

The Cixiidae of Taiwan, Part VII: Tribe Pintaliini (Hemiptera: Fulgoroidea)

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Shun-Chern Tsaaur and Tung-Ching Hsu (2003) The Cixiidae of Taiwan, Part VII: tribe Pintaliini (Hemiptera: Fulgoroidea). *Zoological Studies* 42(3): 431-443. This study completes the first taxonomic revision of the plant-hopper family Cixiidae in Taiwan with emphasis on the morphology of the male and female genitalia. In total, 20 genera and 155 species are recognized. A key to the tribes of Bothriocerinae was given in a previous work. In this paper, keys to both the subfamilies and tribes of the Cixiidae are presented. The 5 tribes Pentastirini, Bothriocerini, Bennini, Stenophlepsini, and Cixiini were previously revised by the authors, and the remaining tribe, Pintaliini, is treated here with 6 species. *Neocarpia maai* represents a new genus and new species. *Kirbyana lini*, *Eucarpia stellata*, *E. specialis*, and *E. truncata* are described as new species. The male of *K. pagana* (Melichar) is described and illustrated for the first time. <http://www.sinica.edu.tw/zool/zoolstud/42.3/431.pdf>

Key words: Insecta, Hemiptera, Cixiidae, Taxonomy, Taiwan.

This revision mainly deals with 3 collections of insects from Taiwan. The largest one, comprising more than 13 000 specimens, was made by various staff of the Taiwan Agricultural Research Institute (TARI) (1980-1985); the second (ca. 2000 specimens) was made by the first author and colleagues of the Department of Entomology, National Chung Hsing Univ. (NCHU) (1981-1989); while the third (ca. 1000 specimens) was made by the first author and colleagues of the Department of Entomology, National Taiwan Univ. (NTU). The collection in which the material is deposited is given for each species under the heading "Specimens examined". Some paratypes are deposited at the British Museum (Natural History) (BMNH).

The Cixiidae are the second largest family within the Fulgoroidea. More than 2200 species in about 135 genera have been reported so far (Tsaaur unpubl. data). Although they are a vector of mycoplasma-like organisms which cause lethal yellowing of palms in the Caribbean and Florida and of flax in New Zealand, and are perhaps impli-

cated in a yellowing disease of palms in the Philippines, they have not caused serious damage on economic vegetation here; and because of the cryptic life history of nymphs, they have attracted little of our attention. We have opened this nearly unexplored field under the support of the National Science Council of the R.O.C. In addition to the 39 already known species, we have also described 116 new species and 5 new genera bringing the total number of cixiid species in Taiwan to 20 genera and 155 species. All measurements were averaged from 5 individuals.

Key to the subfamilies of the Cixiinae in Taiwan

1. Gena with a subantennal process.....Bothriocerinae
- Gena without a subantennal process.....Cixiinae

Key to the tribes of the Cixiidae in Taiwan

1. Mesonotum with 5 longitudinal carinae.....Pentastirini
- Mesonotum with 3 longitudinal carinae.....2
2. Fourth abdominal segment bearing a pair of long, lateral processes.....Bennini

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- Fourth abdominal segment without above processes.....3
- 3. Vertex with transverse, arched carina.....Cixiini
- Vertex without above carina.....Pintaliini

Tribe Pintaliini

Body usually compressed. Vertex without median transverse carina. Mesonotum tricarinate. Tegmina steeply tectiform. Wax-secreting pore absent.

Key to the genera of the Pintaliini in Taiwan

1. Hind tibiae with percurrent dark brown stripes along outer surface; chaetotaxy of hind tarsi 9-11/9-11; median ocellus present.....*Kirbyana* Distant
 - Hind tibiae without longitudinal stripes; chaetotaxy of hind tarsi 6-7/7-8; median ocellus absent.....2
2. Veinlet M_{3+4} - Cu_{1a} in tegmen at same level as veinlet R-M.....*Neocarpia* gen. n.
 - Veinlet M_{3+4} - Cu_{1a} in tegmen distinctly distad of veinlet R-M.....*Eucarpia* Walker

Genus *Kirbyana* Distant, 1906

Kirbya Melichar, 1903: 37.

Kirbyana Distant, 1906, 3: 262.

Commolenda Distant, 1911, 8: 741.

Kirbyana: Fennah, 1978; 34: 211.

Type species: *Kirbyana pagana* (Melichar) (original designation by Distant).

Key to the species of *Kirbyana* from Taiwan based on males

1. Vertex with anterior margin incised medially; chaetotaxy of hind tarsi 11/9.....*pagana* (Melichar)
 - Vertex with anterior margin transverse; chaetotaxy of hind tarsi 9/11.....*lini* sp. n.

The genus *Kirbyana* is one of the smallest genera of cixiids. Only 4 species had been recorded from the Oriental region before this paper.

Head including eyes slightly narrower than pronotum. Vertex transverse or incised in middle. Frons somewhat longer than broad, with median carina, anterior margin angularly indented or transverse, widest below level of antennae, deeply impressed in at least its basal half, disc usually speckled with small spots. Clypeus tricarinate. Median ocellus absent. Lateral ocelli ruby red. Pronotum very narrow, scarcely half as long as vertex. Mesonotum nearly twice as long as pronotum and vertex together, tricarinate. Tegmina each with apical margin slightly convex, 3 discal longitudinal veins, of which the upper and lower are

forked; 2 series of transverse veins in middle and apical areas, the latter much more complete. On wings, R simple, M_{3+4} and Cu_{1a} fused. Abdomen laterally compressed. Legs simple. Hind tibiae without lateral spine, with percurrent dark brown stripe along outer surfaces.

Kirbyana pagana (Melichar, 1903)

(Fig. 1)

Kirbya pagana Melichar, 1903: 38.

Kirbyana pagana Distant, 1906, 3: 262.

General color yellow. Body covered with powdery wax. Vertex sometimes with a dark spot beside median carina, below anterior margin. One parallel-sided, light yellow stripe crossing over vertex, pronotum, and mesonotum. Pro- and mesonotum brown outside this stripe. Frons whitish yellow, with 3 black stripes outside lateral carinae in lateral view: 2 in front of eye, 1 before ocellus. Tegmen yellowish brown, veins paler, pallid yellow between margin and claval vein, a series of large, black spots along clavus and also on inner bifurcate veins, apical veins usually with black spots on apical margin, another black spot on Cu_2 about level with claval end. Abdominal sterna with 3-5 black spots on spiraculæ of segments III and IV.

Vertex 1.2 times as wide at basal emargination as length of middle line, slightly concave anteromedially, median carina weak, absent near base, lateral carinae diverging caudad. Frons 1.1 times wider at widest portion as length of middle line, median carina obscure on basal fourth. Rostrum reaching midlength of hind femora. Tegmen densely covered with setae. Chaetotaxy of hind tarsi 11/9. First and second tarsal segments each with 4 membranous teeth as shown in figure 1.

Male genitalia: Pygofer symmetrical, elongate, widening to dorsolateral angles in ventral view, deeply concave dorsally, inclined dorsocaudally in lateral view. Medioventral process triangular in ventral view, with truncate vertical angle, stout and subtriangular in lateral view. Anal segment with straight dorsal margin before genital opening, ventral margin slightly convex at middle, rounded at apex in lateral view, diverging to apex in dorsal view. Anal style short. Genital styles symmetrical, widening to apex in ventral view, ventral margin convex near base in lateral view, dorsal margin abruptly expanded and curving dorsad on distal half. Aedeagus thin and slender, with 4 spi-

nose processes, all visible in right-side orientation: shortest one needle-like, implanted on right side at basal fourth, directed dorsocaudad; another needle-like process implanted on ventral surface near middle, straight, curving 60° downward; longest one originating from lateroapical angle of right side, stout at base, acuminate to apex, directed cephalad. Flagellum strongly sclerotized on basal half, the rest membranous, a sclerotized process protruding dorsomedially, coiled to ventrocephalad at apex.

