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ORIENTAL PSYLLIPSOCUS (PSOCODEA: 'PSOCOPTERA': PSYLLIPSOCIDAE): CHECKLIST, NEW RECORDS AND DESCRIPTION OF FOUR NEW SPECIES FROM SOUTHEAST ASIA

By CHARLES LIENHARD, KAZUNORI YOSHIZAWA and IDRIS ABD GHANI

Abstract

LIENHARD, C., YOSHIZAWA, K. and IDRIS, A. B. 2022. Oriental *Psyllipsocus* (Psocodea: 'Psocoptera': Psyllipsocidae): checklist, new records and description of four new species from Southeast Asia. *Ins. matsum. n. s.* 78: 1–19, 6 figs.

The widely distributed tropical species *Psyllipsocus yucatan* Gurney is recorded from several localities in Thailand. *P. yongi* New & Lee, previously only known from Peninsular Malaysia, is recorded from Thailand and its male is described for the first time. Four new species are described and illustrated: *P. formosus* Lienhard & Yoshizawa n. sp. (Peninsular Malaysia), *P. sarawakensis* Lienhard & Yoshizawa n. sp. (East Malaysia: Sarawak), *P. siamensis* Lienhard & Yoshizawa n. sp. (Thailand), *P. hyalomarginatus* Lienhard & Yoshizawa n. sp. (Thailand). A checklist of the 17 species of *Psyllipsocus* known from the Oriental Region is provided. The name of the Chinese species *P. maculatus* Li Fasheng, a junior homonym of the American *P. maculatus* Garcia Aldrete, is replaced by the new name *P. apicosectus* Lienhard & Yoshizawa n. nom.

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Introduction

The genus *Psyllipsocus* Selys-Longchamps is one of four extant genera of the family Psyllipsocidae, together with *Dorypteryx* Aaron, *Pseudorypteryx* Garcia Aldrete and *Psocathropos* Ribaga (Lienhard & Smithers, 2002). The genus *Pseudopsyllipsocus* Li Fasheng, initially placed in this family (Li Fasheng, 2002) was assigned to the family Lepidopsocidae by Mockford (2011: 18). Psyllipsocidae is the only known family of the infraorder Psyllipsocetae belonging to the Trogiomorpha, the most basal suborder of the Psocodea (de Moya *et al*., 2021).

Psyllipsocus is the most ancient extant genus of the order Psocodea. Two fossil species from Early Cenomanian amber of Myanmar (about 100 Ma) were discovered very recently, *P. yoshizawai* Alvarez-Parra *et al.* (2020) and *P. myanmarensis* Jouault *et al*. (2021). Another fossil species is known from Tertiary amber of France, *P. eocenicus* Nel *et al.* (2005). The Cretaceous psyllipsocid from Early Aptian amber of Lebanon (about 120 Ma) tentatively assigned to *Psyllipsocus* by Mockford (2011: 45) may belong to another genus of this family (Mockford *et al*., 2013).

Given its ancient origin it is not surprising that the genus *Psyllipsocus* is still widely distributed (Lienhard & Smithers, 2002). It has been rather well studied in the New World (Mockford, 2011; Lienhard & Ferreira, 2015) but only a few species are known from Africa (Lienhard & Smithers, 2002) and from the Oriental Region (see Appendix). In the Palaearctic and in Australia the genus is only represented by the widespread cave species *Psyllipsocus ramburii* Selys-Longchamps, which is often also found in human dwellings. Psyllipsocidae is a family in which the cave-dwelling tendency is particularly prevalent; by inhabiting caves and similar natural habitats this group has possibly avoided competing with more recent forms and survived as relicts from an ancient fauna (Thornton, 1962; Lienhard & Ferreira, 2015).

Thirteen species of *Psyllipsocus* were previously known from the Oriental Region, but only four of them from Southeast Asia (Peninsular Malaysia, Thailand) (see Appendix). In the Psocoptera volume of Fauna Malesiana Handbooks (New & Lienhard, 2007) only three species are listed (see Appendix), an additional species, *P. yucatan,* was recorded from Thailand by Lienhard & Ferreira (2015) but no exact localities were indicated by these authors. Below all known localities from Thailand are listed for this species which is widely distributed in the tropics. As mentioned by Mockford (2011: 26) the name of an Oriental species described from China, *P. maculatus* Li Fasheng, 2002, is a junior homonym of *P. maculatus* Garcia Aldrete, 1993, known from Mexico and the southern USA. It is here replaced by the new name *P. apicosectus* Lienhard & Yoshizawa, **nov. nom.** (see Appendix and remarks on *P. hyalomarginatus* n. sp., below).

The Oriental species *Psyllipsocus sauteri* is the type species of *Parempheria* Enderlein, considered by some authors as a subgenus or a junior synonym of *Psyllipsocus* (Lienhard & Smithers, 2002). Due to the very poor knowledge of this species, Mockford (2011) recommends not using *Parempheria* as a valid taxon until the type species has been redescribed.

The present paper is the first contribution of a planned series of studies on *Psyllipsocus* from Southeast Asia based on specimens deposited in the Geneva Natural History Museum, most of them collected by the Thailand Inventory Group for Entomological Research (TIGER project). New records of six Southeast Asian species of *Psyllipsocus* with characteristic forewing coloration are listed, between them four new

species and *P. yongi,* the male of which is here described for the first time. As a result of the present study 17 species of *Psyllipsocus* are now known from the Oriental Region, eight of them from Southeast Asia (Peninsular Malaysia, Thailand, East Malaysia: Sarawak) (see Appendix).

Material and Methods

Dissection and slide-mounting followed the methods described by Lienhard (1998). The material examined is deposited in the following institutions: Muséum d'histoire naturelle, Geneva, Switzerland (MHNG); Queen Sirikit Botanical Gardens, Mae Rim, Chiang Mai Province, Thailand (QSBG); Center for Insect Systematics, Universiti Kebangsaan Malaysia (UKM); Hokkaido University Insect Collection, Sapporo, Japan (SEHU). Material from the TIGER project is indicated by T-no for samples.

The pilosity of wing veins is usually heavily damaged in the material studied. For the drawings it was reconstructed on the basis of the insertion points of the hairs, which are always visible in slide-mounted wings, and of 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 normally uniform over the whole wing.

Abbreviations: AP = areola postica (the marginal cell in forewing formed by veins CuA1 and CuA2); BL = body length (in alcohol); F = hindfemur (length); 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; NP = National Park; P2 = second article of maxillary palp; P4 = fourth (terminal) article of maxillary palp; T = hindtibia (length); t1, t2, t3 = tarsomeres of hindtarsus (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).

Taxonomy

Psyllipsocus yucatan Gurney

Psyllipsocus yucatan Gurney, 1943: 212.
Psyllipsocus collarti Badonnel, 1946: 140. Synonymy proposed by Lienhard & Ferreira, 2015.
Psyllipsocus decui Badonnel, 1977: 340. Synonymy proposed by Lienhard & Ferreira, 2015.

