

# *Heissophila macrotheleae*, a new genus and new species of Plokiophilidae from Thailand (Hemiptera, Heteroptera), with comments on the family diagnosis<sup>1</sup>

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**Abstract:** *Heissophila macrotheleae* nov.gen. et nov.sp., is described from the webs of *Macrothele* AUSSE-RER sp. (Araneae: Mygalomorphae: Hexathelidae) in Thailand. Digital macrophotographs, scanning electron micrographs, and line drawings are provided for a range of morphological structures. The taxon is distinguished from previously described arachnophilic Plokiophilidae by the 3-segmented tarsi, found elsewhere only in the New World taxon *Lipokophila* ŠTYS, and the apparent absence of traumatic insemination as evidenced from the structure of the male genitalia which lack the piercing acus found in all other described plokiophilid taxa.

**Key words:** classification, Heteroptera, *Macrothele*, new genus, Plokiophilidae.

## Introduction

The Plokiophilidae are the subject of few works, the only comprehensive treatment being that of CARAYON (1974). This no doubt derives from the fact that the group is seldom encountered by general collectors owing to their obscure habit of living only in the webs of a few spiders and of the Embioptera. Material on which the present paper is based was generously provided to the author by Ernst Heiss, Innsbruck, Austria.

### *Heissophila* nov.gen. (Figs 1-5)

Type species: *Heissophila macrotheleae*, new species

**Diagnosis:** Recognized uniquely among Old World Plokiophilidae by the 3-segmented tarsi, the short broad pygophore, the short, stout, right-angled parameres, the four veins (dead) in the membrane, the endosoma in repose in the form of a tube with many internal spicules, and the presence of ovipositor valves within the female abdomen.

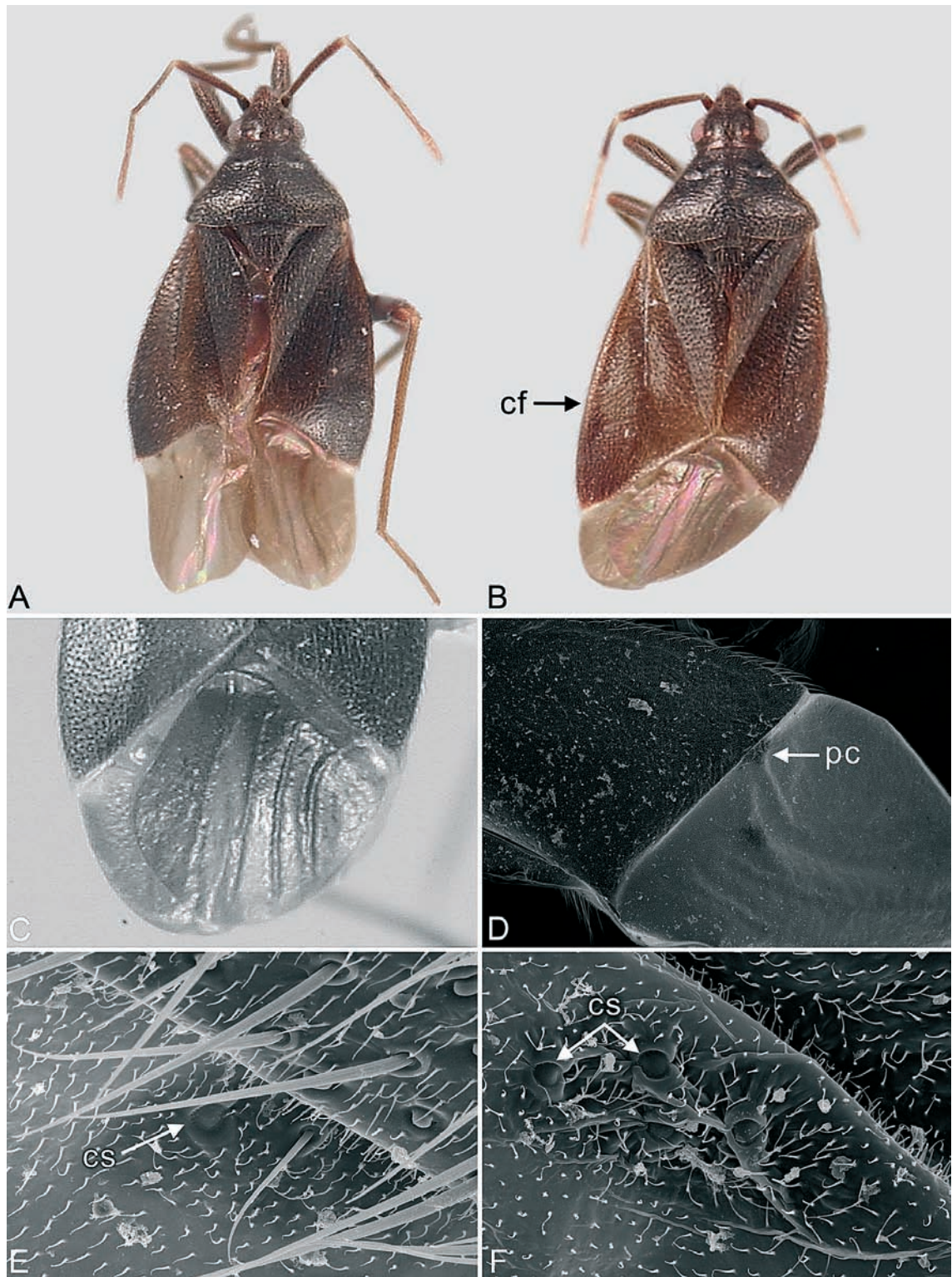
**Description: Male:** Small, rather stout bodied; total length 2.12 mm, length apex