Female genitalia: Pygofer suboval in caudal view, disc densely covered with setae. Anal segment somewhat square-shaped in dorsal view.

	Male	Female
Length of body (incl. teg.)	: 4.87 - 5.43mm	; 5.23 - 5.74mm
Length of tegmen	: 4.20 - 4.61mm	; 4.61 - 5.02mm

Specimens examined: 1 ♀ Taihoku (=Taipei) 4-II-1934 J. Sonan; 1 ♀ Lushan, Nantou Co. 27-31-V-1980 K. S. Lin & L. Y. Chou; 1 ♂ 1 ♀ Tungpu, Nantou Co. 25-29-IX-1980 L. Y. Chou & T. Lin; 3 ♂♂ 2 ♀♀ Kukuan, Taichung Co. 14-17-X-1980 K. S. Lin & C. H. Wang; 1 ♀ Lanyu (Orchid I.), Taitung Co. 13-18-IV-1981 K. S. Lin; L. Y. Chou; T. Lin & S. C. Lin; 1 ♂ Tungpu, Nantou Co. 28-IV-2-V-1981 T. Lin & C. J. Lee; 1 ♂ 5-8-X-1981 T. Lin & W. S. Tang; 1 ♂ 19-23-VII-1982 L. Y. Chou & T. Lin; 12 ♂♂ 6 ♀♀ Fuli, Hualien Co. 9-11-X-1982 K. C. Chou & S. P. Huang; 2 ♂♂ 4 ♀♀ Paling, Taoyuan Co. 3-5-V-1983 K. C. Chou & C. C. Pan; 1 ♂ Wanfang, Taichung Co. III-1984 K. S. Lin & K. C. Chou; 18 ♂♂ 15 ♀♀ Lienhuachih, Nantou Co. III-XII-1984 K. S. Lin & K. C. Chou; 1 ♂ 2 ♀♀ Meifeng, Nantou Co. X-1984 K. S. Lin & K. C. Chou; 43 ♂♂ 4 ♀♀ Tungpu, Nantou Co. X-

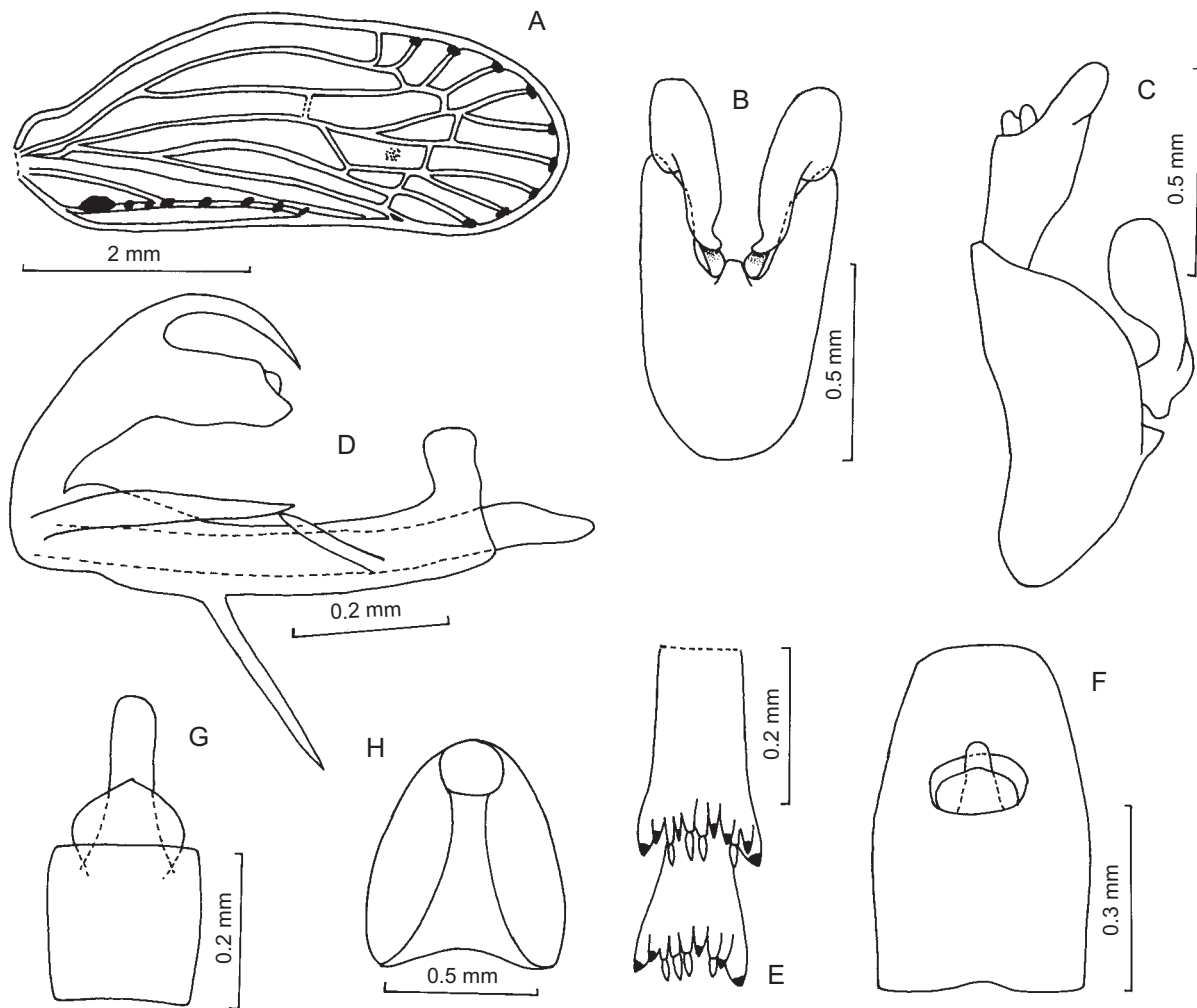


Fig. 1. *Kirbyana pagana* (Melichar). (A) Tegmen. (B, C) Pygofer; (B) ventral view; (C) lateral view. (D) Aedeagus, right-side view. (E) Hind tibia and tarsus. (F, G) Anal segment; (F) ♂, caudal view; (G) ♀, dorsal view. (H) ♀ pygofer, caudal view.

XI-1985 K. S. Lin; 2 ♀♀ Wuchieh, Nantou Co. 26-VII-1984 C. T. Yang & S. C. Tsaur; 1 ♂ Chuhkou, Chiayi Co. 29-I-1985 C. T. Yang; 2 ♀♀ Hueisun, Nantou Co. VII-VIII-1986; 1 ♀ Taiping, Taichung Co. 21-III-1987 M. L. Chan; 1 ♂ Shangpaling, Taoyuan Co. 29-VI-1987 M. L. Chan; 1 ♂ Litao, Taitung Co. 13-VIII-1987 S. C. Tsaur; 2 ♂♂ 1 ♀ Tapang, Chiayi Co. 20-VI-1988 S. C. Tsaur; 1 ♂ Hoshe, Nantou Co. 11-VII-1988 S. C. Tsaur; 1 ♂ 1 ♀ Lienhuachih, Hualien Co. 4-IX-1988 S. C. Tsaur; 1 ♀ Chihpen, Taitung Co. 7-IX-1988 S. C. Tsaur; 1 ♂ 1 ♀ Shihpai, Ilan Co. 19-X-1988 S. C. Tsaur.

Distribution: Oriental region.

Remarks: *Kirbyana pagana* was first recorded by Melichar from Ceylon (Sri Lanka) based on 1 female specimen. In this paper, the male is described for the first time. This species somewhat resembles *K. lini* but differs from the latter in the aspect of the middle of the vertex which is concave in this species but transverse in *lini*; and in the chaetotaxy of the hind tarsi which is 11/9 in *pagana* and 9/11 in *lini*. The aedeagal complex of *K. pagana* also resembles those of *Eucarpia straeleni* (Synave) and *E. africana* (Muir), but differs from the latter in having a short needle-like process implanted on the right side at the basal fourth and which is directed dorsocaudad.

