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TAXONOMIC STUDY OF THE LEAFHOPPER GENUS *WARODIA* DWORAKOWSKA (HEMIPTERA: CICADELLIDAE: TYPHLOCYBINAE), WITH DESCRIPTIONS OF SIX NEW SPECIES

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Abstract.—Ten species of the leafhopper genus *Warodia* Dworakowska are treated, of which six **new species**, ***W. tricornis***, ***W. annulata***, ***W. falcata***, ***W. lineata***, ***W. rigida***, and ***W. gracilicornis***, are described and illustrated. A key to all species is provided.

Résumé.—Une étude taxonomique sur le genre de cicadelle *Warodia* Dworakowska est rapportée. 10 espèces sont traitées, des quelles 6 **nouvelles espèces**, ***W. tricornis***, ***W. annulata***, ***W. falcata***, ***W. lineata***, ***W. rigida***, ***W. gracilicornis***, sont décrits et illustrés, une clef à toutes les espèces est fournie.

Key Words: Hemiptera, Cicadellidae, Typhlocybinae, Typhlocybini, *Warodia*, new species

Warodia was proposed as a new genus by Dworakowska (1970) for *Typhlocyba hoso* Matsumura, 1932, from Japan and China. Thereafter, three new species were described from China (Dworakowska 1982, Hu and Kuoh 1991, Zhang and Xiao 2000). An additional six new species from China are described and illustrated in this study, together with a key to identify males of all species of the genus. The genus belongs to the *Typhlocyba* complex of Typhlocybini according to its 2 apical cells in the hindwings and also resembles the *Farynala* group members in the shape of the paramere.

The type specimens of the new species are deposited in the collections of the Entomological Museum of the Northwest A&F University (NWAFU) in Yangling (Shaanxi) and the China Agriculture University (CAU) in Beijing.

Warodia Dworakowska

Warodia Dworakowska 1970: 215; 1982: 120; Hu and Kuoh 1991: 255–256; Zhang and Xiao 2000: 110–111. Type species: *Typhlocyba hoso* Matsumura, 1932. By orig. desig.

Redescription.—Ivory to yellowish; patches on vertex, pronotum and scutellum, streaks on vein Cua and clavus of forewing, light yellow, orange to ochre; apical quarter of forewing with a smoky pattern. Forewing with second apical cell largest, expanded towards apex, third apical cell subtriangular with short petiole. Hindwing with R and M confluent apically.

Male genitalia: Posterior part of pygofer lobe with hoodlike lower angle and variable-shaped upper angle bearing a few rigid setae along margin. Subgenital plate slender, with one basal macroseta; row of gracile setae longitudinally along midline ventrally; an interrupted row of thickened setae at one-third to half of dorsolateral margin, grouped more densely toward apex. Paramere long; inner margin with row of sensory pits ventrally, outer margin with row of thin setae adjoining group of usually thicker setae on well-developed lateral lobe. Connective large and lamellate, median ledge well developed. Aedeagal shaft bearing processes apically.

Distribution.—Palaearctic and Oriental regions.

Key to Species (Males)

1. Aedeagus with unpaired median process at tip in addition to paired processes (Figs. 8, 30) 2
– Aedeagus with only paired dorsal processes at tip 3
2. Aedeagus with one pair of distal processes (Figs. 29–31) . . . . . *W. tricornis*, n.sp.
– Aedeagus with two pairs of distal processes (Figs. 8–9) . . . . . *W. hoso*
3. Paramere with apex rounded; process of aedeagus branched (Fig. 69) . . . . . *W. gracilicornis*, n.sp.
– Paramere with apex acuminate; process of aedeagus not branched 4
4. Paramere with numerous rigid setae on upper part of lateral lobe 5
– Paramere with gracile setae on lateral lobe 7
5. Aedeagal shaft stout, shorter than process (Fig. 52) . . . . . *W. lineata*, n.sp.
– Aedeagal shaft slender, longer than process 6
6. Pygofer lobe with acute protrusion on upper part of posterior margin; aedeagus with median pair of distal processes crossed at midlength (Figs. 34, 37) . . *W. annulata*, n.sp.
– Pygofer lobe not as above; aedeagus with distal processes divergent (Fig. 45). . . . . *W. falcata*, n.sp.
7. Posterior process much longer than anterior process of aedeagus (lateral view) (Fig. 61) . . . . . *W. rigida*, n.sp.
– Posterior process shorter than anterior process of aedeagus (lateral view, Figs. 12,19,22) 8
8. Posterior process shorter than 1/2 anterior process of aedeagus (lateral view) and anterior process roundly curved basally (Fig. 12) . . . . . *W. biguttata*
– Posterior process longer than 1/2 anterior process of aedeagus (lateral view) and anterior process somewhat straight (Fig. 19,22) 9
9. Aedeagal shaft laterally compressed, almost equal in length to processes (Fig. 22–23) . . . . . *W. euryaedeaga*
– Aedeagal shaft not compressed, much longer than processes (Fig. 18–19). . . . . *W. gregoryi*

Warodia hoso (Matsumura 1932) (Figs. 1–9)

Typhlocyba hoso Matsumura 1932: 64.
Typhlocyba kiiensis Matsumura 1932: 64; Dworakowska 1982: 120.
Warodia hoso: Dworakowska 1970: 215, figs. 25, 42–52; Zhang 1990: 156, fig. 178.