clypeus-costal fracture 1.27 mm, width pronotum 0.68 mm. **Coloration** (Fig. 1A, B): Castaneous. **Surface and Vestiture** (Figs 1A, B, E, 2A, B): Vestiture of dorsum and venter comprising short, reclining, simple setae. Antennae and tibiae with reclining setae of uniform length. Head probably with 4 pairs of long, suberect cephalic setae, two pairs situated near level of antennal insertion, one pair lateromedially on frons, and posterior pair laterad of ocelli (Fig. 2B); pronotum apparently without macrocheta on anterolateral angle as recorded by CARAYON (1974) for other Plokiophilidae; abdominal segment 8 with a macrocheta laterally (Fig. 4A).

**Structure: Head** (Figs 1A, B, 2A, B): Head roughly cylindrical, elongate antero-posteriorly, projecting beyond anterior margin of eyes by about 1.5 time length of eye; vertex and frons sloping at same angle to nearly vertical and weakly prominent clypeus; buccal cavity more or less round, directed anteroventrally, greatly removed from posterior margin of head by gula of length greater than diameter of eye (Fig.

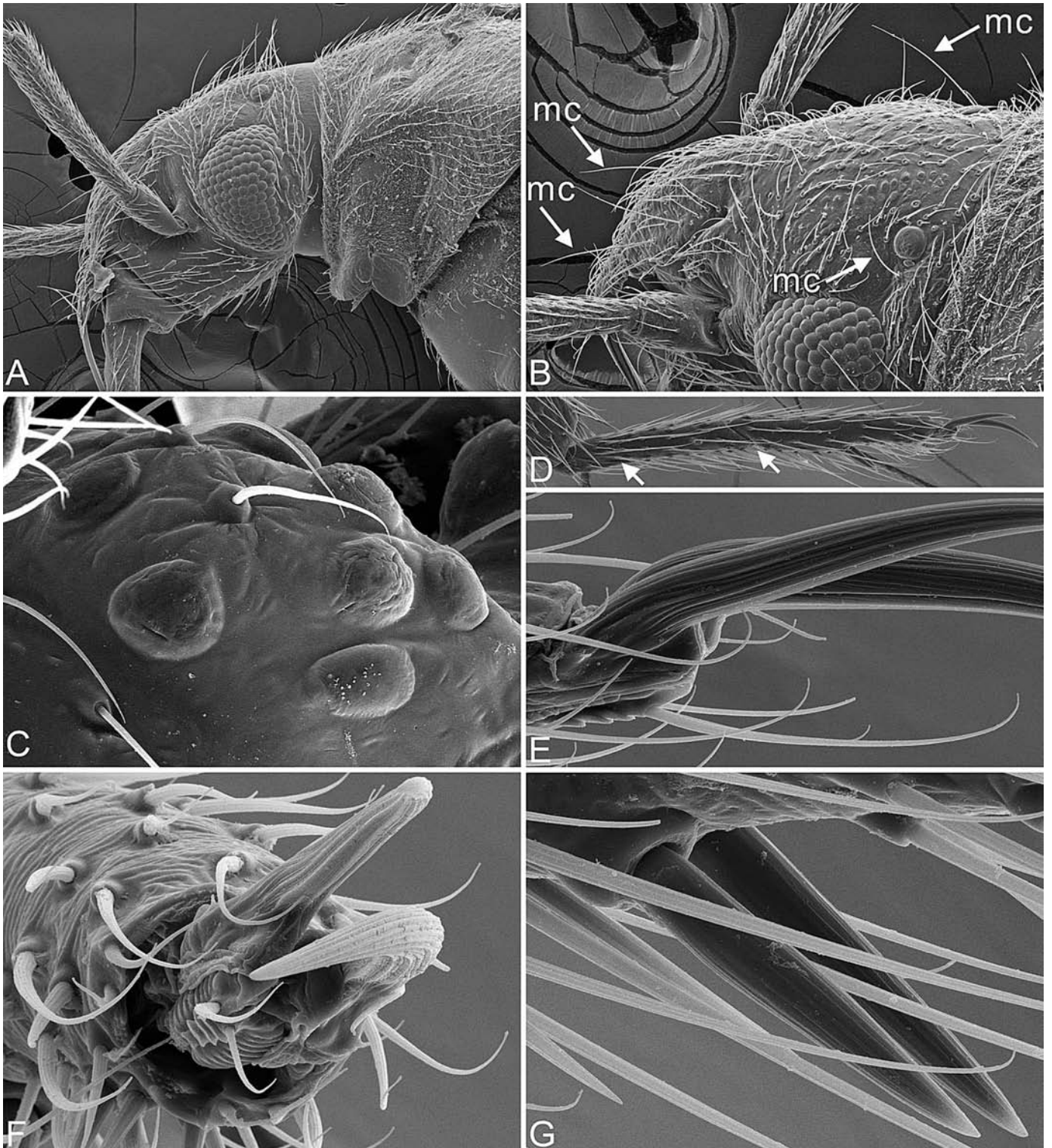
<sup>1</sup> The taxon is named in honor of Ernst Heiss, on the occasion of his seventieth birthday, in recognition of his contributions and dedication to heteropterology, particularly the Aradidae, as well as his generosity and friendship over the years to all of us interested in the study of the true bugs.