***Kirbyana lini* Tsaur et Hsu, sp. n.**

(Fig. 2)

General color brown. Body covered with powdery wax. Vertex entirely yellow, with 1 black spot on either side of median carina just below anterior margin, with same width, yellow stripe passing through pronotum to mesonotum. Frons sordid brown, with 3 black stripes outside lateral carina in lateral view: 2 in front of eye, 1 before ocellus. Rostrum brownish black, subapical segment 3.0 times as long as apical one. Tegmen translucent throughout, yellowish brown between claval vein and margin, brown on basal third, paler on apical half, with 3-5 black spots on clavus. Abdominal sterna sometimes with segments III-V (male) or III-VI (female) bearing black spots on spiraculæ.

Vertex weakly carinate in middle, anterior margin slightly concave medially, posterior margin transverse, 1.4 times as wide at basal emargination as length of middle line. Frons with median carina not touching basal margin, 1.1 times as wide at widest portion as length of middle line. Rostrum reaching distad of hind femora. Tegmen

densely covered with setae. Chaetotaxy of hind tarsi 9/11. Second tarsal segment with 6 membranous teeth as shown in figure 2.

Male genitalia: Pygofer symmetrical, elongate, widening to dorsolateral angle in ventral view, narrowing dorsally in lateral view; medioventral process small, rounded in ventral view, partly covered by pygofer in lateral view. Anal segment widening to apex in lateral view, ventral margin rounded, produced near base; apical production acute, widest near middle in dorsal view, narrowing toward both ends, apical margin concave medially. Anal style very long. Genital styles symmetrical, inner margin with a small concavity near base in ventral view, nearly same width for most portions, roundly curving laterad at apex; curving dorsad near middle in lateral view; apex with an acute production, directed inwardly. Aedeagus with a compressed production on apical two-thirds of left side, in total with 5 spinose processes: ventral surface with 1 short process at mediobasal third, directed caudad; 2 longer ones implanted apically: 1 blade-like, directed ventrocephalad; and the other curving cephalically. Flagellum originating from lateroapical angle of right side, its dorsal compartment with a moderately long process, directed ventrocephalad; 1 small subulate process implanted above base of former process.

Female genitalia: Pygofer suboval in caudal view, disc densely covered with setae. Anal segment somewhat square-shaped, in dorsal view with long anal style.

Etymology: The specific name is given in honor of Mr. K.S. Lin, a Chinese Hymenopterist.

	Male	Female
Length of body (include. Teg.)	: 4.60 - 5.03mm;	4.92 - 5.23mm
Length of tegmen	: 4.00 - 4.41mm;	4.31 - 4.51mm

Holotype: ♂, TAIWAN: Chiahsien, Kaohsiung Co. 11-IV-1985 S. C. Tsaur (in NCHU).

Paratypes: 2 ♂♂ Lanyu (Orchid. I.), Taitung Co. 13-18-VI-1981 K. S. Lin; L. Y. Chou; T. Lin & S. C. Lin; 2 ♀♀ Liukuei, Kaohsiung Co. 27-28-VI-1981 L. Y. Chou & C. H. Yang; 1 ♂ Chubing, Nantou Co. 26-VII-1984 S. C. Tsaur; 2 ♀♀ Lanyu, Taitung Co. 13-VII-1985 L. C. Tang; 1 ♂ 1 ♀ 14-VII-1985 M. M. Yang; 1 ♀ S.J. Fang; 1 ♀ Baolai, Kaohsiung Co. 21-VII-1985 S. C. Tsaur; 1 ♀ Chiahsien, Kaohsiung Co. 23-VII-1985 S. C. Tsaur; 2 ♂♂ 3 ♀♀ 11-IX-1985 S. C. Tsaur; 2 ♀♀ Hsingtan, Pingtung Co. 27-IV-1985 S. J. Fang; 1 ♂ Nanhua, Tainan Co. 4-IV-1985 C. T. Yang; 1 ♂ Hengchun, Pingtung Co. 27-VI-1986 S. C. Tsaur; 1

♂ Fongkang, Pingtung Co. 22-VII-1986 C. T. Yang; 5 ♀♀ Chiahsien, Kaohsiung Co. 14-VIII-1986 S. C. Tsaur; 1 ♀ Hengchun, Pingtung Co. 27-IV-1987 C. T. Yang; 1 ♂ Chiahsien, Kaohsiung Co. 15-IX-1987 C. T. Yang 1 ♀ Shuanlienpi, Ilan Co. 8-VIII-1989 S. C. Tsaur (BMNH, TARI, NTU, NCHU).

Distribution: Taiwan.

Remarks: *Kirbyana lini* is closely related to *K.*

pratti in the following structure of the aedeagal complex: the flagellum arising from the right side; the apex bearing 2 long processes, and the basoventral part bearing a process directed caudad at the basal third. *Kirbyana lini* differs from *K. pratti* in the anterior margin of vertex which is transverse in *lini*, and triangularly concave in *pratti*.