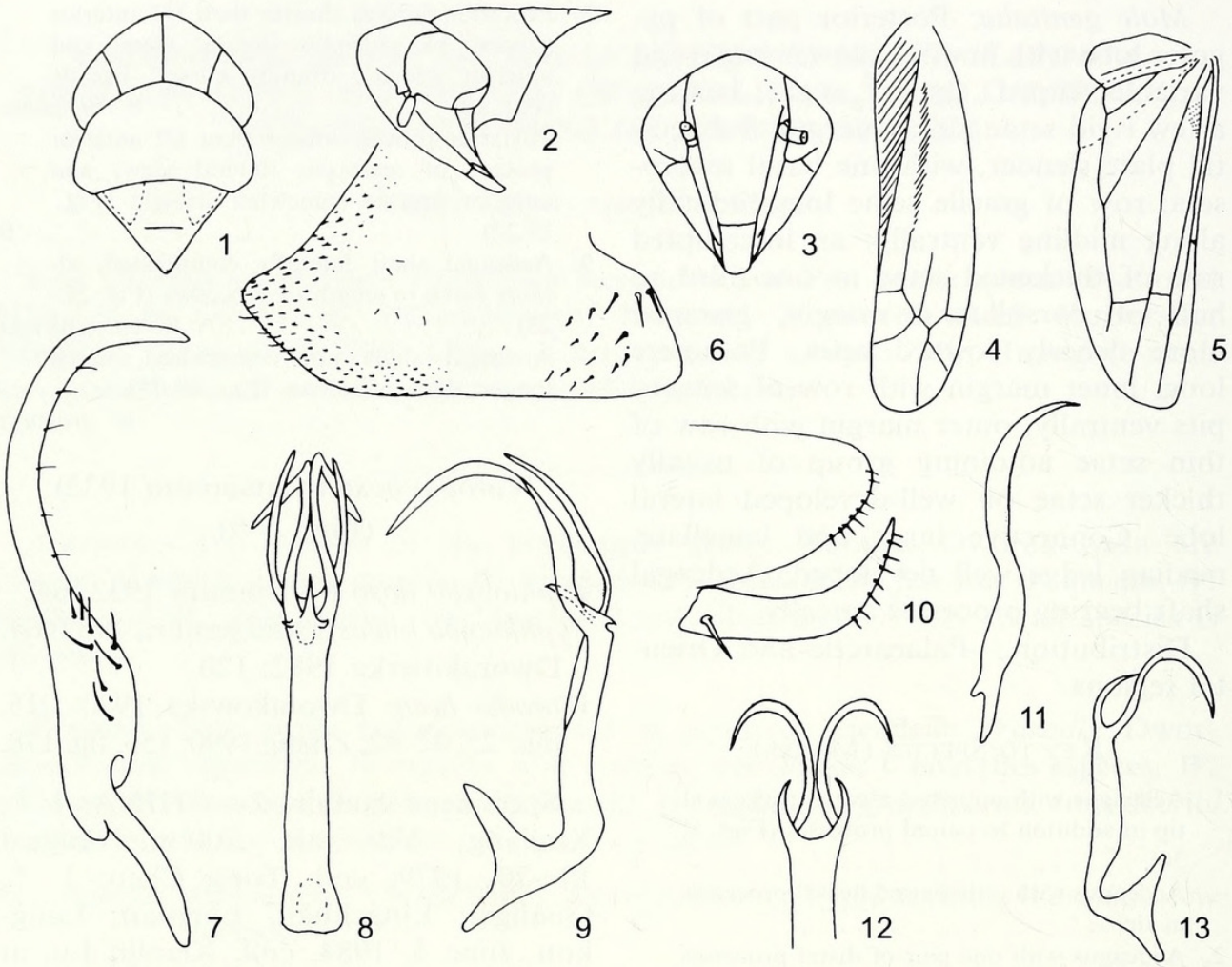
Specimens examined.—CHINA: 1 ♀, Xinjiang: Yili, alt. 700 m, August 19~20, 1979, coll. Tong Chen; 1 ♂, Guangxi: Lingchuan, Lingtian, Longkou, June 5, 1984, coll. Xiaolin Lu, at lamp; 7 ♂, Hunan Province: Chenzhou, August 4, 1985, coll. Yalin Zhang and Yonghui Chai; 7 ♂, 2 ♀, Shaanxi Province: Liuba, Miaotaizi, August 19, 1995, coll. Wenzhu Zhang and Liyun Ren; 1 ♂, 11 ♀, Hubei Province: Mt. Wudang, Taizi slope, July 22, 2001, coll. Min Huang and Guiling Zhang, at light.

Distribution.—China (Zhejiang, Hunan, Hubei, Guangxi, Shaanxi, and Xinjiang), Japan.

Warodia biguttata Hu and Kuoh, 1991 (Figs. 10–13)

Warodia biguttata Hu and Kuoh 1991:255–256, fig. 1.

Specimens examined.—CHINA: 1 ♂, Yunnan Province: Sanchahe, June 7, 1991, coll. Rungang TIAN; 1 ♂, Mt. Zixi, alt. 2,400 m, on *Alnus* and *Rubus*, Nov. 10, 1999, coll. Dworakowska.



Figs. 1–13. 1–9, *Warodia hoso* (after Dworakowska, 1970). 1, Head, pronotum and scutellum, dorsal view. 2, Same, lateral view. 3, Face. 4, Forewing. 5, Hindwing. 6, ♂ pygofer, lateral view. 7, Paramere. 8, Aedeagus, posterior view. 9, Aedeagus, lateral view. 10–13, *Warodia biguttata* (after Hu and Kuoh 1991). 10, ♂ pygofer, lateral view. 11, Paramere. 12, Apical part of aedeagus.13, Aedeagus, lateral view.

Distribution.—SW China (Guizhou, Yunnan).

Warodia gregoryi Dworakowska, 1982
(Figs. 14–20)

Warodia gregoryi Dworakowska 1982: 120, figs. 251–262.

Specimens examined.—CHINA: 1 ♂, Yunnan Province: Xinzhu, alt. 2,300 m, pine forest, Nov.15, 1999; 1 ♀, alt. 2,500 m, pine forest, Nov.15, 1999; 1 ♀, northeastern slop, alt. 2,500 m, Nov.16, 1999; 2 ♀, alt. 2,450 m, on Ericaceae, Nov.14, 1999; 1 ♀, Tengchong, alt. 1,700 m, Nov.22, 1999, on *Quercus*, coll. Dworakowska.

Distribution.—SW China (Yunnan).