Specimens examined (MHNG, QSBG and SEHU). Thailand: 1 male, 1 female, Chiang Mai, San Kamphaeng, Ban On Lhuoy, cave Tham Moung On, 20.vii.1985, leg. P. Leclerc (THAI-85); 1 male, Chiang Mai, Doi Inthanon NP, Vachirathan Fall, 700m a.s.l., Malaise trap, 15-22.iv.2007, leg. A. Areeluck (T1842); 1 female, Loei, Phu Kradueng NP, Koke Hin Ngam, 270m a.s.l., Malaise trap, 30.viii-6.ix.2006, leg. Sutin Khonglasae (T492); 1 female, Phetchabun, Khao Kho NP, mixed deciduous forest, 537m a.s.l., Malaise trap, 26.xii.2006-2.i.2007, leg. Somchai Chachumnan and Saink Singtong (T1187); 1 male, Phetchabun, Khao Kho NP, mixed deciduous forest, 168m a.s.l., Malaise trap, 5-12.i.2007, leg. Somchai Chachumnan and Saink Singtong (T1392); 1 female,

Phetchabun, Khao Kho NP, mixed deciduous forest, 168m a.s.l., Malaise trap, 19-26.i.2007, leg. Somchai Chachumnan and Saink Singtong (T1398); 1 female, Phetchabun, Khao Kho NP, mixed deciduous forest near office, 260m a.s.l., Malaise trap, 5-12.ii.2007, leg. Somchai Chachumnan and Saink Singtong (T1600); 1 female, Phetchabun, Khao Kho NP, Tharn Tip Waterfall, 210m a.s.l., Malaise trap, 19-26.iii.2007, leg. Somchai Chachumnan and Saink Singtong (T2417); 1 male, 1 female, Phetchabun, Khao Kho NP, deciduous forest at Ta Pol river, 242m a.s.l., Malaise trap 5-12. v.2007, leg. Somchai Chachumnan and Saink Singtong (T2548); 1 female, Phetchabun, Khao Kho NP, mixed deciduous forest, 560m a.s.l., Malaise trap, 5-12.vi.2007, leg. Somchai Chachumnan and Saink Singtong (T2452); 1 female, Chaiyaphum, Tat Tone NP, lawn near Sab Somboon forest unit, 648m a.s.l., Malaise trap, 12-19.xi.2006, leg. leg. Tawit Jaruphan (T1139); 1 female, Chaiyaphum, Tat Tone NP, dry dipterocarp forest near swamp at Sab Soboon forest unit, 674m a.s.l., Malaise trap, 12-19.xi.2006, leg. Tawit Jaruphan (T1140); 1 female, Chaiyaphum, Pa Hin Ngam NP, Thung Dok Kra Jeow, in dry evergreen forest, 780m as.l., Malaise trap, 7-13.i.2007, leg. Katae Sa-nog and Buakaw Adnafai (T1457); 1 female, Chaiyaphum, Tat Tone NP, Lum pa tao head water, dry evergreen, 270m a.s.l., Malaise trap, 19-26.ii.2007, leg. Tawit Jaruphan and Orawan Budsawong (T1733); 1 female, Chaiyaphum, Tat Tone NP, water tank at Tat Fah waterfall, 245m a.s.l., Malaise trap, 19-26.iii.2007, leg. Tawit Jaruphan and Orawan Budsawong (T2354); 1 female, Ubon Ratchathani, Pha Taem NP, Wild flower field 1, 232m a.s.l., Malaise trap, 4-11.xi.2006, leg Sorawit and Thongdee (T1054); 1 female, Ubon Ratchathani, Pha Taem NP, E of Thong Luang in Dipterocarpus forest, 238m a.s.l., Malaise trap, 21-28.i.2007, leg. Thongkam and Pakdee (T1484); 1 female, Ubon Ratchathani, Pha Taem NP, Pha Maun, 230m a.s.l., Malaise trap, 3-10.ii.2007, leg. Bunlu Subsiri (T1663); 1 female, Ubon Ratchathani, Pha Taem NP, Khua Nang Nee, 193m a.s.l., Malaise trap, 24.ii-3.iii.2007, leg. Bunlu Subsiri (T1674); 1 female, Ubon Ratchathani, Pha Taem NP, W of Huay Pok substation, 438m a.s.l., Malaise trap, 11-18.iv.2007, leg. Bunlu Subsiri (T2167); 1 male, Ubon Ratchathani, Pha Taem NP, first level Huay Sa Nhom waterfall, 230m a.s.l., Malaise trap, 9-16.v.2007, leg. Sorawit Mingman (T2188).

Distribution. Mexico, Cuba, Jamaica, Aruba, Antigua, Brazil, Congo, Kenya, Senegal, Thailand (see Lienhard & Ferreira, 2015 and above).

Remarks. This species was redescribed and illustrated by Lienhard & Ferreira (2015). The forewing coloration is somewhat variable. In well colored specimens of both sexes the color pattern corresponds to figure 4G in Lienhard & Ferreira (2015), in weakly colored specimens the forewing membrane is almost completely hyaline. In the Oriental Region this species is only known from Thailand, where it was collected in five provinces from northwestern (Chiang Mai) to central (Loei, Phetchabun, Chaiyaphum) and eastern (Ubon Ratchathani) parts of the country. One sample was collected in a cave (Chiang Mai: cave Tham Moung On), all other specimens were collected by Malaise traps.

Psyllipsocus yongi New & Lee
(Figs 1, 2)

Psyllipsocus ornatus New & Lee, 1991: 117 (female).
Not *Psyllipsocus ornatus* Badonnel, 1973: 63. Senior homonym.
Psyllipsocus yongi New & Lee, 1992: 391. Replacement name.

Specimens examined (MHNG and QSBG). Thailand: 1 male, Chanthaburi, Khao Khitchakut NP, Khao Prabant Peak, 150m south of forest base, 875m a.s.l., Malaise trap, 6-13.iii.2009, leg.

Suthida and Charoenchai (T4056); 1 male, Kamphaeng Phet, Mae Wong NP, Chong Yen, 1306m a.s.l., Malaise trap, 17-24.iii.2008, leg. C. Piluek (T3641); 1 female, Phetchabun, Thung Salaeng Luang NP, Gang Wang Nam Yen, 750m a.s.l., Malaise trap, 16-22.i.2007, leg. Pongpitak and Sathit (T1579); 1 female, same data but Malaise trap from 22-29.i.2007 (T1583).

Diagnosis. This species differs clearly from all other members of the genus by its striking forewing pattern and its very particular forewing venation (Fig. 1A).

First description of male. Body light brown to medium brown, forewing marked with striking brown pattern (Fig. 1A), membrane of hindwing hyaline (Fig. 1B). General morphology as indicated by New & Lee (1991) for female holotype. Lacinial tip (Fig. 1C) bifid, outer tine with a slightly irregular and distally truncate margin. Maxillary palp (Fig. 1D) with a long and slightly curved P4, its apex weakly tapering, P2 lacking stout sensillum. Forewing (Fig.1A): Distal part of R1 weakly curved and pterostigma about 3.6 times longer than wide; Rs and M fused for a length, distal closed cell hexagonal, basal closed cell twice as long as distal closed cell, the latter also much shorter than marginal length of pterostigma; first section of pterostigmal R1 and basal section of Rs only about half as long as R1-Rs crossvein; AP quadrangular, joined to M by a short crossvein. Hindwing (Fig. 1B): Basal section of Rs not differentiated and R1 originating from R-M fusion (thus closed cell triangular); a few short marginal hairs present on radial fork. Pretarsal claws simple, symmetrical, with a small preapical denticle (Fig. 1G). Hind leg with well-developed coxal organ.