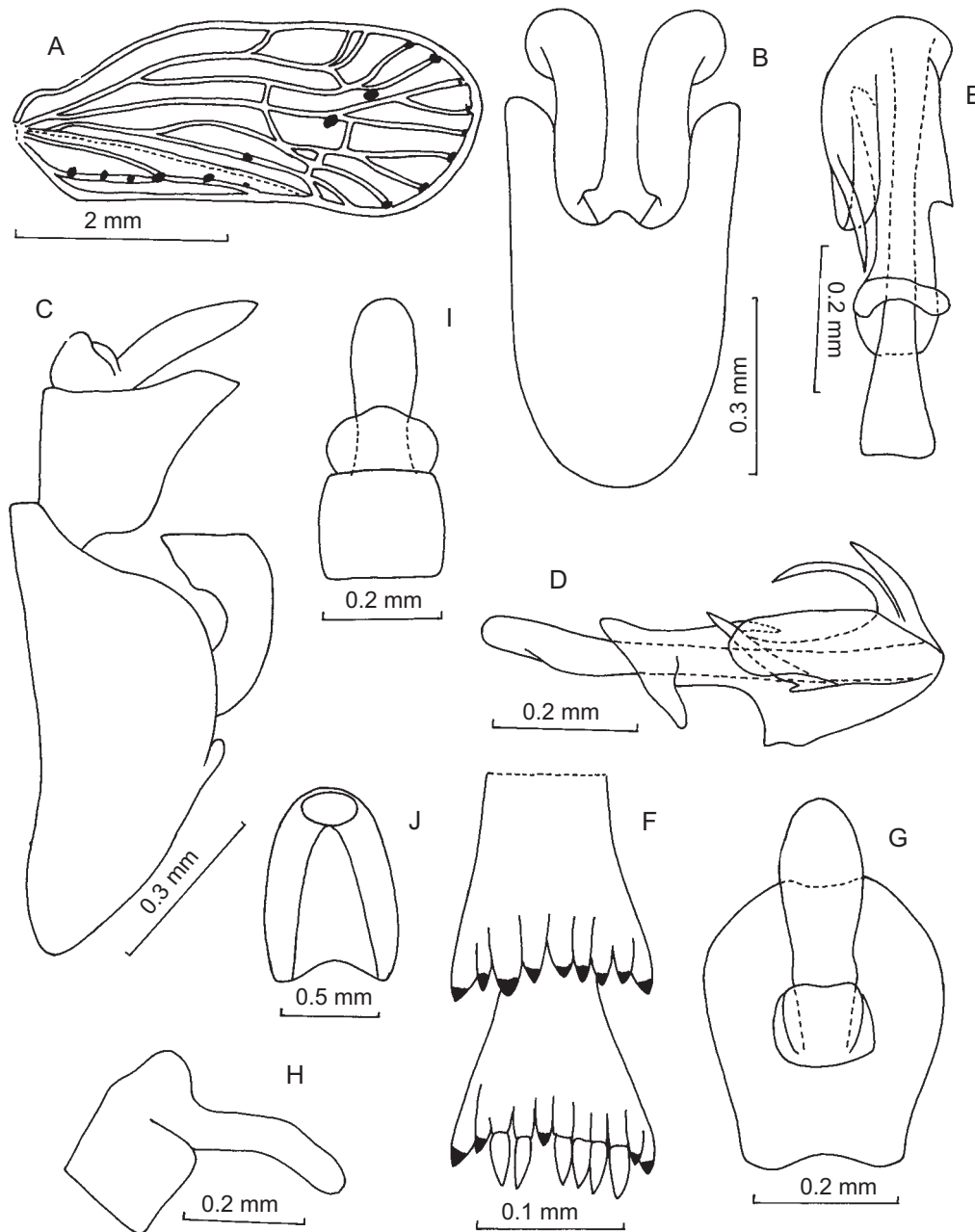


Fig. 2. *Kirbyana lini* sp. n. (A) Tegmen. (B, C) Pygofer; (B) ventral view; (C) lateral view. (D, E) Aedeagus; (D) lateral view; (E) dorsal view. (F) Hind tibia and tarsus. (G-I) Anal segment; (G) ♂, caudal view; (H) ♀, lateral view; (I) ♀ dorsal view. (J) ♀ pygofer, caudal view.

Genus *Eucarpia* Walker, 1857

Eucarpia Walker, 1857, 1: 159.

Ptoleia Stål, 1859, 3: 321.

Ambalangoda Distant, 1912, 8: 188.

Type species: *Eucarpia univitta* Walker (by monotypy).

The genus *Eucarpia* comprises 26 species, distributed in Australian, Afrotropical, and Oriental regions.

Medium-sized cixiid species (4.8-6.1 mm). Body moderately compressed. Head including eyes slightly narrower than pronotum. Vertex parallel-sided or slightly widening to base; transverse at base, apical margin transverse; incised or convex at middle; disc depressed, lateral carinae elevated; medium carina distinct or obsolete. Frons narrowest at base, widest across or below level of antennae, lateral carinae elevated, medium carina complete or at least distinct on apical half, disc somewhat depressed on basal half, sometimes marbled with small blotches. Median ocellus absent. Lateral ocelli yellow with prominent red boundaries. Clypeus with strongly elevated median carina, and elevated lateral carinae. Pronotum short, chevron-shaped, with or without median carina, intermediate carinae finely curved. Mesonotum tricarinate. Tegmina steeply tectiform, usually widening to apex, rounded or obliquely truncate at apex, with 10-11 apical cells, Sc+R forked basad of Cu. Wings with simple R and fused M_{3+4} and Cu_{1a} . Post-tibiae without lateral spines, no longitudinal stripe. Chaetotaxy of hind tarsi 6-7/7-8. Female pygofer devoid of wax-secreting pore, disc densely covered with setae.

Key to the species of *Eucarpia* in Taiwan based on males

1. Frons marbled with blotches; apical cells of tegmen with several yellowish-white areas (Figs. 4A, 5A).....2
- Frons unicolorous; tegmen with 11 black spots on apical branches (Fig. 3A)*stellata* sp. n.
2. Vertex convex medioapically, with median carina, 1.5 times as wide as long; in dorsal view with hexagonal anal segment.....*specialis* sp. n.
- Vertex nearly transverse medioapically, without median carina, 2.2 times as wide as long; in dorsal view with rounded anal segment*truncata* sp. n.

Eucarpia stellata Tsaour et Hsu, sp. n.

(Fig. 3)

General color yellow. Body covered with powdery wax. In dorsal view with 1 parallel-sided, shiny yellow stripe originating from vertex passing

through pro- and mesonotum to end of clavus. In lateral view, with 1 equal-width, brown stripe from lateral carina of frons transversely extending to midlength of clavus. Tegmina translucent on basal half, yellowish brown on the other compartment, apical margin yellow, with a black spot at end of each longitudinal vein, other black spots as shown in figure 3. Wings opaque. Abdomen brown.

Vertex 1.6 times as wide at basal emargination as length of middle line, apical margin transverse, only slightly concave medially, weakly diverging caudad below level of basal margin, weakly carinate medially. Frons slightly longer at midline than width at widest portion, median carina not touching basal margin or frontoclypeal suture. Rostrum reaching 1/3 length of hind femora. Tegmen not covered with seta. Chaetotaxy of hind tarsi 6-7/7-8. Second tarsal segment usually with 3 membranous teeth at apex.

Male genitalia: Pygofer symmetrical, with smoothly rounded margin in ventral view, widest in middle, dorsolateral angle thumb-shaped, dorsal margin roundly concave, narrowing dorsally in lateral view, apical margin convex medially, medioventral process small, obtusely triangular in ventral view. Anal segment short and stout in lateral view, dilating to base of genital opening; lateroapical margin not produced in dorsal view, anal style surpassing anal segment. Genital styles symmetrical, broad distally, with rounded margin in ventral view; distal lobe roundly produced dorsad in lateral view. Aedeagus triangularly produced on ventrobasal surface in lateral view which has truncate apical margin, in caudal view in total with 4 spinose processes: 1 subulate, implanted on dorsolateral angle of right side, directed cephalad; 1 needle-like inserted on right side near base of flagellum, above aedeagus; and 2 slender, originating from lateroapical angle of flagellum on left side, upper one short, directed cephalad, lower one longer, gently curving to left side, directed laterocephalad. Flagellum with a deflexed process at apex.

Female genitalia: Pygofer much longer than wide in caudal view, deeply incised ventromedially, incised medially. Anal segment swollen in lateral view, square in dorsal view.

Etymology: The specific name indicates the black markings on the tegmina.

	Male	Female
Length of body (include. teg.)	: 5.07 - 5.64mm;	5.95 - 6.15mm
Length of tegmen	: 4.31 - 4.92mm;	5.13 - 5.23mm

Holotype: ♂, TAIWAN: Shihcho, Chiayi Co. 17-VI-1988 S. C. Tsaur (in NTU).

Paratypes: 1 ♂ Arisan (=Alishan), Chiayi Co. IV-1914 M. Maki; 1 ♂ Musha (=Wushe), Nantou Co. 28-IV-1928 J. Sonan; 1 ♀ Wushe, Nantou Co. 16-VII-1971 C. T. Yang; 8 ♂♂ 24 ♀♀ Tayuling, Hualien Co. 9-16-VI-1980 K. S. Lin & B. H. Chen; 11 ♂♂ 13 ♀♀ Tungpu, Nantou Co. 19-23-VII-1982 K. S. Lin & B. H. Chen; 4 ♂♂ 7 ♀♀ 23-27-VII-1984 K. C. Chou & C. H. Yang; 2 ♂♂ 7 ♀♀ Wuchieh, Nantou Co. 27-VII-1984 S. C. Tsaur; 1 ♀ Wushe, Nantou Co. 25-28-VI-1985 K. S. Lin; 1 ♂ Hsingtan, Pingtung Co. 27-IV-1985 S. J. Fang; 2 ♂♂ 10 ♀♀ North Tungyenshan, Nantou Co. 17-

VII-1986 L. Y. Huang; 1 ♀ 21-VII-1985 C. T. Yang; 2 ♀♀ 23-VII-1985 C. L. Chen.; 22 ♂♂ 23 ♀♀ Fenchihu, Chiayi Co. 15-16-VI-1987 S. C. Tsaur; 5 ♂♂ 9 ♀♀ Chiabaotai, Taichung Co. 10-12-VII-1987 C. T. Yang & S. C. Tsaur; 20 ♂♂ 31 ♀♀ Shihcho, Chiayi Co. 17-VI-1988 S. C. Tsaur; 52 ♂♂ 21 ♀♀ Tapang, Chiayi Co. 18-20-VI-1988 S. C. Tsaur; 2 ♀♀ 19-VI-1988 C. C. Chiang; 2 ♂♂ 2 ♀♀ Tungpu, Nantou Co. 13-VII-1988 S. C. Tsaur (BMNH, TARI, NTU, NCHU).