**Fig. 1:** *Heissophila macrotheleae*. (A) Male habitus. (B) Female habitus. (C) Membrane, light micrograph. (D) Corium and membrane, scanning electron micrograph. (E) Corial process, dorsal view, scanning electron micrograph. (F) Corial process, ventral view, scanning electron micrograph (cf, costal fracture; cs, campaniform sensillum; pc, corial process).



2A); mandibular and maxillary plates small; buccula very narrow (Fig. 2A); labium long, slender, tapering to acute apex, slightly surpassing apex of middle coxae, segment 1 short and broad, well developed (Figs 2A, 4H), ratio of length of segments 1-4, 2:4:4:7 (Fig. 4H); eyes relatively small in dorsal view, broadly excavated on mesial margin,

removed from anterior margin of pronotum by about the diameter of antennal segment 1; eyes in lateral view occupying about half of height of head, nearly semicircular, posterior margin nearly straight; antennal fossa located just below midpoint of eye and slightly removed from eye (Fig. 2A); ocelli small (Figs 1A, B, 2A, B), widely separated,

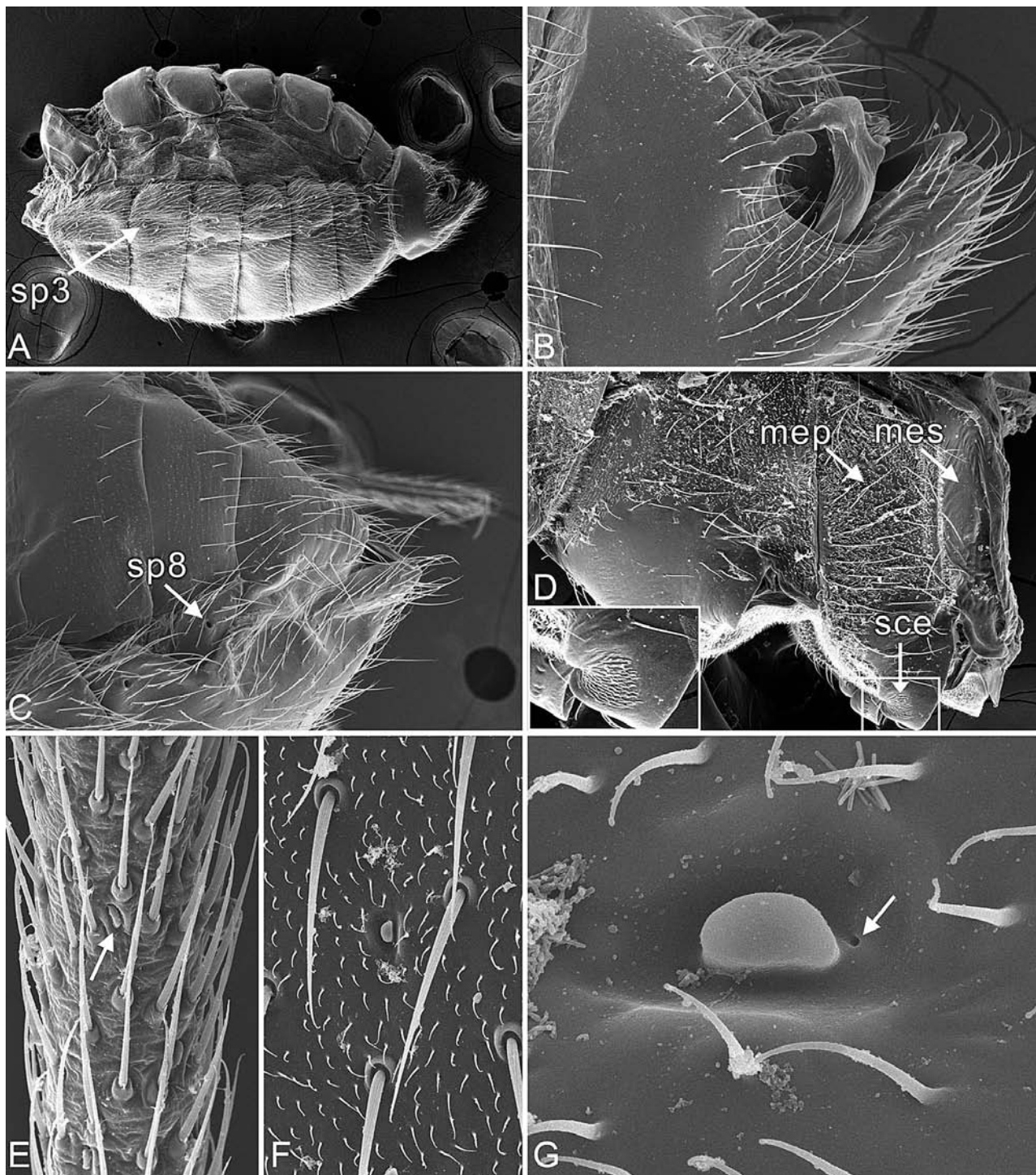


**Fig. 2:** *Heissophila macrotheleae*, scanning micrographs of morphological structures. (A) Lateral view of head, male. (B) Dorsolateral view of head, female, arrows indicating cephalic setae. (C) Compound eye, third (?) instar nymph. (D) Lateral view of tarsus, foreleg, arrows indicating segmental divisions. (E) Lateral view of pretarsus, fore leg. (F) Frontoventral view of pretarsus, fore leg. (G) Detail of ventral spines on segment 3 of fore leg tarsus (mc, macrocheta).

placed at level of posterior margin of eye, removed from eye by distance slightly greater than diameter of ocellus (Fig. 2B); antenna relatively short, segment 1 short, not attaining apex of head (Fig. 2A), segments 2, 3, and 4 subequal in length, segment 1 of slightly greater diameter than segment 2, nearly 2 times diameter of segments 3 and 4, prepedicellite present as a narrow sclerotized band at base of segment 2. **Thorax:** Pronotum trapezoidal, lateral margins nearly straight, posterior margin excavated medially and convexly rounded laterally; pronotum strongly elevated posteriorly, transversely rounded (Fig. 1A, B); calli small, ovoid, shining, and devoid of setae, widely separated and placed near lateral margins of pronotum (Fig. 1A, B); scutellum slightly wider than long. Metathoracic scent-gland evaporatory area of limited extent, located anteroventrally on metepimeron (Fig. 3D, inset), this structure noted as not discernible in *Lipokophila* by ŠTYS (1967). **Hemelytra:** Costal margin of corium strongly convex, coriomembranal juncture nearly straight, well defined, and weakly angled anteromedially (Fig. 1A-D); costal fracture located at about two-thirds distance from base to apex of corium, angled anteromedially, traversing costal-radial veins, but not beyond, lacking incisure on corial margin (Fig. 1B); membrane with 4 longitudinal “dead” veins, none of them