Male terminalia: Clunium and epiproct simple, epiproct distally with a short fine hair between the pair of long marginal setae, paraproct lacking sensorium, its hind margin with a short spine-like seta and two tiny distal setal sensilla adjacent to a sclerotized marginal knob situated just basally of the membranous ventral paraproctal lobe (Fig. 1E). Hypandrium and phallosome as in Fig. 1F.

Female. See original description. Terminalia of a female from Thung Salaeng Luang NP illustrated in Fig. 2. Paraproct with a stout seta about in middle of its hind margin and a pair of tiny setal sensilla ventrally to it (Fig. 2B), spermapore plate membranous, spermatheca not observed.

Measurements. Male: BL 1.7 mm, FW 2.14 mm, FWw 0.61 mm, HW 1.64 mm, F 403 µm, T 804 µm, t1 304 µm, t2 50 µm, t3 58 µm, IO/D 1.3.

Distribution. Peninsular Malaysia (Cameron Highlands, see New & Lee, 1991); Thailand (Phetchabun, Kamphaeng Phet and Chanthaburi Provinces). These data may indicate that the species is more widely distributed in this region.

Remarks. Some slight differences between the holotype female, as it was described by New & Lee (1991), and the Thai specimens can be observed: R1 more strongly curved in the holotype and pterostigma somewhat longer (4.6 times longer than wide); a very short basal section of Rs present in the hindwing of the holotype (thus closed cell quadrangular); a stout marginal paraproctal seta present in both sexes of the Thai material (not figured for the holotype by New & Lee, 1991: fig. 5); outer tine of lacinia regularly tapering in the holotype. Despite these differences we think that the description of a new species would be premature. In particular, presence or absence of a short basal section of Rs in the hindwing (thus closed cell quadrangular or triangular, respectively) seems to be a character of rather low taxonomic value in this genus, regarding its variability observed in *P. sarawakensis* n. sp. and *P. siamensis* n. sp. (see below). However, no variability of this character was observed among the Thai specimens of *P. yongi*.

As indicated by New & Lee (1991) this species has a unique forewing venation

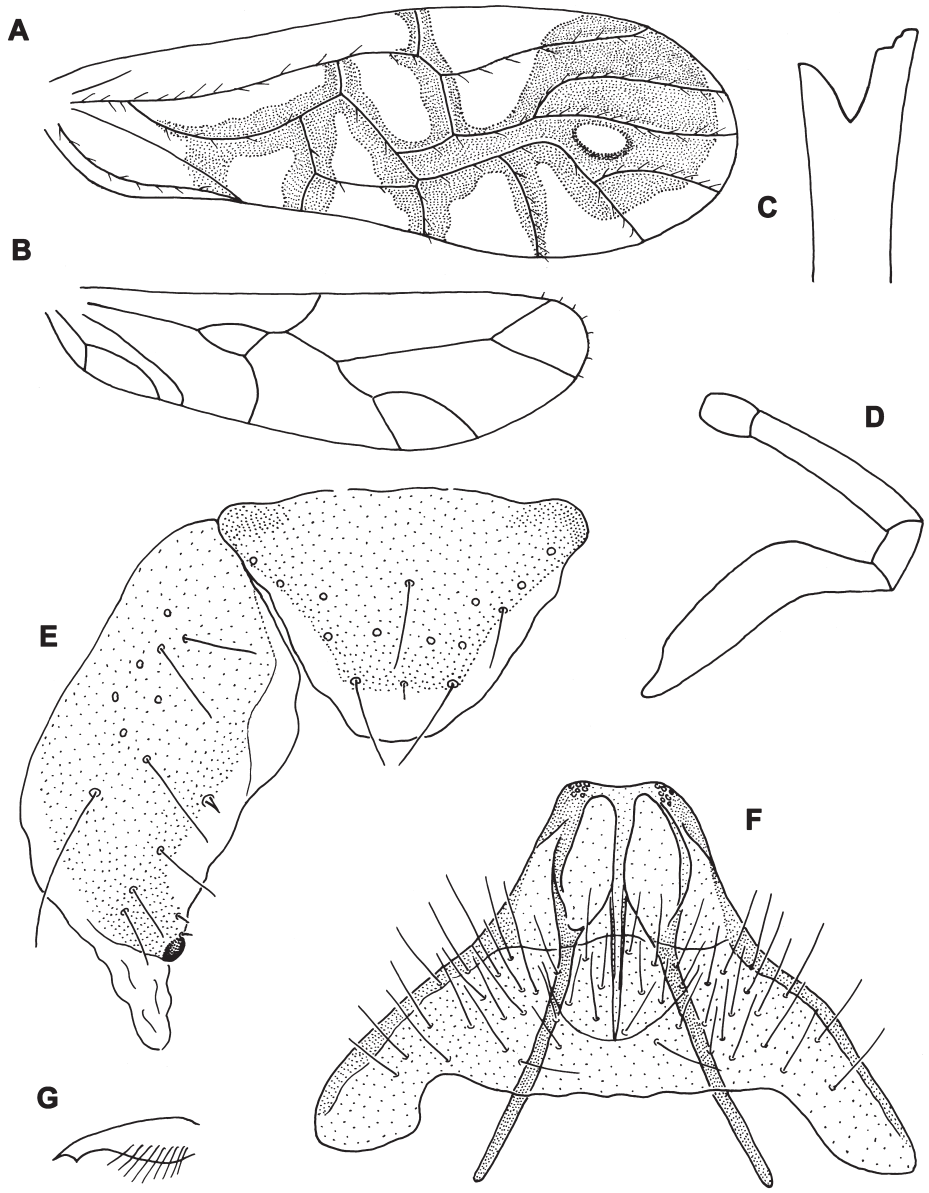

Fig. 1. *Psyllipsocus yongi* New & Lee, male from Thailand. A. Left forewing (mirror image). B. Left hindwing (mirror image). C. Lacinial tip. D. Maxillay palp. E. Epiproct and left paraproct. F. Hypandrium and phallosome, ventral view. G. Pretarsal claw.

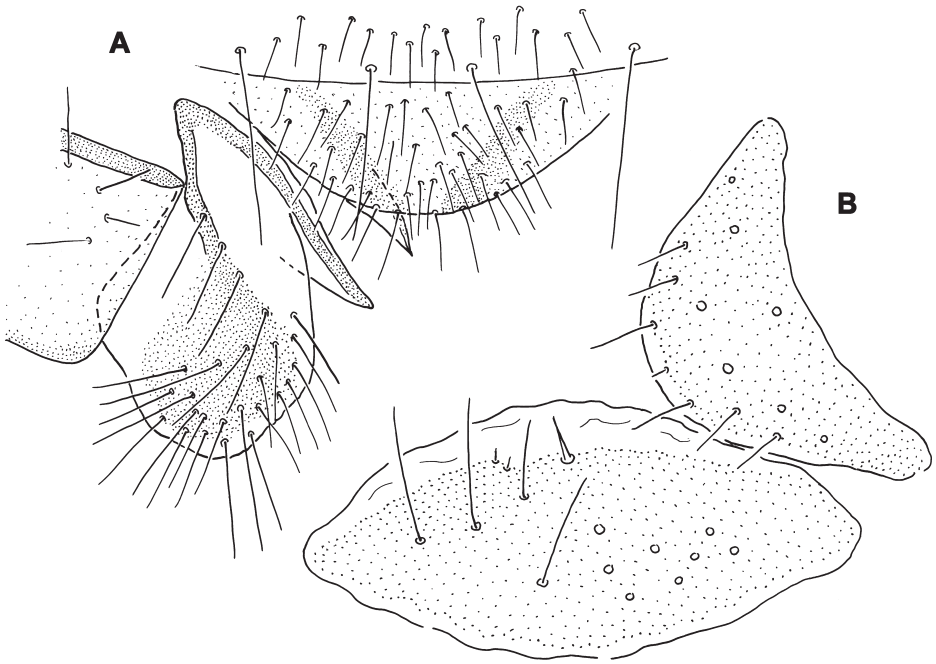

Fig. 2. *Psyllipsocus yongi* New & Lee, female from Thailand. A. Subgenital plate, right ovipositor valvulae and right hind corner of clunium. B. Epiproct and right paraproct.