Host plant: *Villebrunea pedunculata* Shirai (Urticaceae).

Distribution: Taiwan.

Remarks: This new species can be easily rec-

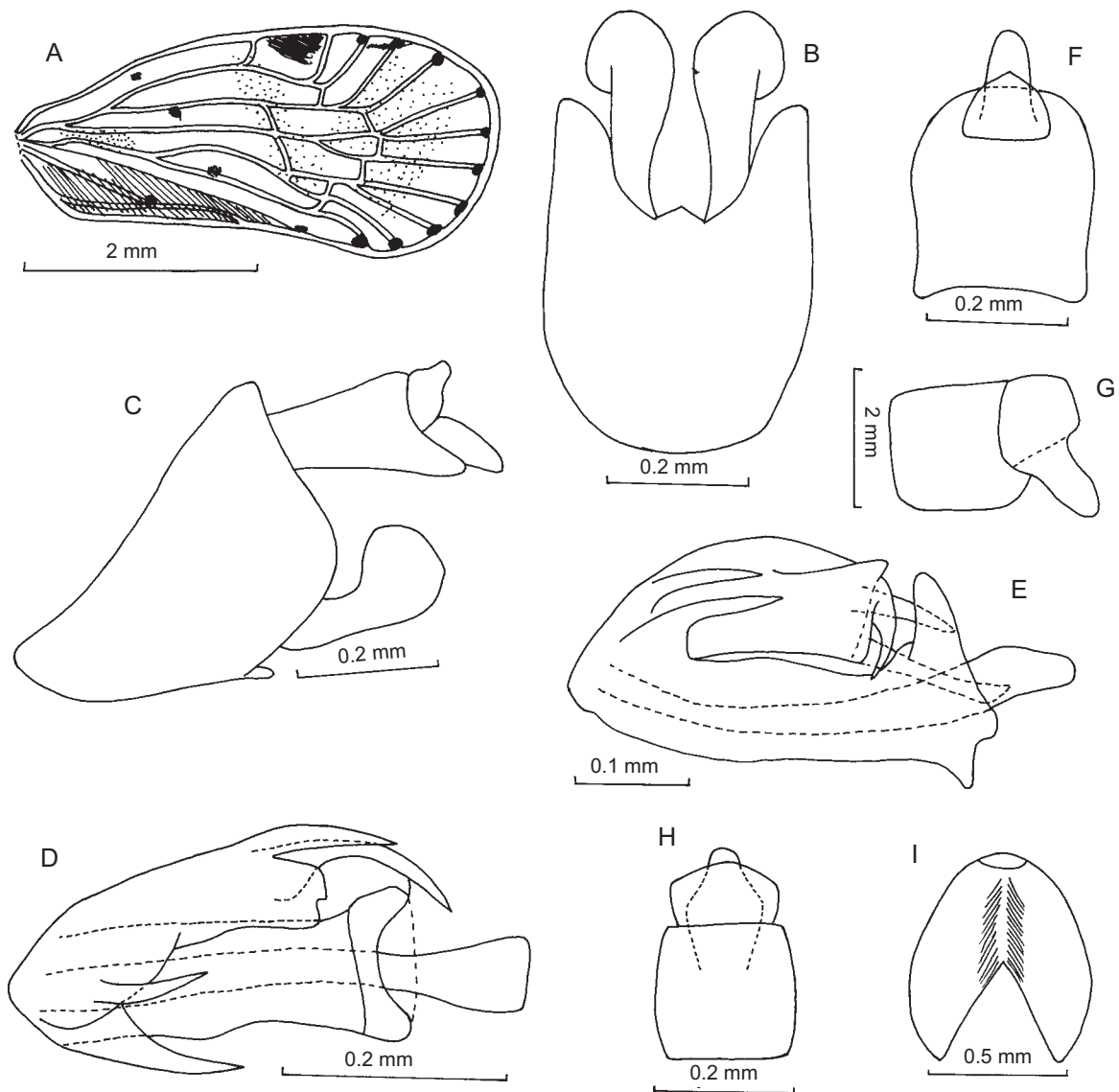


Fig. 3. *Eucarpia stellata* sp. n. (A) Tegmen. (B, C) Pygofer; (B) ventral view; (C) lateral view. (D, E) Aedeagus; (D) dorsal view; (E) lateral view. (F-H) Anal segment; (F) ♂, caudal view; (G) ♀, lateral view; (H) ♀, dorsal view. (I) ♀ pygofer, caudal view.

ognized by the black markings on the tegmina; hundreds of individuals were found on host plants in Shihcho.

***Eucarpia specialis* Tsaur et Hsu, sp. n.**

(Fig. 4)

General color blackish brown. Body covered with powdery wax. Vertex with a parallel, yellow stripe passing through pronotum to mesonotal area between lateral carinae. Frons yellowish marbled with numerous brown blotches. Tegmen translucent, with blackish-brown markings as shown in figure 4, apical margin with 8 whitish spots. Sterna with 4 red membranous areas medially.

Vertex with transverse basal and apical margins, only convex anteromedially, parallel-sided, diverging caudad below level of apical margin, 1.5 times as wide at basal emargination as length of middle line, median carina distinct. Frons with median carina throughout, as long in middle line as width of widest portion. Rostrum reaching midlength of hind femora. Tegmina not covered with seta. Chaetotaxy of hind tarsi 6-7/8. Second tarsal segment usually with 2-3 membranous teeth at apex.

Male genitalia: Pygofer elongate, symmetrical, suboval; dorsal margin deeply concave in ventral view, slanting caudad in lateral view; apical margin roundly convex in middle; medioventral process small in ventral view, 3.0 times as long in middle line as width of base; finger-shaped in lateral view. Anal segment with sinuate dorsal margin in lateral view; ventral margin with a large, obtusely triangular production; apical production moderately long, hexagonal in dorsal view; apical margin slightly concave in caudal view; anal style short. Genital styles symmetrical, touching each other near middle then diverging to apex in ventral view; on apical two-thirds in lateral view. Aedeagus moderately long, right side with a process which is swollen at the base, narrow and gently curving upward to apex; ventral surface bearing a long, straight process medioapically, directed ventrocephalad; dorsoapical angle with another straight process, acute at apex; apical angle of left side protruding ventrocephalad with a very large production with the apical part shaped like a spear head, its ventral margin with several scale-like processes subapically. Flagellum mostly covered by former production.

Female genitalia: Pygofer oval in caudal view. Wider ventrally than dorsally, deeply roundly, con-

cave ventromedially. Anal segment with lateral margin diverging to apex in dorsal view, as long in middle line as width of base.

Etymology: The specific name indicates the special shape of the male anal segment.

	Male	Female
Length of body (include. teg.)	: 5.33 - 5.74mm;	5.84 - 6.05mm
Length of tegmen	: 4.72 - 4.92mm;	5.13 - 5.33mm

Holotype: ♂ Lanyu (Orchid I.), Taitung Co. 13-18-IV-1981 K. S. Lin; L. Y. Chou; T. Lin & S. C. Lin (in TARI).

Paratypes: 1 ♀ Kotosho (=Lanyu), Taitung Co. 10-III-14-V-1920 T. Okuni; 1 ♀ III-IV-1932 S. Hirayama; 17 ♂♂ 10 ♀♀ 13-18-IV-1981 K. S. Lin; L. Y. Chou; T. Lin & S. C. Lin; 1 ♂ 14-VII-1985 S. J. Fang; 2 ♀♀ 29-IX-1985 S. C. Tsaur; 2 ♂♂ 21-I-1987 S. J. Fang; 1 ♂ 2-VII-1987 S. C. Tsaur. (BMNH, TARI, NTU, NCHU)

Distribution: Taiwan (Lanyu).