bearing setae, the posterior 3 nearly straight, the most anterior rather strongly curving (Fig. 1A-C); corial process (processus corial of CARAYON 1974) present sublaterally on membrane at juncture of corium and membrane (Fig. 1D), dorsal surface bearing a single simple seta and apparently one campaniform sensillum (Fig. 1E), ventral surface of corial process bearing 4 campaniform sensilla (Fig. 1F). Hind wing as in Figure 4; hamus absent. **Corial Glands:** Corial glands widely distributed, including at least pronotum, hemelytra, and antennal segment 2; external component in the form of an ovoid depression with an elongate central mound, and minute pore located at one end of mound (Fig. 3E-G). **Legs:** Relatively short; femora of moderate length, slender, nearly parallel sided, devoid of spines; fore tibia with a cleaning comb on medial surface at apex; no fossula spongiosa; tarsi relatively stout, only

moderately long, 3 segmented, segment 1 very short, segments 2 and 3 subequal in length (Figs 2D, 4J, K); fore and middle tarsi with a pair of strong reclining spinelike setae on segment 3, removed from apex of tarsus by about 2 times length of spine (Figs 2D, G, 4J); claws elongate, very slender, roughly cylindrical, tapering to sharply pointed apex, inner claw longer than exterior (Figs 2D-F, 4J, K); parempodia well developed, setiform, of unequal length (Fig. 2E, F), of similar structure on all 3 pairs of legs, longer parempodium on side of shorter claw. **Abdomen:** (Figs 3A, 4A): Short, stout; sterna entire, ventrolateral tergites fused with sterna but demarcated by a sublateral impression (Fig. 3A); terga widely separated from dorsal laterotergites by a broad membranous area, allowing for great expansion, as shown in Figure 3A for alcohol-preserved specimens; paired openings of dorsal abdominal glands (DAG 1) visible on tergum 4 (Fig. 4A; but see female); spiracles placed on sternum near lateral margin of abdominal segments 2-7. **Genitalia** (Figs 3A, B, 4A-D): **Pygophore:** Short, very broadly connected to abdomen, in contrast to genera such as *Lipokophila* ŠTYS; opening of pygophore directed dorsally (Figs 3A, 4A, C); parameres arising laterally from a semicircular excavation with the dorsal thumblike projection (Figs 3B, 4A, C, D). **Aedeagus** (Fig. 4B, C): In repose endosoma enclosed within phallosoma; phallobase with sclerotized arms directed anteriorly from attachment to capitata processes, broad basally, attenuated distally; anterodorsal portion of aedeagus with a “stirrup-like” structure; endosoma tubular, oriented in longitudinal axis of body, anterior half appearing striated, posterior half with many fine spicules directed internally and a pair of larger medial spines directed posteriorly in repose (Fig. 4B, C). **Parameres** (Fig. 4A, C, D): Symmetrical, narrow at base, body of paramere broad and flattened, apical portion at nearly right angle to body with a few short setae on apicodorsal margin.