which could easily be used to justify the erection of a new genus. The presence, in the male of *P. yongi*, of a sclerotized postero-ventral knob on the paraproct is also unique in *Psyllipsocus*; this sexually dimorphic structure is absent in the female. However, general structures of the male genitalia of *P. yongi* clearly correspond to what is known from most other species of the genus *Psyllipsocus*. Several morphological observations indicate that this genus is very heterogeneous, with some isolated species or small species groups characterized by spectacular autapomorpies concerning forewing venation (Garcia Aldrete, 1997), pretarsal claws (Lienhard, 2009) or male and female terminalia (Lienhard & Ferreira, 2013, 2014; Lienhard & Garcia Aldrete, 2016). Generic separation of such isolated species or small monophyletic clades would leave the remaining genus as a paraphyletic group. This would probably also be the case after separation of *P. yongi* in a genus of its own. However, a comprehensive phylogenetic analysis may allow a sound generic splitting of the very ancient, widely distributed and fascinating genus *Psyllipsocus*.

Psyllipsocus formosus Lienhard & Yoshizawa, n. sp.
(Fig. 3)

Holotype male (UKM). Peninsular Malaysia: Cameron Highlands, Gunung Beremban, 10.iii.2005, leg. N. Takahashi.

Diagnosis. This species differs clearly from all other members of the genus by its striking forewing pattern (Fig. 3A).

Description of male. Macropterous, forewing marked with striking brown pattern (Fig. 3A), hindwing weakly tinged with brown (Fig. 3B). Body yellowish to light brown, head with a reddish brown band on gena between compound eye and insertion point of mandible and frons laterally with such a band between compound eye and antennal socket. Maxillary palp and legs light brown. Thorax and abdomen laterally with some reddish brown pigmentation, abdomen dorsally with two broad light brown transversal bands, terminalia light brown.

Lacinial tip (Fig. 3C) trifid, with a large curved outer tine. Maxillary palp (Fig. 3D) with a hatchet shaped P4, P2 lacking stout sensillum. Antennal flagellum broken in both antennae. Ocelli well developed. Forewing (Fig. 3A): Distal part of R1 strongly curved and ending perpendicular to wing margin, pterostigma about three times longer than wide; Rs and M fused for a length, distal closed cell small, hexagonal, basal closed cell 4.8 times longer than distal closed cell, the latter also much shorter than marginal length of pterostigma, first section of pterostigmal R1 about half as long as R1-Rs crossvein, the latter of about same length as basal section of Rs; R-branches and M-branches strongly curved; AP about three times longer than high and distally about three times higher than basally. Hindwing (Fig. 3B): Basal section of Rs not differentiated and R1 originating from R-M fusion (thus closed cell triangular); veins A1 and A2 not reaching wing margin; a few short marginal hairs present on radial fork. Pretarsal claws simple, symmetrical, with a small preapical denticle (Fig. 3E). Hind leg with well-developed coxal organ.

Male terminalia: Clunium and epiproct simple, epiproct (Fig. 3F) distally with a short spine-like seta between the pair of long marginal hairs, paraproct (Fig. 3G) with a sensorium of seven trichobothria on vague basal florets, with two spine-like setae on hind margin (the dorsal one stouter than the ventral one) and with a tiny setal sensillum close to the ventral spine. Hypandrium and phallosome as in Fig. 3H.

Measurements. Male holotype: BL 1.3 mm, FW 1.83 mm, FWw 0.66 mm, HW 1.54 mm, F 298 µm, T 635 µm, t1 221 µm, t2 52 µm, t3 54 µm, IO/D 1.0.

Distribution. Peninsular Malaysia (Cameron Highlands).

Etymology. The species epithet refers to the striking and particularly beautiful forewing pattern (Latin *formosus* = beautiful).

Remarks. The female of this species is not known. *P. formosus* is characterized by its striking forewing pattern and the structure of the male genitalia. The colour pattern of the forewing is somewhat similar, but less contrasted, in *P. sarawakensis* n. sp. and *P. siamensis* n. sp. (see descriptions below). However, these species have a hyaline area distally around R2+3 which is absent in *P. formosus*. See also remarks on *P. siamensis* n. sp., below.