Remarks: This new species, so far, is only known from Lanyu (a small island, also called Orchid I. or formerly Botel Tobago, 80 km off the southeastern coast of Taiwan). One male deposited in TARI labeled "collected from Alishan" (Central Mountain Range, elev. 2300 m) is doubtful, and thus was not included in the specimens examined. The special markings on the tegmina, the shape of the male anal segment and the genital styles immediately separate *E. specialis* from all its congeners.

***Eucarpia truncata* Tsaur et Hsu sp. n.**

(Fig. 5)

General color pale yellow, female much darker than male. Body marbled with numerous black blotches. Eyes black. Postclypeus entirely black. Sterna and legs yellow. First tarsal segment of hind leg with 1 black stripe coiled basad and distad respectively. Tegmina powdery translucent, with black markings as shown in figure 5. Wings gray.

Vertex with yellow stripe representing median carina, apical margin transverse, lateral carina diverging to base, 2.2 times as long in middle line as width of basal emargination. Frons with median carina distinct on apical half, slightly wider at widest portion than length of middle line. Tegmina not covered with seta. Chaetotaxy of hind tarsi 7/8. Second tarsal segment with 1 membranous tooth at apex.

Male genitalia: Pygofer symmetrical, view roundly U-shaped in ventral; dorsal margin deeply

concave in middle inclined to dorsocaudad; narrowest dorsally in lateral view, apical margin sinuate to middle then smooth ventrad, medioventral process subtriangular in ventral view, acute at vertical angle, most portions covered by pygofer in lateral view. Anal segment asymmetrical, subparallel-sided in left-side view, only narrowing handle-like at base; ventral margin slightly roundly convex near base in right-side view; gently converging to apex in dorsal view, rounded at apical margin, anal style very short. Genital styles symmetrical, concave near base in ventral view, narrowly roundly produced mesad at middle then narrowing to apex; narrowing dorsoventrally at basal third in lateral view, apical half with a triangular production on dorsal margin. Aedeagus slightly S-shaped in dorsal view, ventral surface concave at basal third in lateral view, swollen from this concavity to apical fourth, dorsal surface protruding a compressed, tri-

angular production. Each lateroapical angle with a process, all directed cephalad. Flagellum with subulate process medioapically.

Female genitalia: Pygofer in caudal view oval, wider ventrally than dorsally. Anal segment in dorsal view somewhat square-shaped, with short anal style.

Etymology: The specific name is an allusion to the transverse anterior margin of the vertex.

	Male	Female
Length of body (include. teg.):	6.36 - 7.07mm;	6.36 - 6.87 mm
Length of tegmen	: 5.33 - 5.54mm;	5.54 - 5.95mm

Holotype: ♂, TAIWAN: Tungpu, Nantou Co. 19-23-VII-1982 L. Y. Chou & T. Lin (in TARI).

Paratypes: 4 ♂♂ 1 ♀ Tungpu, Nantou Co. 19-23-VII-1982 L. Y. Chou & T. Lin; 1 ♀ Kenting, Pingtung Co. 15-III-1984 K. C. Chou & C. C. Pan;

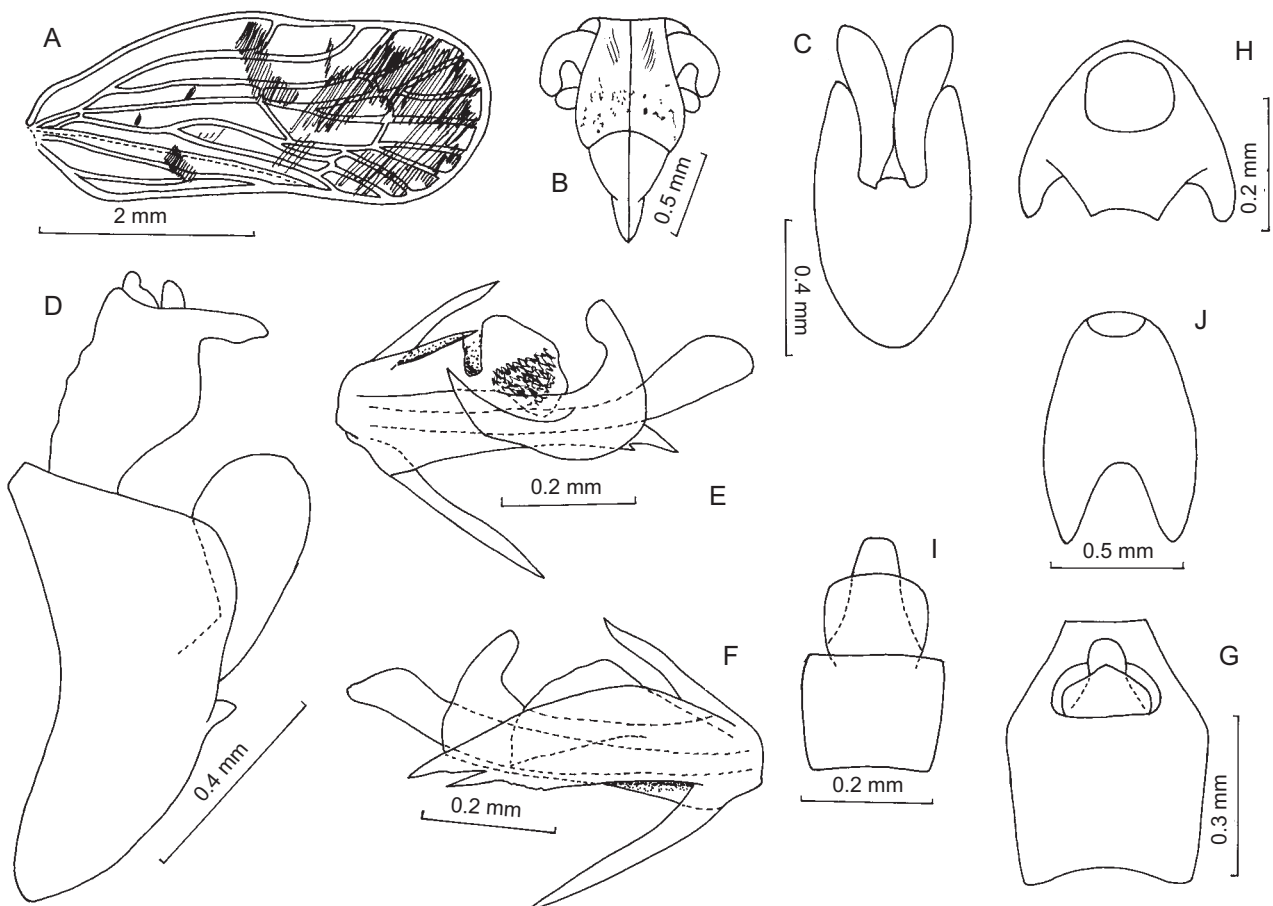


Fig. 4. *Eucarpia specialis* sp. n. (A) Tegmen. (B) Face, ventral view. (C, D) Pygofer; (C) ventral view; (D) lateral view. (E, F) Aedeagus; (E) right-side; (F) left-side view. (G-I) Anal segment; (G) ♂, dorsal view; (H) ♂, caudal view; (I) ♀, dorsal view. (J) ♀ pygofer, caudal view.

5 ♂♂ 4 ♀♀ Tungpu, Nantou Co. 23-27-VII-1984
K. C. Chou & C. H. Yang (TARI, NTU).

Distribution: Taiwan.

Remarks: *Eucarpia truncata* somewhat resembles *E. specialis* in appearance, but differs from the latter in the anterior margin of the vertex which is truncate in this species, apparently concave medially in *specialis*; and the apical margin of the male anal segment which is rounded in *truncata* and hexagonal in *specialis*.

Genus *Neocarpia* Tsaour et Hsu, gen. n.

Type species: *Neocarpia maai* sp. n.

Gender: feminine.