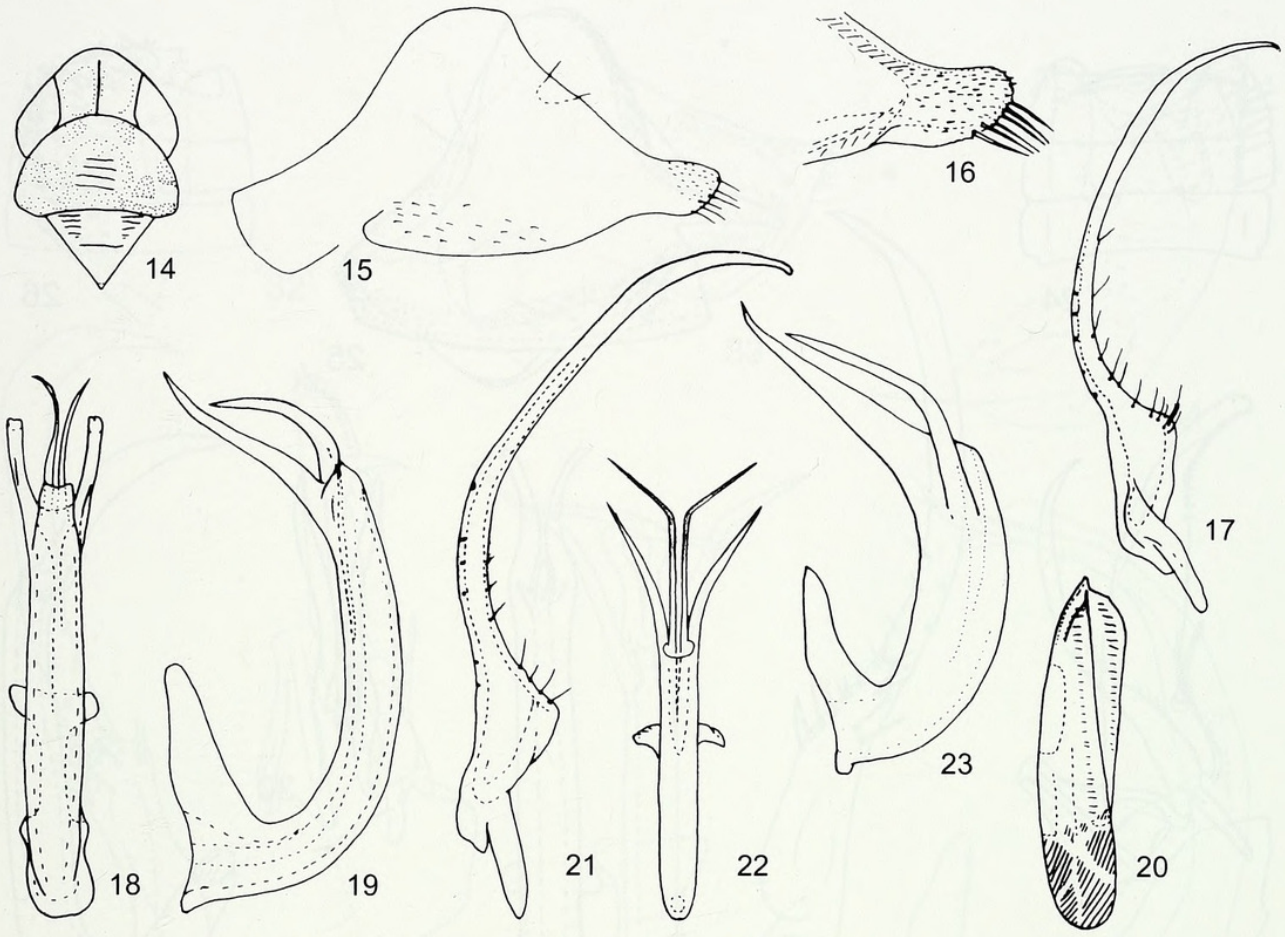
Warodia euryaedeaga
Zhang and Xiao, 2000
(Figs. 21–23)

Warodia euryaedeaga Zhang and Xiao 2000:110, figs. 27–30.

Distribution.—SW China (Yunnan).

***Warodia tricornis* Zhang and Huang, new species**
(Figs. 24–31)

Notes.—This species resembles *W. biguttata*, but it can be distinguished by the absence of the patches on the vertex



Figs. 14–23. 14–20, *Warodia gregoryi* (after Dworakowska, 1982). 14, Head, pronotum and scutellum, dorsal view. 15, ♂ pygofer, lateral view. 16, Hind part of ♂ pygofer, lateral view. 17, Paramere. 18, Aedeagus, posterior view. 19, Aedeagus, lateral view. 20, Forewing. 21–23, *Warodia euryaedeaga* (after Zhang and Xiao 2000). 21, Paramere. 22, Aedeagus, posterior view. 23, Aedeagus, lateral view.

and pronotum and by its single process between the long paired processes at the tip of the aedeagus (Fig. 30).

Description.—Beige, basal triangles yellow; forewing yellowish, with apical quarter light smoky.

Male. Abdominal apodemes reaching base of 5th abdominal sternite (Fig. 24). Pygofer lobe gradually narrowed, posterior margin truncate with row of short rigid setae; a group of different-sized rigid setae scattered at basal angle (Figs. 25–26). Dorsolateral margin of subgenital plate with basal and distal groups of short setae (Fig. 27). Paramere with apex slender and slightly sinuated, and with shorter and less numerous setae on central part (Fig. 28). Aedeagal shaft straight, terminating in pair of long sinuate lateral processes and a single short dorsal process (Figs. 30–31).

Length: ♂, 3.21 mm.