**Female** (Fig. 1B): Structure and coloration as in male; total length 2.09 mm, length apex clypeus-cuneal fracture 1.36 mm, width pronotum 0.74 mm. **Abdomen:** Paired openings of dorsal abdominal glands visible on abdominal terga 4 and 5; spiracle



**Fig. 3:** *Heissophila macrotheleae*, scanning micrographs of morphological structures. (A) Lateral view of abdomen, male. (B) Lateral view of pygophore, male, detail. (C) Lateral view of apex of abdomen, female. (D) Lateral view of thoracic pleuron, inset showing detail of scent-gland evaporatory area. (E) Antennal segment 2, arrow indicating integumental gland. (F) Hemelytral surface, showing integumental gland. (G) Detail of integumental gland on hemelytron, arrow indicating pore (mpe, metepimeron; mes, metepisternum; sce, scent-gland evaporatorium; sp 3, spiracle 3; sp 8, spiracle 8).

**Fig. 4:** *Heissophila macrotheleae*, morphological details.

(A) Male abdomen, dorsal view.

(B) Aedeagus (top to bottom), lateral, dorsal, and ventrolateral views.

(C) Pygophore and aedeagus, cutaway dorsal view.

(D) Left and right parameres.

(E) Female abdomen, dorsal view.

(F) Female abdomen, dorsal cutaway view.

(G) Female abdomen, ventral cutaway view.

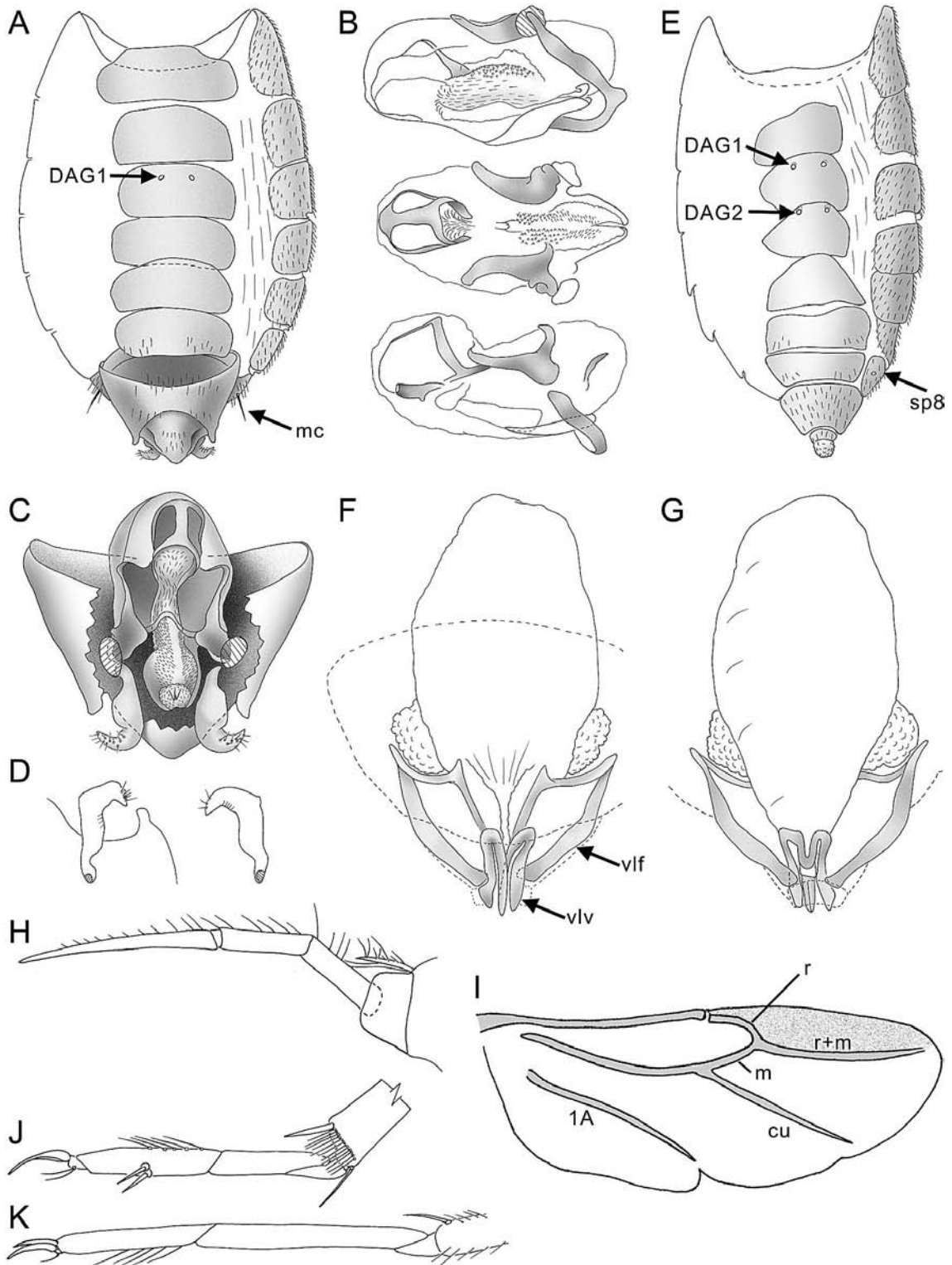
(H) Labium, lateral view.