Medium-sized cixiid species. Body moderately compressed. Head including eyes slightly nar-

rower than pronotum. Vertex wider at apex than length of middle line, slightly widening to base, transverse at base, apical margin slightly concave in middle, disc depressed, with median carina, lateral carinae moderately elevated. Frons slightly wider at apex than at base, widest across level of antennae; with median carina; disc not depressed; unicolorous; lateral carinae moderately elevated, frontoclypeal suture angled. Median ocellus absent. Lateral ocelli with red borders. Clypeus with strongly elevated median carina, moderately elevated lateral carinae. Pronotum short, chevron-shaped, without median carina, intermediate carinae curved following posterior margins of eyes. Mesonotum tricarinate. Tegmina steeply tectiform, widening to apex, apical margin rounded, with 10 apical cells, Sc+R forked slightly basad of Cu; transverse veinlet M_{3+4} - Cu_{1a} much longer than vein

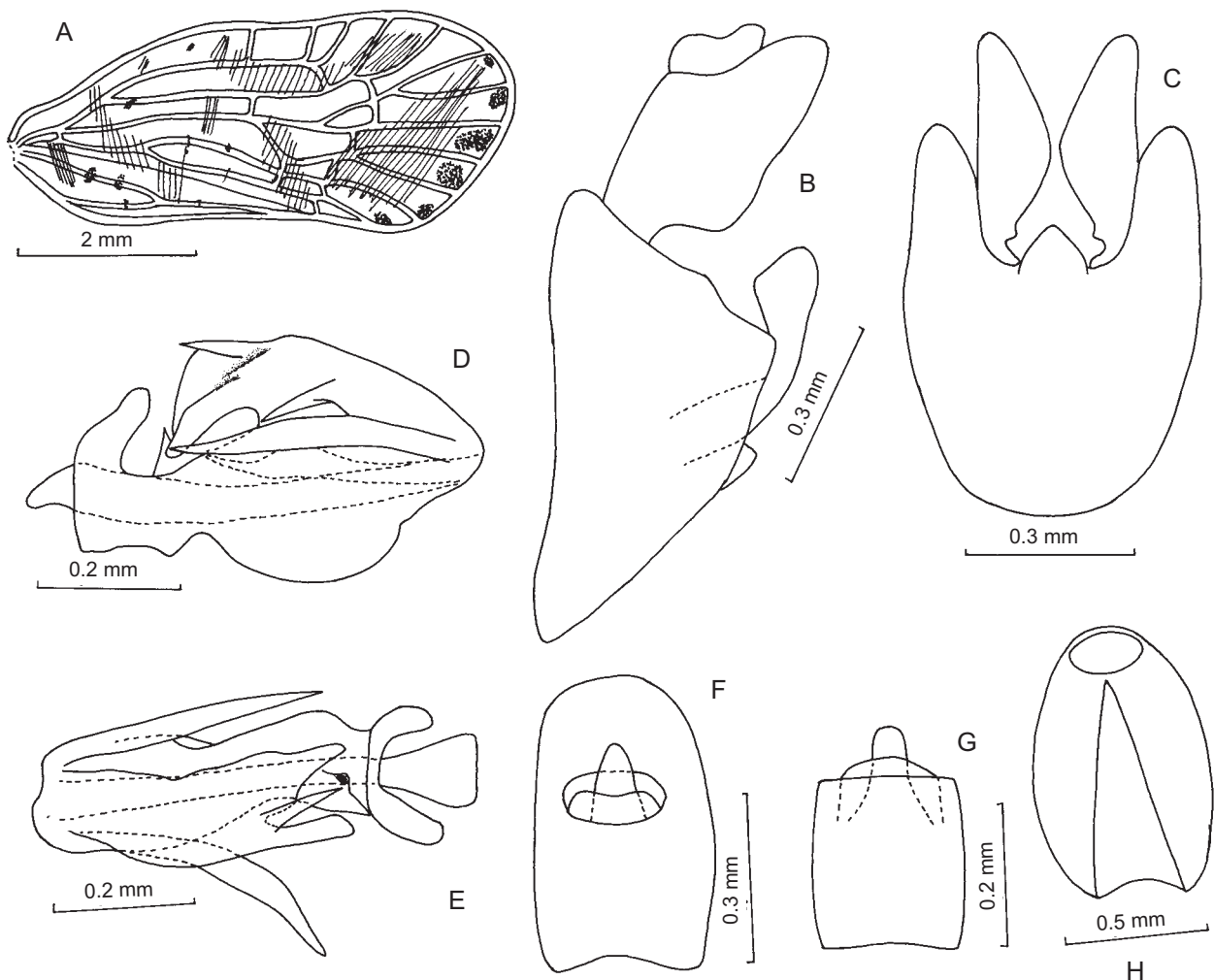


Fig. 5. *Eucarpia truncata* sp. n. (A) Tegmen. (B, C) Pygofer; (B) ventral view; (C) lateral view. (D, E) Aedeagus; (D) lateral view; (E) dorsal view. (F, G) Anal segment; (F) ♂, dorsal view; (G) ♀, dorsal view. (H) ♀ pygofer, caudal view.

M_{3+4} from M fork to this veinlet, subapical cells M_{3+4} with upper margin (vein M_{3+4}) weakly concave, no transverse vein between Cu_1 and Cu_2 . Wings with simple R, fused M_{3+4} and Cu_{1a} . Post-tibiae with no lateral spine, longitudinal stripe absent. Chaetotaxy of hind tarsi 7/8. Female pygofer without wax-secreting pore, disc densely covered with setae.

Diagnosis: The shapes of the genital styles and male anal segment suggest that *Neocarpia* is allied to *Bajauana*.

***Neocarpia maai* Tsaur et Hsu, sp. n.**

(Fig. 6)

General color fulvous. Body covered with powdery wax. Eyes black. Lateral ocelli yellow. Clypeus with a black, transverse marking between post- and anteclypeus. Legs yellow with 2 black, ring-like stripes on each fore-tibia, 1 basally, another distally. Abdomen yellowish gray. Tegmina translucent, with gray spots on end of each apical cell.

Vertex weakly carinate medially, 2.0 times as wide at basal emargination as length of middle line. Frons 1.1 times as long in middle line as width of widest portion, median carina feeble on basal fifth. Rostrum reaching midlength of hind femora. Tegmen covered with setae. Chaetotaxy of hind tarsi 7/7-8. Second tarsal segment with 0-3 membranous teeth at apex.

Male genitalia: Pygofer symmetrical, stout, subparallel-sided in ventral view, narrowing dorsally in lateral view, widest across ventral margin, apical margin obtusely produced at middle, medioventral process pentagonal in ventral view, finger-shaped in lateral view. Anal segment parallel-sided in lateral view, narrowed near base in dorsal view, converging to apex, with short anal style. Genital styles symmetrical, inner margin concaved on basal half in ventral view, with a triangular production near base, apical half oar-shaped; curving dorsad to apex in lateral view, with smooth apical margin. Aedeagus slender, ventrobasal surface with scale-like productions, in total with 3 slender processes, 2 on ventroapical surface: shorter one