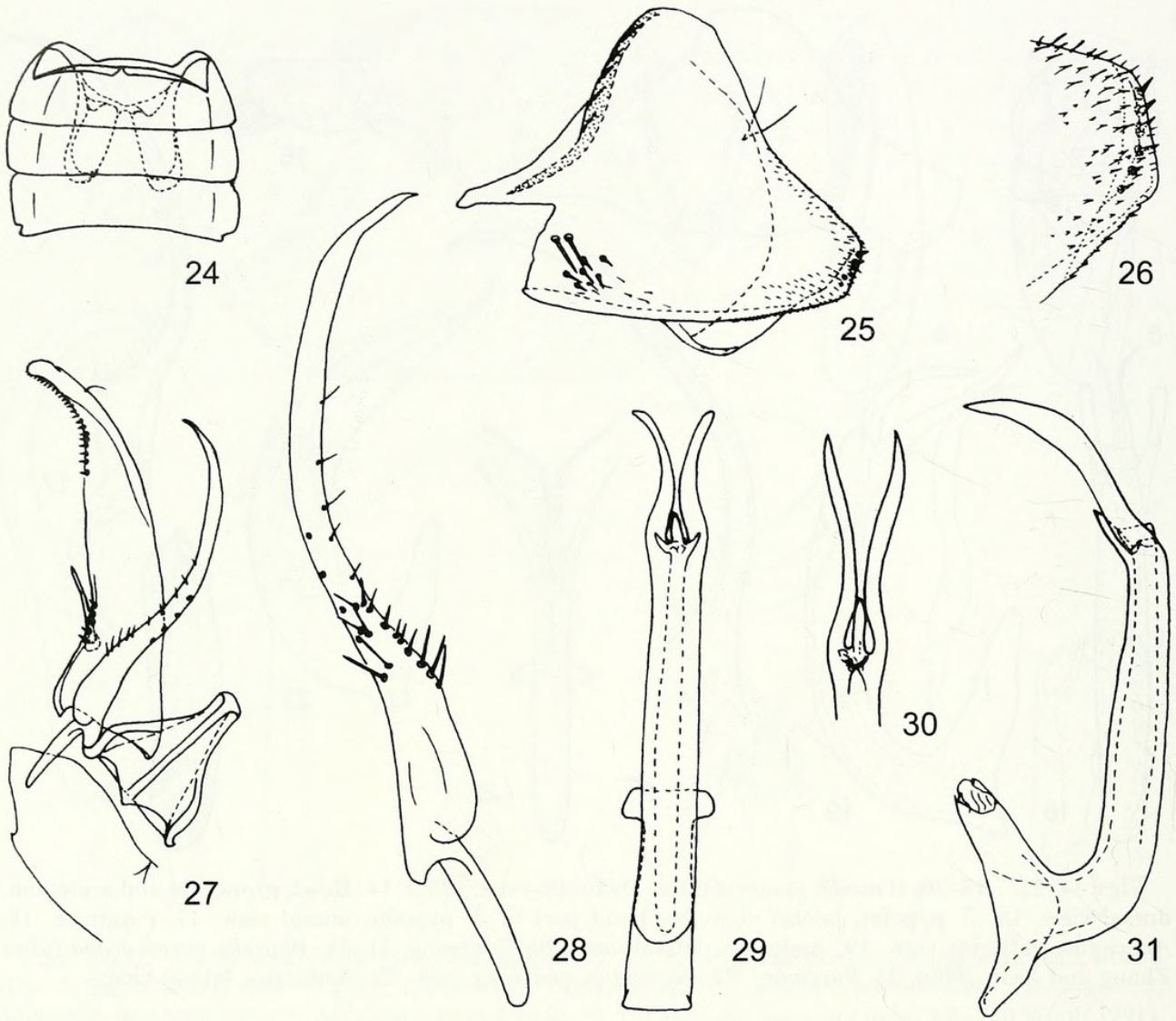
Type material.—Holotype: ♂, CHINA. Yunnan Province: Kunming, Jindian Botanic Garden, alt. 2,050 m, Jan.2, 2000, coll. I. Dworakowska (NWAFU).

Etymology.—The species is named for the three processes of the aedeagus.

Warodia annulata Zhang and Huang, new species

(Figs. 32–38)

Notes.—This species is close to *W. hoso*, but the aedeagal shaft of the former species is arched, with all processes paired and the dorsal ones crossed (Figs. 37–38).



Figs. 24–31. *Warodia tricornis*. 24, Abdominal apodemes. 25, ♂ pygofer, lateral view. 26, Hind part of ♂ pygofer, lateral view. 27, Paramere, connective, subgenital plate and sternite 9, dorsal view. 28, Paramere. 29, Aedeagus, posterior view. 30, Apical part of aedeagus, ventral view. 31, Aedeagus, lateral view.

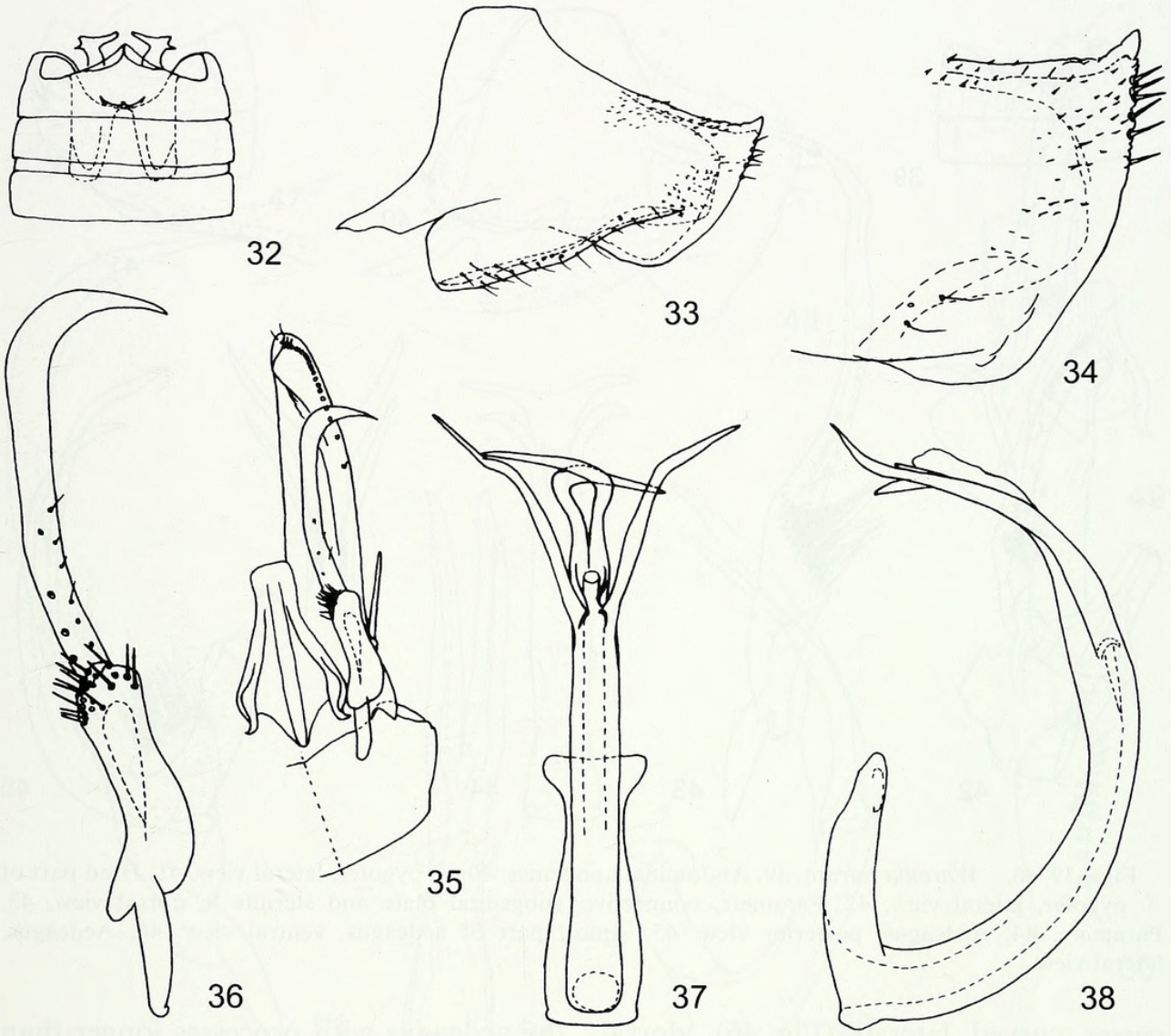
Description.—Yellowish; forewing greenish yellow, with faint streaks, apical quarter light smoky.