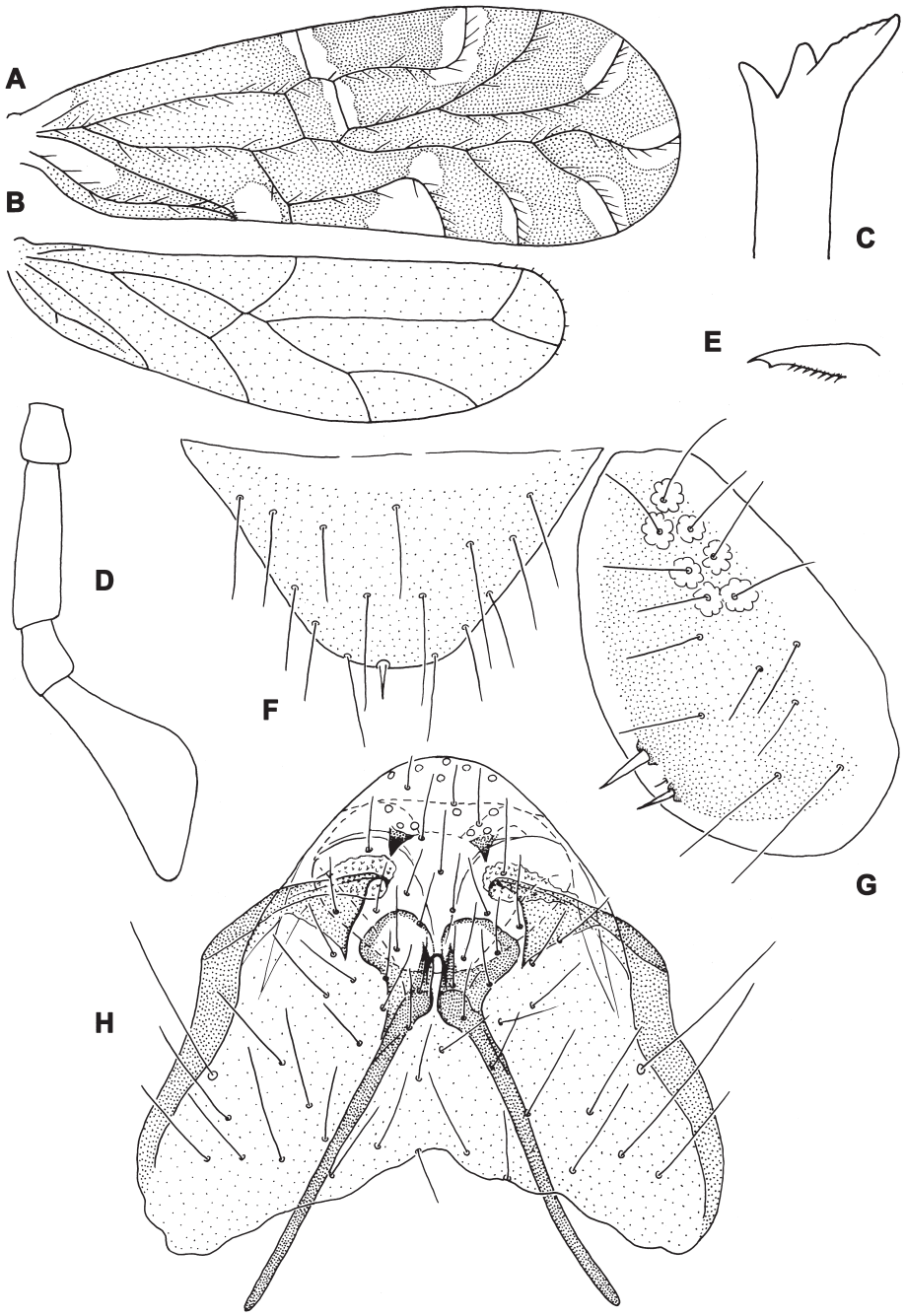

Fig. 3. *Psyllipsocus formosus* Lienhard & Yoshizawa, n. sp., male. A. Forewing. B. Hindwing. C. Lacinial tip. D. Maxillay palp. E. Pretarsal claw. F. Epiproct. G. Right paraproct. H. Hypandrium and phallosome, ventral view.

Psyllipsocus sarawakensis Lienhard & Yoshizawa, n. sp.
(Fig. 4)

Holotype male (MHNG). East Malaysia: Sarawak: Bau, near Fairy-caves, beating vegetation, 100m a.s.l., 3.xii.1987, leg. C. Lienhard (Sar-87/41).
Paratype (MHNG). 1 female, same data as for holotype.

Diagnosis. This species is similar to *P. siamensis* n. sp. by its forewing pattern but differs from it by the much longer distal closed cell in the forewing and by the structure of the spermatheca (Fig. 4E).

Description. Macropterous, forewing marked with a characteristic but weakly contrasted brown pattern (Fig. 4A), hindwing almost hyaline (Fig. 4B). Body whitish to light brown, no particular pigmentation on head, thorax and abdomen. Maxillary palp, legs and antenna whitish brown.

Lacinial tip (Fig. 4I) trifid, with a large outer tine. Maxillary palp (Fig. 4G) with a moderately hatchet shaped P4, P2 lacking stout sensillum. Ocelli well developed. Antennal flagellum damaged in both antennae of holotype and paratype, secondary annulation visible on basalmost flagellomeres. Forewing (Fig. 4A): Distal part of R1 weakly curved and ending perpendicular to wing margin, pterostigma about twice as long as wide; Rs and M fused for a length, distal closed cell large, hexagonal, basal closed cell about of same length than distal closed cell, the latter clearly longer than marginal length of pterostigma, first section of pterostigmal R1 about twice as long as R1-Rs crossvein, the latter almost as long as basal section of Rs; R-branches and M-branches weakly curved; AP flat, about 4.4 times longer than high. Hindwing (Fig. 4B): Basal section of Rs very short or not differentiated (thus closed cell quadrangular or triangular, respectively); both anal veins reaching wing margin or A1 ending just before wing margin; some short distal marginal hairs present, especially on radial fork. Pretarsal claws simple, symmetrical, with a minute preapical denticle (Fig. 4F). Hind leg with well-developed coxal organ.

Male terminalia: Clunium and epiproct simple, epiproct distally with a short stout seta between the pair of long marginal hairs (Fig. 4J), paraproct lacking clearly differentiated trichobothria, with two spine-like setae on hind margin (the dorsal one stouter than the ventral one) and with a tiny setal sensillum close to the ventral stout seta (Fig. 4K). Hypandrium and phallosome as in Fig. 4H.

Female terminalia: Clunium, epiproct and paraproct as in male. Subgenital plate simple, v1 membranous, v2 relatively short, with a sclerotized central rod, v3 broad, internal half pilose and slightly sclerotized (Fig. 4C); spermapore plate simple, slightly sclerotized around opening of spermathecal duct (Fig. 4D); spermatheca with complex internal sclerotizations (Fig. 4E).

Measurements. Male holotype: BL 1.18 mm, FW 1.27 mm, FWw 0.45 mm, HW 1.03 mm, F 248 µm, T 508 µm, t1 172 µm, t2 39 µm, t3 47 µm, IO/D 1.2. Female paratype: BL 1.24 mm, FW 1.28 mm, FWw 0.44 mm, HW 1.04 mm, F 237 µm, T 491 µm, t1 168 µm, t2 37 µm, t3 45 µm, IO/D 1.3.

Distribution. East Malaysia (Sarawak).

Etymology. The species epithet refers to the geographical situation of the type locality.

Remarks. Due to the forewing colour pattern this species is similar to *P. formosus* n.