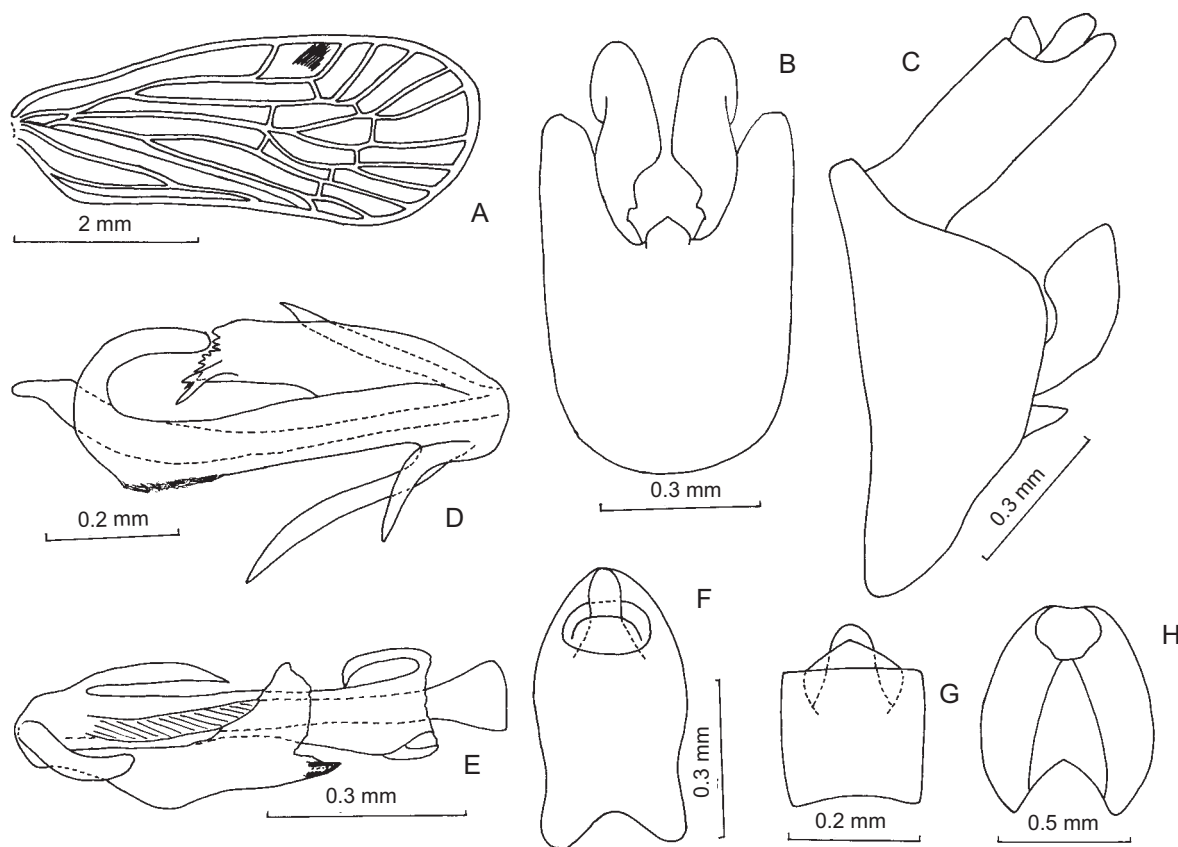


Fig. 6. *Neocarpia maai* gen. and sp. n. (A) Tegmen. (B, C) Pygofer; (B) ventral view; (C) lateral view. (D, E) Aedeagus; (D) lateral view; (E) dorsal view. (F, G) Anal segment; (F) ♂, dorsal view; (G) ♀, dorsal view. (H) ♀ pygofer, caudal view.

curving outward and parallel with aedeagus on basal third then curving downward, directed ventrad at apex, longer one slightly curving ventral cephalad at apex, another process implanted on right side near apex, gently curving upward, directed dorsocephalad at apex. Flagellum very long, with sinuate apical margin, small awl-shaped production protruding on left side near apex.

Female genitalia: Pygofer symmetrical, sub-oval in caudal view. Anal segment quadrate in dorsal view, slightly wider than long.

Remarks: The specific name is given in honor of late Mr. T. C. Maa, a Chinese entomologist.

	Male	Female
Length of body (include. teg.) :	5.13 - 5.74mm;	6.05 - 6.25mm
Length of tegmen :	4.41 - 4.92mm;	5.23 - 5.33mm

Holotype: ♂, TAIWAN: Chiabaotai, Taichung Co. 11-VII-1987 S. C. Tsaur (in NTU).

Paratypes: 2 ♂♂ Shinchiku (=Hsinchu), Hsinchu Co. 1-30-VII-1918 J. Sonan & K. Miyake; 1 ♀ Arishan (=Alishan), Chiayi Co. 2-23-X-1918 J. Sonan & M. Yoshino; Taito (=Taitung), Taichung Co. 25-II-27-III-1919 S. Inamura; 1 ♀ Tungpu, Nantou Co. 19-23-VII-1982 L. Y.Chou & T. Lin; 1 ♀ Hueisun, Nantou Co. 6-IV-1983 M. M. Yang; 1 ♀ Mutantsun, Pingtung Co. 14-III-1984 K. C. Chou & C. C. Pan; 1 ♂ 1 ♀ Chubing, Nantou Co. 26-II-1984 S. C. Tsaur; 1 ♂ Wuchieh, Nantou Co. C. T. Yang; 1 ♂ 1 ♀ Kuantaoshan, Nantou Co. 4-IX-1984 S. C. Tsaur; 1 ♀ Hsenping, Kaohsiung Co. 10-15-VII-1984 H. M. Wei; 1 ♂ 4 ♀♀ Lienhuachih, Nantou Co. V-X-1984 K. S. Lin & K. C. Chou; 4 ♂♂ 4 ♀♀ Meifeng, Nantou Co. X-1984 K. S. Lin & K. C. Chou; 1 ♂ Fuhsing, Taoyuan Co. 31-VIII-1985 S. C. Tsaur; 1 ♂ 1 ♀ North Tungyenshan, Nantou Co. 17-VII-1986 L. Y. Huang; 1 ♀ Paling, Taoyuan Co. 8-VII-1986 J. T. Yang; 1 ♀ Chihtuan, Ilan Co. 1-VIII-1986 S. C. Tsaur; 1 ♀ Taipingshan, Ilan Co. 12-VIII-1986 C. C. Chiang; 4 ♂♂ 4 ♀♀ Chiabaotai, Taichung Co. 10-12-VII-1987 S. C. Tsaur; 1 ♀ Kuantaochi, Taichung Co. 5-IX-1987 M. M. Yang; 1 ♀ Shuanglienpi, Ilan Co. 14-V-1988 S. C. Tsaur; 1 ♀ Tapang, Chiayi Co. 19-VI-1988 S. C. Tsaur; 3 ♀♀ Tungpu, Nantou Co. 13-VII-1988 S. C. Tsaur; 1 ♀

Nanjenshan, Pingtung Co. 26-XI-1988 S. C. Tsaur (BMNH, TARI, NTU, NCHU).

Distribution: Taiwan.

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Appendix: Collecting locales of the specimens examined in both Chinese and their Romanized equivalent.

Romanization	Chinese	Romanization	Chinese
Alishan, Chiayi	阿里山	Lienhuachih, Nantou	蓮花池
Baolai, Kaohsiung	寶來	Litao, Taitung	利稻
Chiabaotai, Taichung	佳保台	Liukuei, Kaohsiung	六龜
Chiahsien, Kaohsiung	甲仙	Lushan, Nantou	廬山
Chihpen, Taitung	知本	Meifeng, Nantou	梅峰
Chihtuan, Ilan	池端	Mutantsun, Pingtung	牡丹村
Chubing, Nantou	曲冰	Nanhua, Tainan	南化
Chuhkou, Chiayi	觸口	Nanjenshan, Pingtung	南仁山
Fenchihu, Chiayi	奮起湖	North Tungyenshan, Nantou	北東眼山
Fongkang, Pingtung	楓港	Paling, Taoyuan	巴陵
Fuli, Hualien	富里	Shangpaling, Taoyuan	上巴陵
Fuhsing, Taoyuan	復興	Shihcho, Chiayi	石卓
Hengchun, Pingtung	恆春	Shihpai, Ilan	石牌
Hoshe, Nantou	合社	Shuanglienpi, Ilan	雙連碑
Shanping, Kaohsiung	扇平	Taipei	台北
Hsinchu	新竹	Taiping, Taichung	太平
Hsingtan, Pingtung	馨潭	Taipingshan, Ilan	太平山
Hueisun, Nantou	惠蓀	Tapang, Chiayi	達邦
Kenting, Pingtung	墾丁	Tayuling, Nantou	大禹嶺
Kuantaochi, Taichung	關刀溪	Tungpu, Nantou	東埔
Kuantaoshan, Nantou	關刀山	Wanfang, Taichung	萬芳
Kukuan, Taichung	谷關	Wuchieh, Nantou	武界
Lanyu, Taitung	蘭嶼	Wushe, Nantou	霧社