Male. Abdominal apodemes reaching to 1/3 of 5th abdominal sternite (Fig. 32). Pygofer lobe with acute protrusion dorsoapically, posterior margin rounded with row of rigid setae on upper part (Fig. 34). Subgenital plate bearing a group of rigid setae apically and peglike setae along upper 1/3 of outer margin (Fig. 35). Paramere with apex somewhat hooked, with thick setae on lateral lobe (Fig. 36). Aedeagus evenly recurved (Fig. 38), with two pairs of apical processes, medial pair crossed ringlike at midlength, in posterior view, lateral pair curved laterad (Fig. 37).

Length: ♂, 3.12 mm.

Type material.—Holotype: ♂, CHINA. Yunnan Province: Xinzhu, alt. 2,450 m, on Ericaceae, Nov.14, 1999, coll. I. Dworakowska (NWAFU).

Etymology.—The specific name is derived from the Latin words "*annulata*," referring to the ringlike shape formed by the crossed dorsal processes of the aedeagus in posterior view.



Figs. 32–38. *Warodia annulata*. 32, Abdominal apodemes. 33, ♂ pygofer, lateral view. 34, Hind part of ♂ pygofer, lateral view. 35, Paramere, connective, subgenital plate and sternite 9, dorsal view. 36, Paramere. 37, Aedeagus, posterior view. 38, Aedeagus, lateral view.

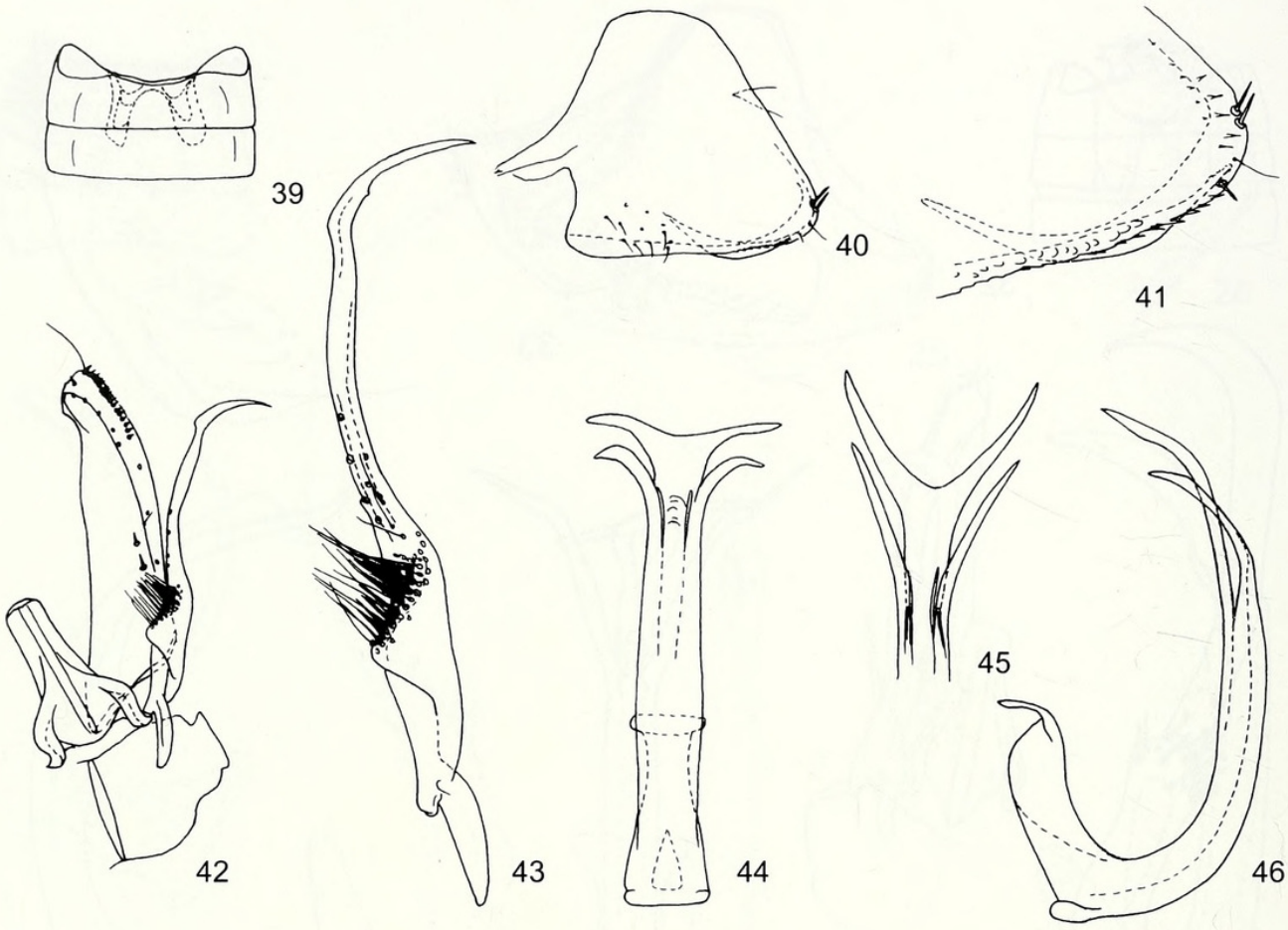
Warodia falcata Zhang and Huang, new species

(Figs. 39–46)

Notes.—This species is similar to *W. annulata*, but it can be distinguished from the latter in having the male pygofer narrowing and rounded caudally without a protrusion (Figs. 40–41) and the apical aedeagal processes shorter and straighter (Fig. 45).

Description.—Beige. Patches on lateral margin of vertex and lateral part of anterior margin of pronotum yellow, basal triangles golden yellow; longitudinal oval patch on midline of pronotum yellowish ocher. Streaks in forewing, from base to apical part, yellowish ocher to yellow.

