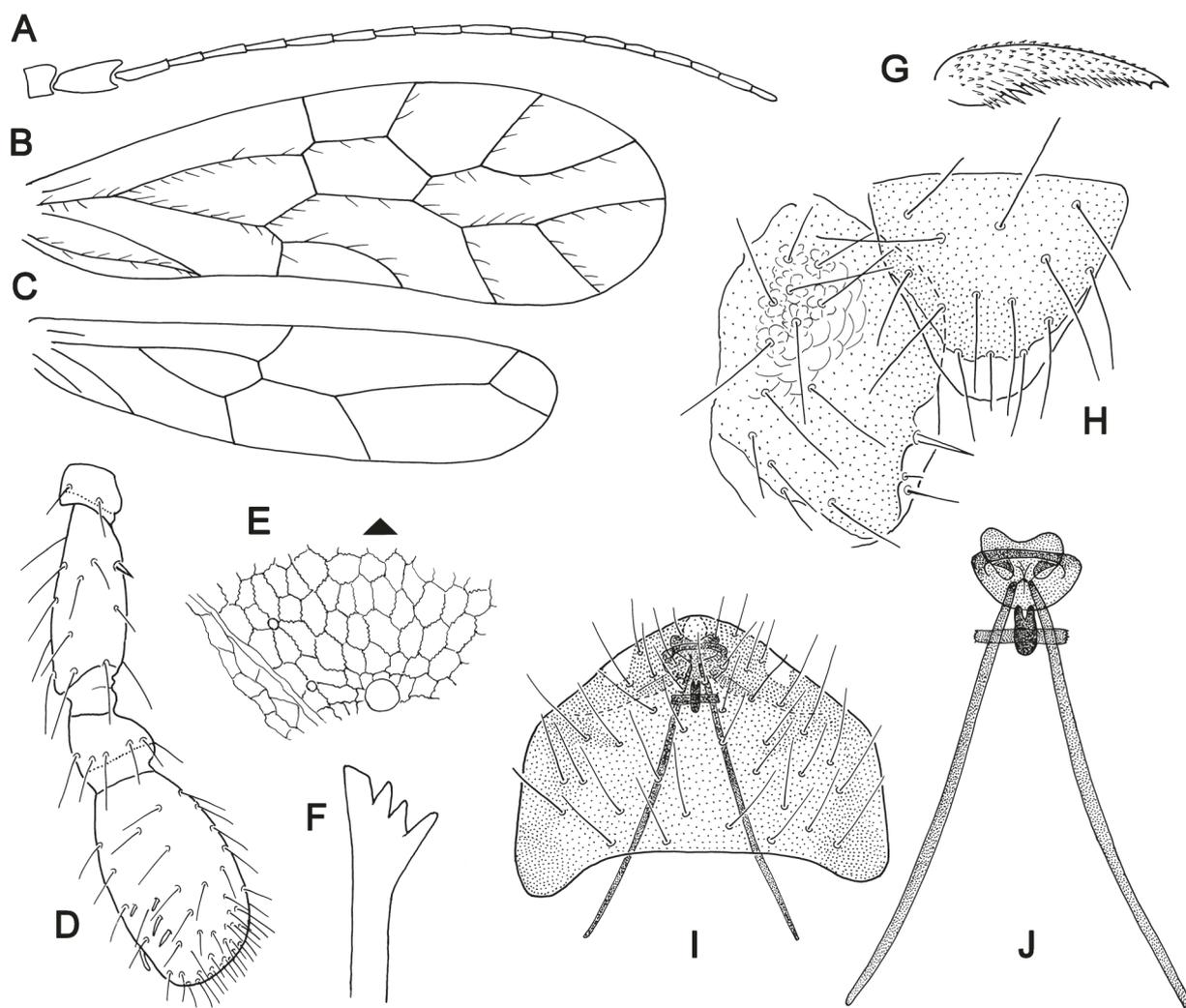


Fig. 8. *Psyllipsocus quadridentatus* sp. nov., male. (A) Antenna. (B) Forewing. (C) Hindwing (same magnification as B). (D) Maxillary palp. (E) Sculpture in middle of head capsule, with frontal ocellus (big cercle), left frontal suture and insertion points of two setae (small cercles); arrowhead pointing towards anterior part of frons. (F) Lacinial tip. (G) Pretarsal claw. (H) Epiproct and left paraproct. (I) Hypandrium and phallosome (ventral view). (J) Details of phallosome.

group (*bidentatus* sp. nov., *cluniopilosus* sp. nov.) characterized by the presence of a particular basi-ventral abdominal organ in the male, the strongly asymmetric bifid lacinial tip and the subdivision of the postero-lateral clunial corner in a main lobe and a narrow sclerotized band; the *quadridentatus* group (*quadridentatus* sp. nov.) characterized by the quadridentate lacinial tip, the short and ovoid P4, the reticulate head sculpture, the relatively short t1 and the reduced number of antennal segments (19 segments, i.e. 17 flagellomeres). In the future, a comprehensive phylogenetic analysis may allow some generic splitting based on such monophyletic species groups, but at present this would be premature.

Psyllipsocus is a very ancient genus and several fossil species have been assigned to it (see Lienhard *et al.*, 2022 and Liang & Liu, 2021). The similarity between *Sinopsyllipsocus fushunensis* Zhang, Nel, Azar & Wang,

2016 (from Eocene Fushun amber) and *Psyllipsocus yangi* Liang & Liu, 2021 (from Mid-Cretaceous Burmese amber) is the basis of the assignment of *S. fushunensis* to the genus *Psyllipsocus* by Liang & Liu (2021: 86) who consider *Sinopsyllipsocus* Zhang, Nel, Azar & Wang, 2016 as a junior synonym of *Psyllipsocus*. The separation of two other similar fossil psyllipsocids from Burmese amber in a genus of their own, *Annulipsyllipsocus* Hakim, Azar, Maksoud, Huang & Azar, 2017, may also not be justified.

As most trogiomorphan psocids, members of the family Psyllipsocidae have usually more than 20 antennal segments (Lienhard, 1998). However, two of the above mentioned fossil psyllipsocids, both from Cretaceous Burmese amber, show already the tendency to the reduction of the number of flagellomeres in this family which was here also observed in the extant *Psyllipsocus*

quadridentatus sp. nov. (19 segments, i.e. 17 flagellomeres). In *Annulipsyllipsocus andreneli* Hakim, Azar, Maksoud, Huang & Azar, 2017, the antenna has only 16 segments (14 flagellomeres) (Hakim *et al.*, 2017: 392) and in *Psyllipsocus myanmarensis* Jouault, Yoshizawa, Hakim, Huang & Nel, 2021 only 11 segments (9 flagellomeres) (Jouault *et al.*, 2021). In the latter case the antennal reduction may be an indication of peculiar biology and behavior (Jouault *et al.*, 2021). At present the number of antennal segments seems not to be a reliable character for generic definitions within this family.

The discovery of a novel abdominal organ of possibly proprioceptive function in the males of *P. bidentatus* sp. nov. and *P. cluniopilosus* sp. nov. (Fig. 6C, D) may also be an indication of a particular biology and behavior, characterizing the *bidentatus* species group. Proprioception in situations of strong ventral bending of the abdomen (e.g. during copulation) may result when the bilobed sclerotized and ventrally prominent part of this organ touches the pair of basal hair sensilla. No similar structure has previously been observed in psocids.

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