(I) Hind wing.

(J) Fore tarsus, right leg, lateral view.

(K) Hind tarsus, left leg, lateral view.

(1A, first anal vein; cu, cubital vein; DAG 1, DAG 2, opening of dorsal abdominal gland; m, medial vein; mc, macrocheta; r, radial vein; r+m, radiomedial vein; sp 8, spiracle 8; vlf, valifer; vlv, valvula).



of segment 8 in female dorsal (Figs 3C, 4E). **Genitalia** (Figs 3C, 4F, G): Ovipositor with an elongate apparent valifer and short valvulae (Fig. 4F, G); abdomen (macerated) internally with a large baglike structure with bulging bodies posterolaterally.

**Nymph:** General coloration red, tibiae

and tarsi pale. Compound eye with 7 or 8 facets and 2 central setae (Fig. 2C), similar to condition seen in *Lipokophila* (SCHUH 1993). Paired openings of dorsal abdominal glands located between terga 3-4, 4-5, and 5-6, although these not visible with scanning electron microscopy.

Etymology: A combination of Heiss and the suffix -phila, following pattern of generic names previously proposed in the Plokiophilidae. Feminine.

Discussion: CARAYON (1961), in a brief article dealing with the distribution of viviparity in the Heteroptera, recognized the Plokiophilidae as a family distinct from the Microphysidae, where its members had originally be placed by CHINA and MYERS (1929) and CHINA (1953). CARAYON (1961) recognized two subfamilies, on the basis of their being found in the webs of spiders and embiids, respectively, as well as the form of viviparity, but gave no further diagnostic characters. ŠTYS (1967), in his description and discussion of *Lipokophila* ŠTYS, explicitly deferred from more detailed morphological characterization of CARAYON's proposed subfamilies. Later, CARAYON (1974) produced a comprehensive treatment of the Plokiophilidae, including a more detailed listing of diagnostic morphological features for the family as well as of the two subfamilies he had previously proposed. At the family level, CARAYON (1974) concluded emphatically that the sclerotized tubular processus gonopori (acus) is distinctive to the Plokiophilidae, occurring in all known members, that this structure is associated with the practice of traumatic insemination, and that consequently traumatic insemination is a diagnostic feature for the group. CARAYON (1974) for the first time provided a morphological characterization of the "corial glands", also treating them as diagnostic for the group. Whereas CARAYON (1974) believed the corial glands to be restricted to the external margin of the corium, in *Heissophila* nov.gen. at least their external manifestation is present on the coriaceous portion of the hemelytra, on the pronotum, and on antennal segment 2 (Fig. 3E-G). The structure of the head would also appear to be novel within the group, with its cylindrical form and relatively small eyes. Furthermore, all taxa currently placed in the Plokiophilidae on the presence of corial glands and head structure also have elongate asymmetrically developed claws, and this might therefore be considered a diagnostic feature (see CARAYON 1974; SCHUH 1993). CARAYON (1974) also listed the macrocheta located on the anterolateral angle of the pronotum as occurring in all Plokiophilidae and as being distinctively oriented in the two recognized subfamilies. These setae are not evident in *Heissophila* nov.gen.

**Tab. 1:** Known associations of Plokiophilidae with spiders.

<b>Plokiophilidae</b>	<b>Spider host</b>	<b>Spider suborder and family</b>
<i>Heissophila</i>	<i>Macrothele</i>	Mygalomorphae: Hexathelidae
<i>Lipokophila</i>	<i>Tengella</i>	Araneomorphae: Tengellidae (SCHUH 1993)
<i>Plokiophiloidea</i>	<i>Agelena</i>	Araneomorpha: Agelenidae (CARAYON 1974)
<i>Plokiophiloidea</i>	<i>Ischnothele</i>	Mygalomorphae: Dipluridae (CARAYON 1974)

tum as occurring in all Plokiophilidae and as being distinctively oriented in the two recognized subfamilies. These setae are not evident in *Heissophila* nov.gen.