Male. Abdominal apodemes reaching 1/3 length of 4th abdominal sternite (Fig. 39). Pygofer lobe rounded apically, with few rigid setae on upper angle (Fig. 41). Row of marginal setae on subgenital plate interrupted, with very few setae basally (Fig. 42). Paramere with apex slender and falciform, dorsomedial lobe with numerous gracile and rigid setae (Fig. 43). Aedeagus evenly recurved, with two pairs of distal pro-



Figs. 39–46. *Warodia falcata*. 39, Abdominal apodemes. 40, ♂ pygofer, lateral view. 41, Hind part of ♂ pygofer, lateral view. 42, Paramere, connective, subgenital plate and sternite 9, dorsal view. 43, Paramere. 44, Aedeagus, posterior view. 45, Apical part of aedeagus, ventral view. 46, Aedeagus, lateral view.

cesses curved laterad (Fig. 46), dorsal pair longer and fused basally (Fig. 45).

Length: ♂, 3.12 mm; ♀, 3.06 mm.

Type material.—Holotype: ♂, CHINA. Yunnan Province: Xinzhu Botanic Garden, alt. 2,300 m, on grass and shrub, Nov.16, 1999, coll. I. Dworakowska (NWAFU). Paratype, 1 ♀, same data as holotype (NWAFU).

Etymology.—The species is named for the sicle-shaped apex of the paramere.

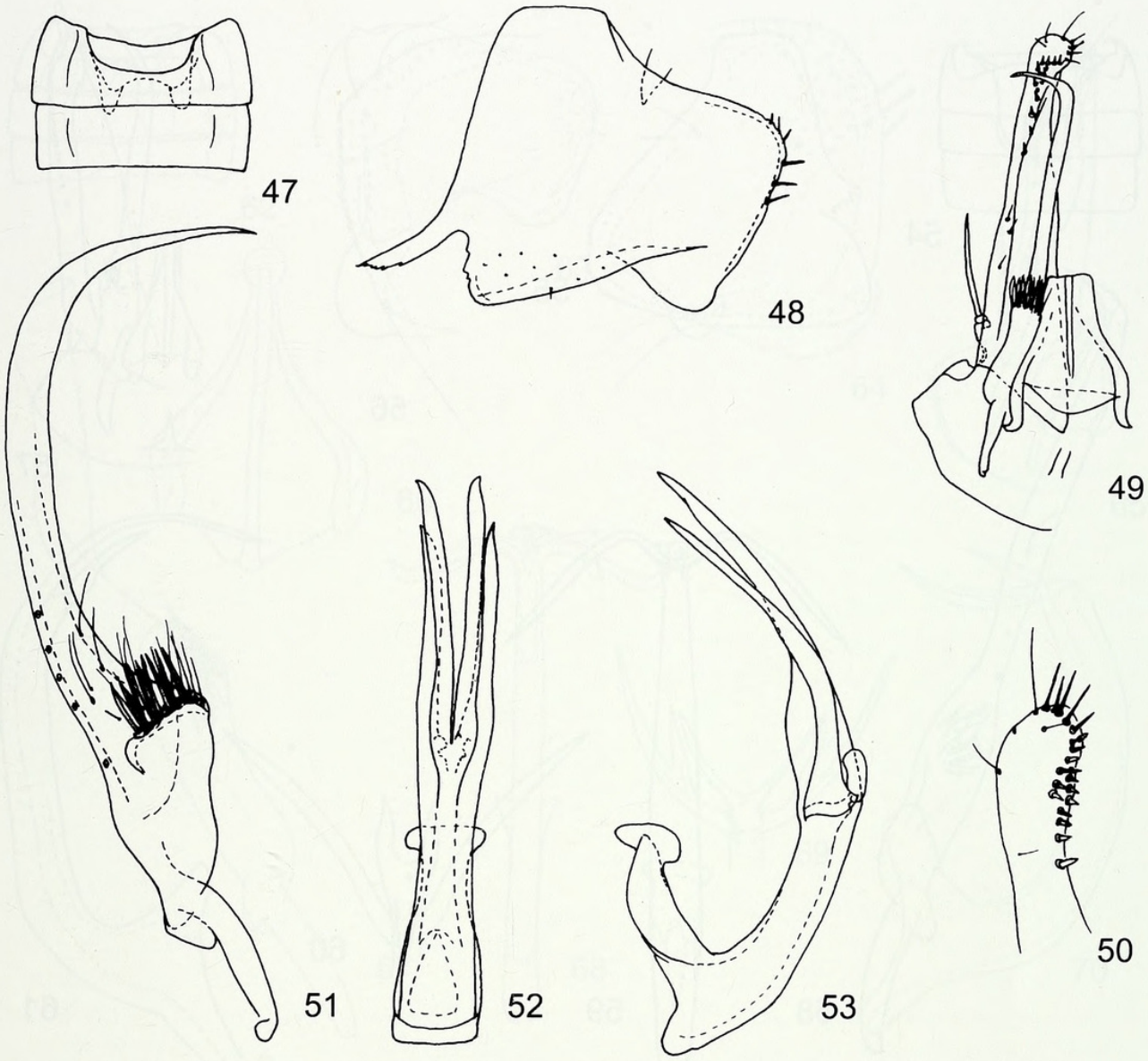
Warodia lineata Zhang and Huang, new species

(Figs. 47–53)

Notes.—This species is close to *W. falcata* externally, but it differs from the latter in having the male pygofer broadened and truncate caudally (Fig. 48) and the aedeagus with processes longer than the stout shaft (Fig. 53).

Description.—Beige. Two patches on disk of vertex yellow. Pronotum with hind part light smoky, two patches N-shaped on disc yellowish orange, each with small reddish-orange spots scattered on inner arm. Scutellum with basal triangles infuscate, tip and lateral margin blackish brown. Forewing yellowish with apical quarter smoky with reddish-orange streaks.

Male. Abdominal apodemes reaching 4th abdominal sternite (Fig. 47). Pygofer lobe truncate and broadened, with a few rigid setae on upper part of posterior margin (Fig. 48). Subgenital plates with marginal row of setae interrupted, with few setae located near midlength (Fig. 49). Paramere with apex long and



Figs. 47–53. *Warodia lineata*. 47, Abdominal apodemes. 48, ♂ pygofer, lateral view. 49, Paramere, connective, subgenital plate and sternite 9, dorsal view. 50, Apical part of subgenital plate. 51, Paramere. 52, Aedeagus, posterior view. 53, Aedeagus, lateral view.

arched, acute apically; few gracile and numerous rigid setae on upper part of lateral lobe (Fig. 51). Aedeagal shaft short and slightly curved dorsally (Fig. 53), with two pairs of strong processes at tip, each pair relatively straight and longer than shaft (Fig. 52).