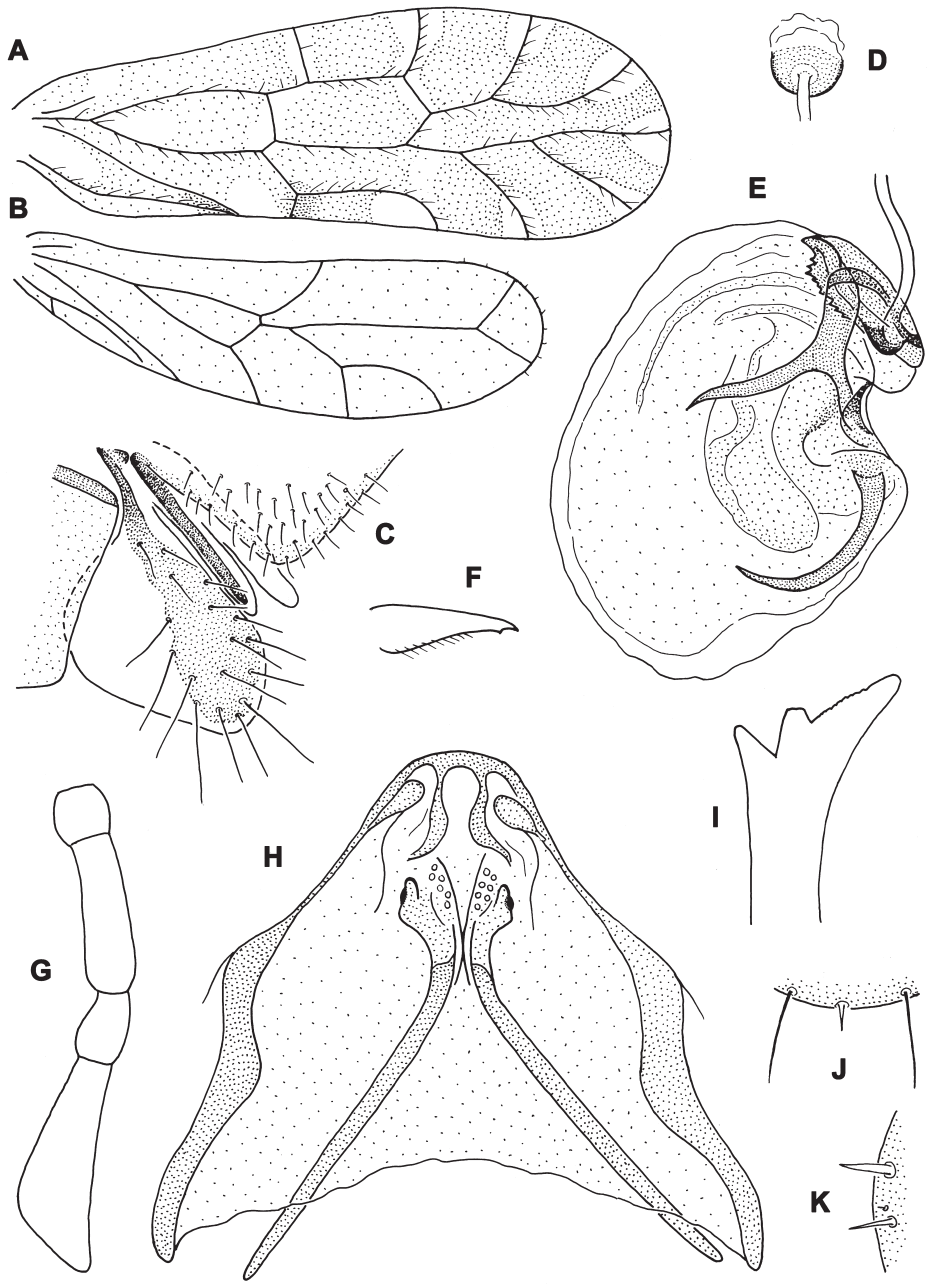

Fig. 4. *Psyllipsocus sarawakensis* Lienhard & Yoshizawa, n. sp. A–E: Female. F–K: Male. A. Forewing. B. Hindwing. C. Subgenital plate, right ovipositor valvulae and right hind corner of clunium. D. Spermapore plate. E. Spermatheca (same magnification as D). F. Pretarsal claw. G. Maxillay palp. H. Hypandrium and phallosome, ventral view (pilosity not shown). I. Lacinial tip. J. Hind margin of epiproct. K. Hind margin of right paraproct.

sp. and *P. siamensis* n. sp. but it can easily be distinguished from both species by details of the forewing venation, especially size and shape of pterostigma, distal closed cell and AP. In addition, the wing pattern of *P. formosus* is much more contrasted than in the other species and lacks the hyaline area around distal R2+3. See also remarks on *P. siamensis* n. sp., below.

As many other species of *Psyllipsocus* are cave-dwellers (see Introduction) this new species may also live inside the Fairy-caves near the entrance of which the type material was collected by beating vegetation.

Psyllipsocus siamensis Lienhard & Yoshizawa, n. sp.
(Fig. 5)

Holotype female (QSBG). Thailand: Phetchabun, Khao Kho NP, Tharn Tip waterfall, 210m a.s.l., Malaise trap, 5-12.iii.2007, leg. Somchai Chachumnan and Saink Singtong (T2411).

Paratypes (MHNG, QSBG and SEHU). Thailand: 1 female and 1 specimen lacking abdomen, Phetchabun, Khao Kho NP, view point at Khla Stream, 246m a.s.l., Malaise trap, 12-19.iii.2007, leg. Somchai Chachumnan and Saink Singtong (T2413); 1 female, Chaiyaphum, Pa Hin Ngam NP, car park at Thung Dok Kra Jeow, 750m a.s.l., Malaise trap, 1-7.i.2007, leg. Katae Sa-nog and Buakaw Adnakai (T1453); 1 female, Chaiyaphum, Tat Tone NP, water tank at Tat Fah waterfall, 215m a.s.l., Pan traps, 6-7.iii.2007, leg. Tawit Jarunhan and Orawan Budsawang (T2340).

Diagnosis. This species is similar to *P. sarawakensis* n. sp. by its forewing pattern but differs from it by the much shorter distal closed cell in the forewing and by the structure of the spermatheca (Fig. 5E).

Description of female. Macropterous, forewing marked with a characteristic but weakly contrasted brown pattern (Fig. 5A), hindwing almost hyaline (Fig. 5B). Body whitish brown to medium brown, vertex medium brown, vertical suture dark brown, frons and postclypeus white (striking contrast between white frons and brown vertex). Maxillary palp, legs and antenna light brown.

Lacinial tip (Fig. 5H) trifid, with a large outer tine. Maxillary palp (Fig. 5G) with a broadly hatchet shaped P4, P2 lacking stout sensillum. Ocelli well developed. Antennae heavily damaged in all specimens, secondary annulation visible on basalmost flagellomeres. Forewing (Fig. 5A): Distal part of R1 weakly curved and ending perpendicular to wing margin, pterostigma nearly twice as long as wide; Rs and M fused for a length, distal closed cell relatively small, hexagonal, basal closed cell about 2.6 times length of distal closed cell, the latter clearly shorter than marginal length of pterostigma, first section of pterostigmal R1 almost of same length as R1-Rs crossvein and basal section of Rs; R-branches and particularly M-branches slightly curved; AP flat, about four times longer than high. Hindwing (Fig. 5B): Basal section of Rs very short or not differentiated (thus closed cell quadrangular or triangular, respectively); A1 ending just before wing margin or both anal veins reaching wing margin; some short marginal hairs present on radial fork. Pretarsal claws simple, symmetrical, with a distinct preapical denticle (Fig. 5F). Hind leg with well-developed coxal organ.

Female terminalia: Clunium and epiproct simple, epiproct distally with a short stout seta between the pair of long marginal hairs (Fig. 5I), paraproctal sensorium with seven trichobothria on vague basal florets, hind margin of paraproct with two stout setae (the dorsal one somewhat shorter than the ventral one) and with a tiny setal sensillum close to the ventral stout seta (Fig. 5J). Subgenital plate simple, v1 differentiated as a