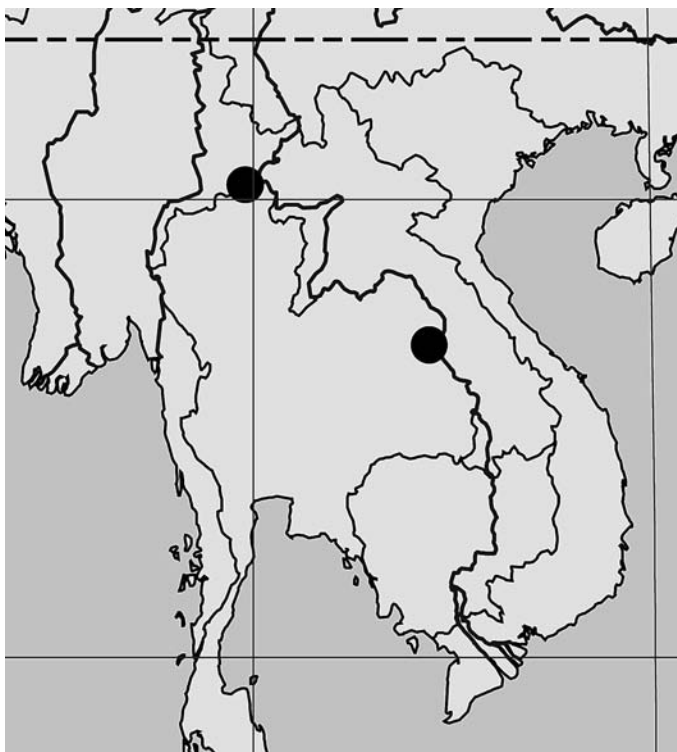
*Heissophila* nov.gen. is clearly a member of the Plokiophilidae, based on the presence of corial glands, head structure, and claw structure. Nonetheless, other aspects of its morphology are distinctly at variance with those previously provided for most of the Plokiophilidae. *Heissophila* nov.gen. and *Lipokophila* ŠTYS are set apart from other plokiophilid genera by their possession of 3-segmented tarsi (Figs 2D, 4J, K).

The pygophore of *Heissophila* nov.gen. is short and rather broad, as opposed to elongate and tubular, the condition seen in all other known taxa. Possibly most notable is the structure of the aedeagus in the male. The endosoma does not possess a processus gonopori, but rather appears saclike in form, the distal half being covered with many, fine, closely-placed spicules, these being inwardly directed when the endosoma is in repose. Furthermore, the parameres in *Heissophila* nov.gen. are short, stout, and form a right-angle bend subapically, rather than being long, slender, and nearly straight as in all other known members of the Plokiophilidae.

Examination of the female abdomen, including clearing and staining with chlorazol black, provided no indication of copulatory tubes or other evidence of traumatic insemination. This would seem to be concordant with the structure of the male phallus. Also, the female has some structural elements associated with an ovipositor (Fig. 4F, G), in apparent contrast with other members of the Plokiophilidae. I was not able to determine whether *Heissophila* nov.gen. has a spermatheca of the type described by CARAYON (1974) for some other members of the Plokiophilidae.

The hemelytral membrane in *Heissophila* nov.gen. has four distinct longitudinal

**Fig. 5:** *Heissophila macrotheleae*, distribution, Thailand.



dead veins, contrary to the condition found in all other Plokiophilidae (see ŠTYS 1967) where the membrane appears to be devoid of veins, dead or alive, except for the corial process (noted by ŠTYS (1967); described in detail by CARAYON (1974)). Nonetheless, other members of the Cimicoidea such as some species of Anthocoridae possess 4 longitudinal veins in the membrane. The structure of the corial process is similar to that described for *Plokiophiloides asolen* CARAYON (CARAYON 1974), with several campaniform sensilla, located primarily on the ventral surface of the wing (Fig. 1F).

The costal fracture in *Heissophila* nov.gen. is readily seen with transmitted light, but difficult to see with scanning microscopy; there is no incisure on the costal margin of the forewing. By contrast, evidence presented by CARAYON (1974) indicates that the costal fracture is at least readily visible in most other species of Plokiophilidae, while in *Lipokophila* it is prominent and contributes to the formation of distinct cuneus (see SCHUH 1993).

Thus, I tentatively propose that the diagnosis of the Plokiophilidae be altered to include a modified description of the male genitalia, possibly including the method of insemination, and that the 3-segmented tar-

sus may be the basal condition in the group rather than that the condition is uniquely derived in *Lipokophila*.