Length: ♂, 3.75 mm; ♀, 3.60 mm.

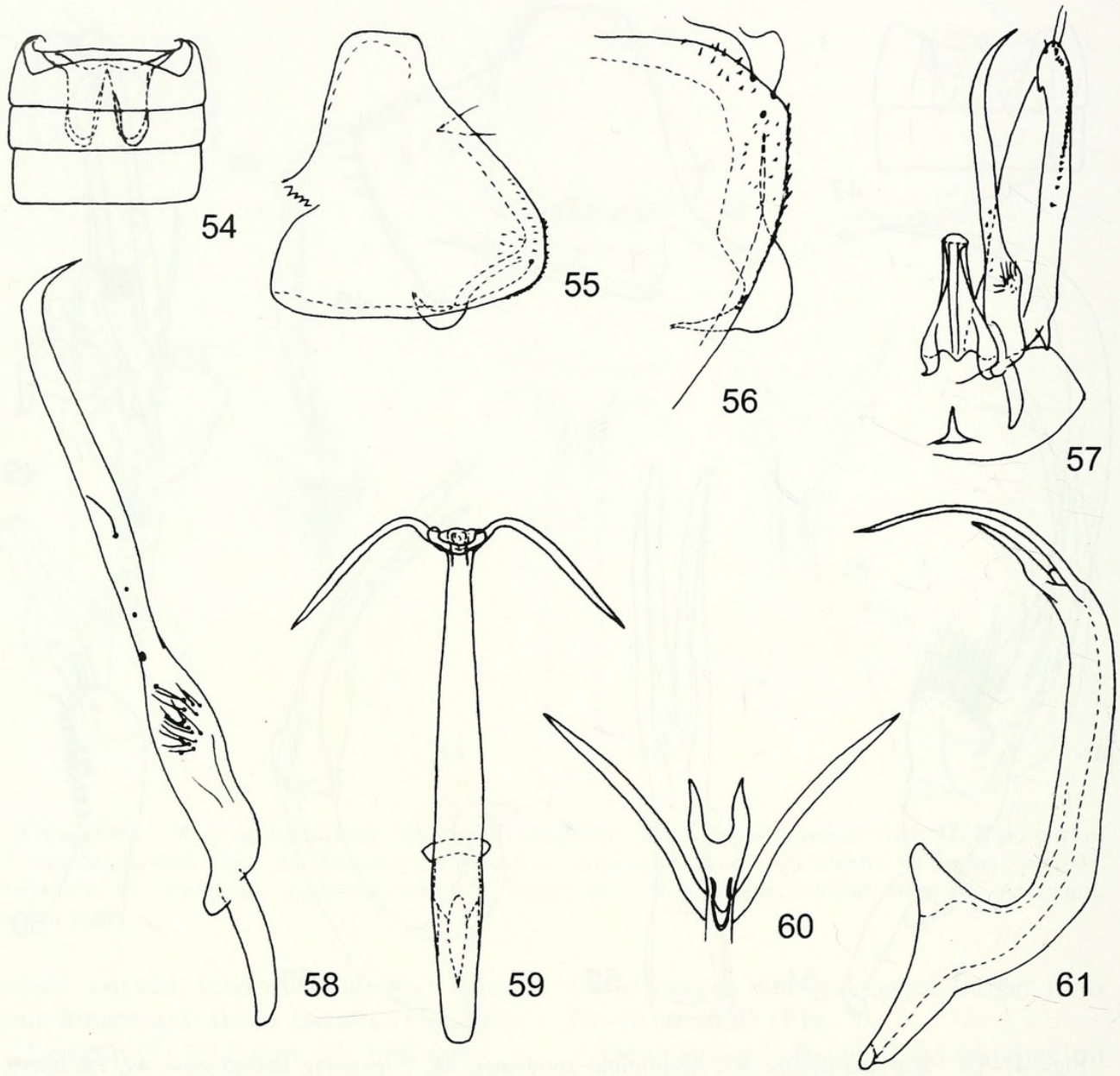
Type material.—Holotype: ♂, CHINA. Yunnan Province: Xinzhu, alt. 2,450 m, on Ericaceae, Nov.14, 1999, coll. I. Dworakowska (NWAFU). Paratype: 1 ♂, 1 ♀, north slope, alt. 2,300 m, on *Alnus*, Nov.16, 1999; 1 ♀, north slope, alt. 2,400 m, Nov.16, 1999, coll. I. Dworakowska (NWAFU); 1 ♂, 1 ♀, Kunming, Xishan, alt. 2,000 m, May 16, 1981, coll. Jikun Yang (CAU).

Etymology.—The specific name is derived from the Latin words "*lineata*," referring to the erect processes of the aedeagus.

Warodia rigida Zhang and Huang, new species

(Figs. 54–61)

Notes.—This species resembles *W. biguttata* in the male genitalia, but it can



Figs. 54–61. *Warodia rigida*. 54, Abdominal apodemes. 55, ♂ pygofer, lateral view. 56, Hind part of ♂ pygofer, lateral view. 57, Paramere, connective, subgenital plate and sternite 9, dorsal view. 58, Paramere. 59, Aedeagus, posterior view. 60, Apical part of aedeagus, from above. 61, Aedeagus, lateral view.