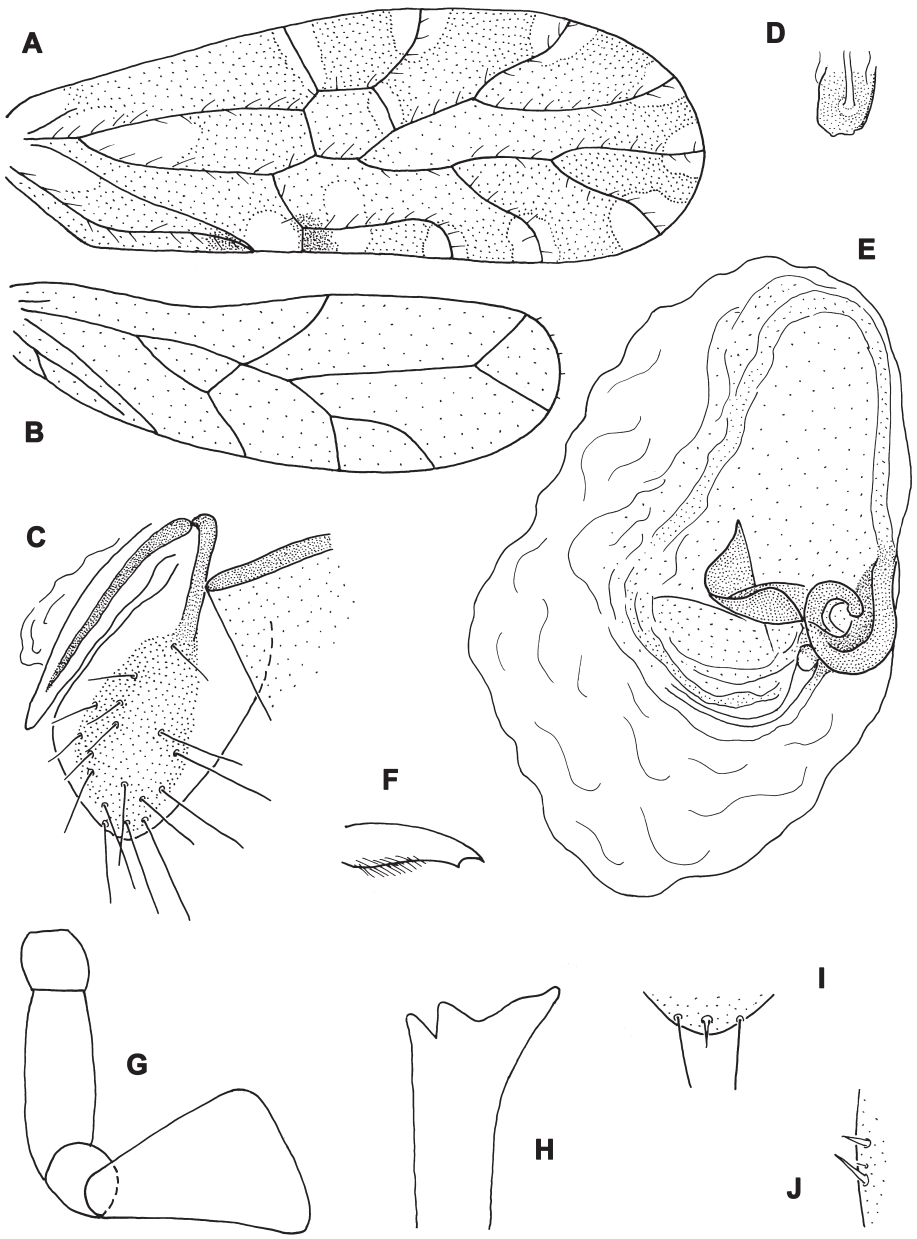

Fig. 5. *Psyllipsocus siamensis* Lienhard & Yoshizawa, n. sp., female. A. Forewing. B. Hindwing. C. Left ovipositor valvulae and left hind corner of clunium. D. Spermapore plate. E. Spermatheca (same magnification as D). F. Pretarsal claw. G. Maxillay palp. H. Lacinial tip. I. Hind margin of epiproct. J. Hind margin of right paraproct.

small membranous flap, v2 with a sclerotized central rod, v3 broad, most setae in distal half, only 1-2 setae in basal half (Fig. 5C); spermapore plate simple, slightly sclerotized around opening of spermathecal duct (Fig. 5D); spermatheca with relatively simple internal sclerotizations (Fig. 5E).

Measurements. Female holotype: BL 1.27 mm, FW 1.41 mm, FWw 0.49 mm, HW 1.15 mm, F 265 µm, T 513 µm, t1 181 µm, t2 37 µm, t3 43 µm, IO/D 1.4.

Distribution. Thailand (Phetchabun and Chaiyaphum Provinces).

Etymology. The species epithet refers to the country of the type locality (Siam is an old name for Thailand).

Remarks. The male of this species is not known. The differences between this species and *P. sarawakensis* n. sp and *P. formosus* n. sp. have been discussed above. These three species seems to be rather closely related due to their similar forewing pattern and the presence of a large curved external tine on the lacinial tip.

Psyllipsocus hyalomarginatus Lienhard & Yoshizawa, n. sp.
(Fig. 6)

Holotype female (QSBG). Thailand: Nakhon Nayok, Khao Yai NP, Lum Ta Kong View Point, 744m a.s.l., Malaise trap, 5-12.iv.2007, leg. Pong Sandao (T2123).

Diagnosis. This species differs from all other members of the genus by its forewing pattern, especially by the presence of a narrow hyaline marginal zone between R1 and CuA1 (Fig. 6A).

Description of female. Macropterous, forewing marked with a characteristic but weakly contrasted brown pattern (Fig. 6A), hindwing almost hyaline (Fig. 6B). Body and legs whitish brown, no particular colour pattern on head but vertical suture brown.

Maxillary palps, antennae and left forewing broken in holotype. Lacinial tip (Fig. 6C) trifid, with a relatively short and straight outer tine. Ocelli well developed. Forewing (Fig. 6A): Distal part of R1 weakly curved and forming an acute angle with anterior wing margin, first section of pterostigmal R1 very short, thus pterostigma almost triangular; Rs and M fused for a length, distal closed cell relatively large, hexagonal, basal closed cell about 1.8 times length of distal closed cell, the latter about as long as marginal length of pterostigma, first section of pterostigmal R1 very much shorter than R1-Rs crossvein and basal section of Rs; R-branches and M-branches almost straight; AP flat, almost six times longer than high. Hindwing (Fig. 6B): Basal section of Rs differentiated but very short (closed cell quadrangular); A1 and A2 both reaching wing margin; one short marginal hair present on radial fork. Pretarsal claws simple, symmetrical, with a distinct preapical denticle (Fig. 6D). Hind leg with well-developed coxal organ.

Female terminalia (see also remarks below): Clunium and epiproct simple, postero-marginal hairs of epiproct broken, paraproctal sensorium with seven trichobothria on vague basal florets, hind margin of paraproct with two stout setae of about equal length and with a tiny setal sensillum close to the ventral stout seta (Fig. 6H). Subgenital plate simple, v1 membranous (almost not differentiated), v2 relatively long, with a sclerotized central rod, v3 broad, most setae in distal half, only one seta in basal half (Fig. 6E); spermapore plate simple, weakly sclerotized around opening of spermathecal duct (Fig. 6G); spermatheca with a complicated system of spirally twisted structures near origin of spermathecal duct (Fig. 6F).