On the basis of some characters, *Heissophila* nov.gen. would be placed in the subfamily Plokiophilinae. These include the overall structure of the legs and the proportions of the scutellum. Yet, the distribution of the corial glands is much wider in *Heissophila* nov.gen. than is known for all other Plokiophilidae, this in addition to features of the male and female genitalia, which are at variance with all other taxa placed within the Plokiophilidae. For these reasons I am treating the subfamily placement of *Heissophila* nov.gen. as incertae sedis, pending further work on morphology and relationships within the Plokiophilidae.

Associations: Table 1 lists the presently known associations of Plokiophilidae with spiders. It appears that all spider taxa serving as hosts for Plokiophilidae construct funnel-shaped webs, even though several groups of distantly related spiders are involved. It would also appear that most of these webs are large, persistent, and built by relatively large spiders.

#### *Heissophila macrotheleae* nov.sp. (Figs 1-5)

Diagnosis: See generic diagnosis

Description: **Measurements, male:** Total length 2.12 mm, length clypeus-costal fracture 1.27 mm, length head 0.20 mm, length pronotum 0.33 mm, length scutellum 0.27 mm, width head 0.31 mm, interocular distance 0.22 mm, width pronotum 0.68 mm, width scutellum 0.31 mm, antennal segment 1-0.09 mm, 2-0.36 mm, 3-0.30 mm, 4-0.32 mm.

**Measurements, female:** Total length 2.09 mm, length clypeus-costal fracture 1.36 mm, length head 0.20 mm, length pronotum 0.35 mm, length scutellum 0.22 mm, width head 0.33 mm, interocular distance 0.21 mm, width pronotum 0.74 mm, width scutellum 0.33 mm, antennal segment 1-0.10 mm, 2-0.35 mm, 3-0.28 mm, 4-0.38 mm.

Etymology: Named for its association with the mygalomorph spider genus *Macrothele*.



Biotic Association: *Heissophila macrotheleae* nov. sp. is known to occur only in the webs of *Macrothele* AUSSERER (Araneae: Hexathelidae).

Distribution: Chiang Rai and Sakon Nakhon Provinces, northern Thailand.

Discussion: See generic discussion. Examined material is deposited in the American Museum of Natural History (AMNH) and the Museum d'Histoire Naturelle, Geneva.

Holotype male: **Thailand: Chang Rai Province:** Doi Tung, 20.32°N 99.82°E, 1300 m, 2 Oct 1992, P.J. Schwendinger (AMNH\_PBI 00137269) (AMNH).

Paratypes: **Thailand: Chang Rai Province: Mae Sai District:** Doi Tung, 20.32°N 99.82°E, 1300 m, 2 Oct 1992, P.J. Schwendinger, 9♂♂ (AMNH\_PBI 00137271, AMNH\_PBI 00137315, AMNH\_PBI 00139048), 4♀♀ (AMNH\_PBI 00137270, AMNH\_PBI 00137316, AMNH\_PBI 00139048) (AMNH; MHNG); 30 Oct 1991, P.J. Schwendinger, 5♂♂ (AMNH\_PBI 00139046) (AMNH); 13 Oct 1994, P.J. Schwendinger, 2♂♂ (AMNH\_PBI 00139045), 2♀♀ (AMNH\_PBI 00139045) (AMNH). **Sakon Nakhon Province: Kut Bak District:** Phu Phan National Park, 16.82°N 104.43°E, 520 m, 25 Nov 1992, P.J. Schwendinger, 3♂♂ (AMNH\_PBI 00139044), 1♀ (AMNH\_PBI 00139044) (AMNH).

Other Specimens Examined: **Thailand: Chang Rai:** Doi Tung, 20.32°N 99.82°E, 1300 m, 2 Oct 1992, P.J. Schwendinger, 3 nymphs (AMNH\_PBI 00139047, AMNH\_PBI 00139048) (AMNH); 30 Oct 1991, P.J. Schwendinger, 1 nymph (AMNH\_PBI 00139046) (AMNH). **Sakon Nakhon Province: Kut Bak District Co.:** Phu Phan National Park, 16.82°N 104.43°E, 520 m, 25 Nov 1992, P.J. Schwendinger, 3 nymphs (AMNH\_PBI 00139044) (AMNH).

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## Zusammenfassung

*Heissophila macrotheleae* nov.gen. et nov.sp. wird aus Netzen der Spinnengattung *Macrothele* AUSSERER sp. (Araneae, Mygalomorphae, Hexatelidae) aus Thailand neu beschrieben. Morphologische Strukturen werden durch Makrophotographien, Rasterelektronenmikroskopische Photographien und Strichzeichnungen dargestellt. Das Taxon unterscheidet sich von den bisher beschriebenen arachnophilen Plokiophilidae durch 3-gliedrige Tarsen, die sonst nur in der Neuweltlichen Gattung *Lipokophila* ŠTYS bekannt sind. Traumatische Insemination scheint nicht vorzuliegen, da die männlichen Genitalien – im Unterschied zu allen bisher bekannten Plokiophiliden – keinen sklerotisierten processus gonopori (acus) aufweisen.

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