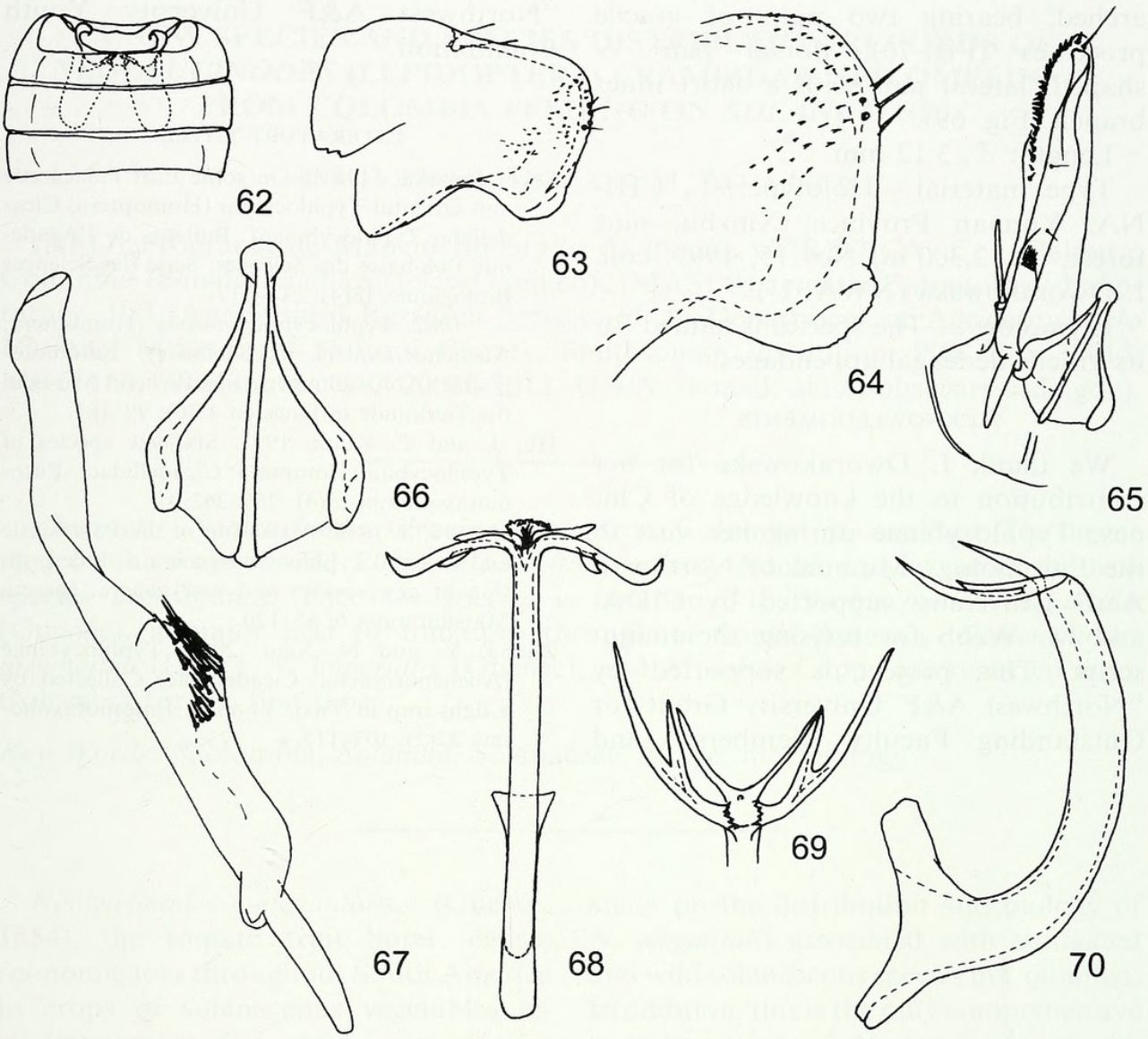
be distinguished from the latter in having the dorsoapical aedeagal processes on a longer base and the lateral processes V-shaped in dorsal view (Fig. 60).

Description.—Beige. Patches near midline of vertex, anterior part of pronotum, scutellum, streaks in Cua and clavus and rounded patch at end of claval area of forewing yellowish.

Male. Abdominal apodemes extended nearly 5th abdominal sternite (Fig. 54). Pygofer lobe narrow, apex somewhat truncate, microsetae not detectable (Fig. 56). Subgenital plate with row of lateral setae on caudal half (Fig. 57). Paramere with apex relatively straight with a hooklike apex; numerous gracile and few rigid setae on central part (Fig. 58). Aedeagus shaft relatively straight, bearing two pairs of processes on tip (Fig. 61), dorsal pair U-shaped and about half length of slender lateral pair (Fig. 60).

Length: ♂, 3.30 mm.

Type material.—Holotype: ♂, CHINA. Yunnan Province: Xinzhu, north-



Figs. 62–70. *Warodia gracilicornis*. 62, Abdominal apodemes. 63, ♂ pygofer, lateral view. 64, Hind part of ♂ pygofer, lateral view. 65, Paramere, connective, subgenital plate and sternite 9, dorsal view. 66, Connective. 67, Paramere. 68, Aedeagus, posterior view. 69, Apical part of aedeagus, dorsal view. 70, Aedeagus, lateral view.

west slope, alt. 2,400–2,500 m, Nov.16, 1999, coll. I. Dworakowska (NWAFU).

Etymology.—The species is named for its rigid dorsal aedeagal appendages.

Warodia gracilicornis Zhang and Huang, new species

(Figs. 62–70)

Notes.—This species is close to *W. rigida*, but it differs from the latter by its broadened posterior margin of the pygofer lobe (Fig. 64) and branched lateral aedeagal process (Fig. 69).

Description.—Beige. Patches near midline of vertex, streaks along anterior margin of pronotum, scutellum and streaks on forewing yellow.

Male. Abdominal apodemes reaching end of 4th abdominal sternite (Fig. 62). Pygofer lobe with posterior margin strongly truncate, with a few rigid setae on caudodorsal angle (Fig. 64). Subgenital plate with row of compact and relatively long thickened setae (Fig. 65). Paramere with short apex rounded apically; numerous short and rigid setae on lateral lobe (Fig. 67). Aedeagal shaft

arched, bearing two pairs of gracile processes (Fig. 70), dorsal pair V-shaped, lateral pair with a short inner branch (Fig. 69).

Length: ♂, 3.12 mm.

Type material.—Holotype: ♂, CHINA. Yunnan Province: Xinzhu, pine forest, alt. 2,300 m, Nov.15, 1999, coll. I. Dworakowska (NWAFU).

Etymology.—The species is named for its gracile aedeagal appendages.

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Literature Cited

Dworakowska, I. 1970. On some East Palaearctic and Oriental Typhlocybini (Homoptera, Cicadellidae,Typhlocybinae). Bulletin de l'Academie Polonaise des Sciences. Serie des Sciences Biologiques 18(4): 211–217.

———. 1982. Typhlocybini of Asia (Homoptera, Auchenorrhyncha, Cicadellidae). Entomologische Abhandlungen Staatlichen Museum für Tierkunde in Dresden 45(6): 99–181.

Hu, J. and C. Kuoh. 1991. Six new species of Typhlocybini (Homptera: Cicadellidae). Entomotaxonomia 13(4): 255–262.

Matsumura, S. 1932. A revision of the Palaearctic and Oriental Typhlocybid-genera with description of new species and new genera. Insecta Matsumurana 6: 55–120.

Zhang, Y. and N. Xiao. 2000. Typhlocybinae (Auchenorryncha: Cicadellidae) Collected by a light trap in Yuxi, Yunnan. Entomotaxonomia 22(2): 107–115.