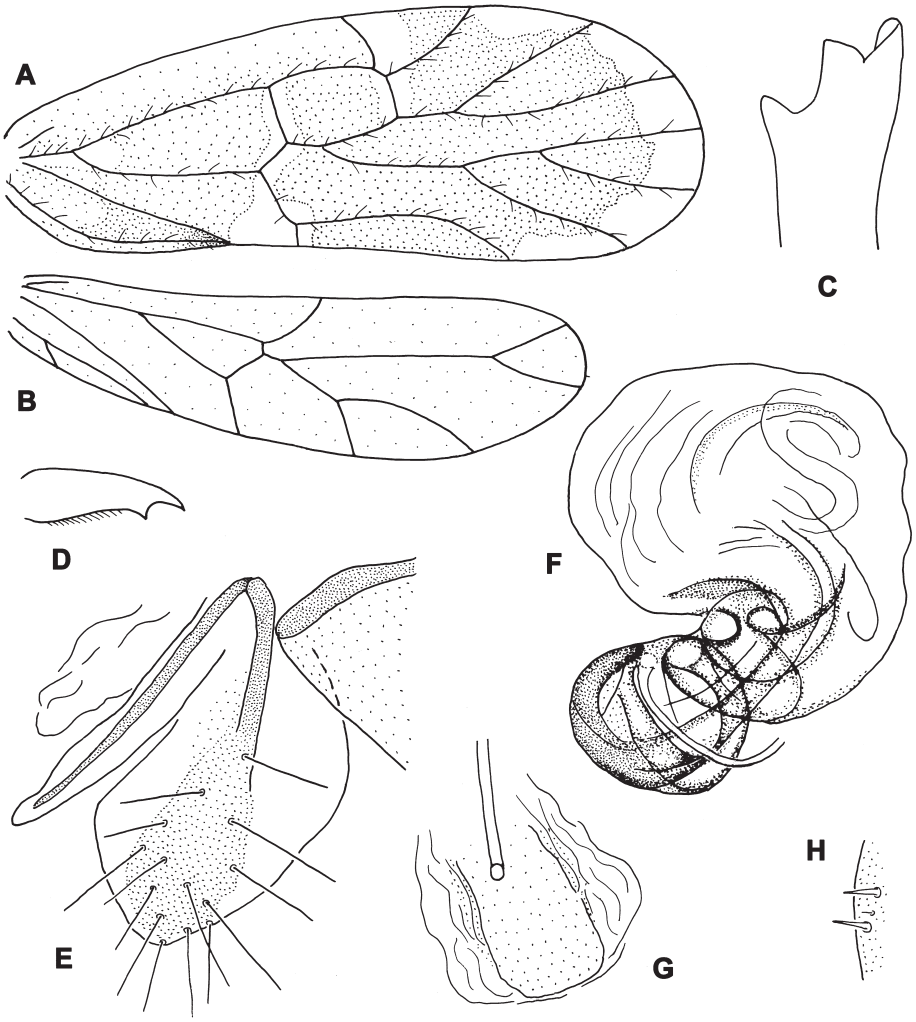

Fig. 6. *Psyllipsocus hyalomarginatus* Lienhard & Yoshizawa, n. sp., female. A. Forewing. B. Hindwing. C. Lacinial tip. D. Pretarsal claw. E. Left ovipositor valvulae and left hind corner of clunium. F. Spermatheca (lower magnification than G). G. Spermapore plate (same magnification as E). H. Hind margin of right paraproct.

Measurements. Female holotype: BL 1.5 mm, FW 1.80 mm, FWw 0.63 mm, HW 1.47 mm, F 375 µm, T 720 µm, t1 276 µm, t2 54 µm, t3 62 µm, IO/D 1.0.

Distribution. Thailand (Nakhon Nayok Province).

Etymology. The species epithet refers to the characteristic forewing pattern with a hyaline zone on apical margin.

Remarks. The male of this species is not known. We would also like to mention here that a very slight doubt remains whether the female terminalia described above belong really to the specimen considered here as the holotype of this species. After sorting of the sample by a very qualified technician of the Geneva Museum the detached abdomen was preserved in the same vial as the remaining body of the specimen (no other psocids or debris of psocids were in this vial). This was the state of the material when it was first examined by CL.

A species with a somewhat similar forewing pattern was described from China by Li Fasheng (2002) under the preoccupied name *P. maculatus*. This name is here replaced by the new name *P. apicosectus* Lienhard & Yoshizawa, **nov. nom.** (see also Introduction and Appendix). *P. apicosectus* can easily be distinguished from *P. hyalomarginatus* n. sp. by its much smaller distal closed cell and by the important extension of the hyaline apical zone in the forewing, comprising almost the apical quarter of the wing. The striking contrast between the dark brown basal three quarters of the forewing and the hyaline apical part may give the impression, at first glance, that the latter is lacking. The etymology of the replacement name, derived from Latin *apex* (genetive case: *apicis*) and *sectus* (removed by cutting) is based on this striking colour pattern. However, these species seem not to be closely related due to the differences in wing venation and shape of lacinial tip (long external tine present in *P. apicosectus*).

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Appendix. Checklist of extant species of the genus *Psyllipsocus* known from the Oriental Region (for fossil species see Introduction)

Psyllipsocus apicosectus Lienhard & Yoshizawa, **n. nom.**, replacement name for *P. maculatus* Li Fasheng, 2002: 59 (China: Guang Dong Province) which is a junior homonym of *P. maculatus* Garcia Aldrete, 1993: 10 (Mexico and southern USA, see Mockford, 2011). See also Introdution and remarks on *P. hyalomarginatus* n. sp., above.

Psyllipsocus batuensis Thornton, 1962: 442, Peninsular Malaysia (see Lienhard & Smithers, 2002 and New & Lienhard, 2007).

Psyllipsocus bombayensis Menon, 1942: 38, India (see Lienhard & Smithers, 2002).

Psyllipsocus edentulus Menon, 1942: 40, India (see Lienhard & Smithers, 2002).

Psyllipsocus formosus Lienhard & Yoshizawa, **n. sp.**, Peninsular Malaysia (see description in the present study).

Psyllipsocus hirsutus Thornton, 1962: 447, Peninsular Malaysia (see Lienhard & Smithers, 2002 and New & Lienhard, 2007).

Psyllipsocus hyalomarginatus Lienhard & Yoshizawa, **n. sp.**, Thailand (see description in the present study).

Psyllipsocus metamicropterus (Enderlein, 1908), Taiwan (see Lienhard & Smithers, 2002).
Parempheria metamicroptera Enderlein, 1908: 775.

Psyllipsocus minutissimus (Enderlein, 1920), Hawaii, Taiwan (see Lienhard & Smithers, 2002).
Parempheria minutissima Enderlein, 1920: 458.

Psyllipsocus ramburii Selys-Longchamps, 1872: 146, almost cosmopolitan, often domestic, in the Oriental Region only recorded from India (see Lienhard & Smithers,

2002 and New & Lienhard, 2007).

Psyllipsocus sanxiaensis Li Fasheng, 1997: 386, China: Sichuan Province (see Lienhard & Smithers, 2002 and Li Fasheng, 2002).

Psyllipsocus sarawakensis Lienhard & Yoshizawa, **n. sp.**, East Malaysia: Sarawak (see description in the present study).

Psyllipsocus sauteri (Enderlein, 1906), Japan, Taiwan (see Lienhard & Smithers, 2002).
Parempheria sauteri Enderlein, 1906: 307.

Psyllipsocus siamensis Lienhard & Yoshizawa, **n. sp.**, Thailand (see description in the present study).

Psyllipsocus sinicus Li Fasheng & Yang Chikun, 1988: 70, China: Guizhou Province (see Lienhard & Smithers, 2002 and Li Fasheng, 2002).

Psyllipsocus yongi New & Lee, 1992: 391, Peninsular Malaysia and Thailand (see Lienhard & Smithers, 2002, New & Lienhard, 2007, and redescription in the present study).

Psyllipsocus yucatan Gurney, 1943: 212, widely distributed in American and African tropics, also mentioned from Thailand by Lienhard & Ferreira (2015), but no exact locality indicated by these authors. For detailed records from Thailand, see present study.