

**A STUDY OF THE GENUS *HETEROCONIS* ENDERLEIN
(INSECTA: NEUROPTERA: CONIOPTERYGIDAE)
WITH FOUR NEW SPECIES FROM MAINLAND CHINA**

Zhi-Qi Liu, Chi-Kun Yang and Zuo-Rui Shen

Department of Entomology, China Agricultural University, Beijing 100094, P. R. China
Email: liuzhiqin@cau.edu.cn

ABSTRACT. – Six Chinese species of the genus *Heteroconis* Enderlein, 1905 are reported in the present paper, among them, four species are described as new to science: *Heteroconis electrina*, new species, *H. hainanica*, new species, *H. tricornis*, new species, and *H. unicornis*, new species. A key to the known species of the genus *Heteroconis* from mainland China is given.

KEY WORDS. – China, Insecta, Neuroptera, Coniopterygidae, *Heteroconis*, new species.

INTRODUCTION

In the monograph “A revision of the family Coniopterygidae (Planipennia)” (Meinander, 1972), only eighteen species were known, but now, over fifty species have been described worldwide, which are included in the following studies: Tjeder (1973), Monserrat (1982, 1989), (Monserrat & Aranda, 1988), New (1987, 1988, 1990), Meinander (1990, 1998), Sziráki (2001, 2002). Among the known species, 14 species are from the Oriental Region. In China, only three species were known to occur: *H. picticornis* (Banks, 1939), *H. nigripalpis* Meinander, 1972 (Formosa), *H. terminalis* (Banks, 1913)(Liu & Yang, 2002). In the present paper, six species of the genus *Heteroconis* from mainland of China are revised. Four of them are described as new to science.

Representatives of the genus *Heteroconis* Enderlein, 1905, are characterized by the following features: one corniform projection often present between antennae; antennae 18-segmented (seldom 17-segmented) and often bicolorous, some segments whitish and others dark brown or blackish; M forked in both wings; in fore wing, anterior branch of M either coalesced or connected by cross-vein with R_{4+5} , medial setae rising from distinct thickenings; in hind wing, radial cross-vein striking R_s on its stem or fork.

MATERIALS AND METHODS

Genitalic terminology used follows Meinander (1972). All specimens were examined through a light microscope. Measurements were made with an ocular micrometer, and in millimeters. The type specimens are deposited in the Insect Collections of China Agricultural University (CAU), Beijing,

China and the Zoological Reference Collection of the Raffles Museum of Biodiversity Research, National University of Singapore (ZRC).

TAXONOMY

***Heteroconis* Enderlein, 1905**

Heteroconis Enderlein, 1905: 226.

Niphadicera Withycombe, 1925: 5. Type species: *Malacomyza terminalis* Banks, 1913, by monotype. Synonymized by Meinander, 1972: 59.

Type species. – *Heteroconis ornata* Enderlein, 1905, by monotypy.

Key to species of genus *Heteroconis* Enderlein from mainland China (for males)

1. Projections present on the frons 2
– No projections present on the frons .. *H. picticornis* (Banks, 1939)
2. Either a pair of projections present on the frons above the antennae or a projection present between the antennae ... 3
– Both a pair of projections present on the frons above the antennae, and also a corniform projection present between the antennae (Fig. 11) *H. tricornis*, new species
3. A pair of projections present on the frons above the antennae (Figs. 1, 7) 4
– A nose-like or a corniform projection present between the antennae (Figs. 4, 13) 5
4. The basal and distal antennal segments light, the middle ones dark. A pair of ventral processes on ninth sternite detached *H. terminalis* (Banks, 1913)
– The basal antennal segments light, the others dark. The ventral process on ninth sternite forks only at base, and fused at the other distal part *H. hainanica*, new species

5. A nose-like projection present between the antennae (Fig. 4).
 Antennal segments 1-8 and the two distal ones light, the others dark *H. electrina*, new species
 – A corniform projection present between antennae (Fig.13).
 Antennal segments 1-3 or 1-4 and the distal one light, the others dark *H. unicornis*, new species

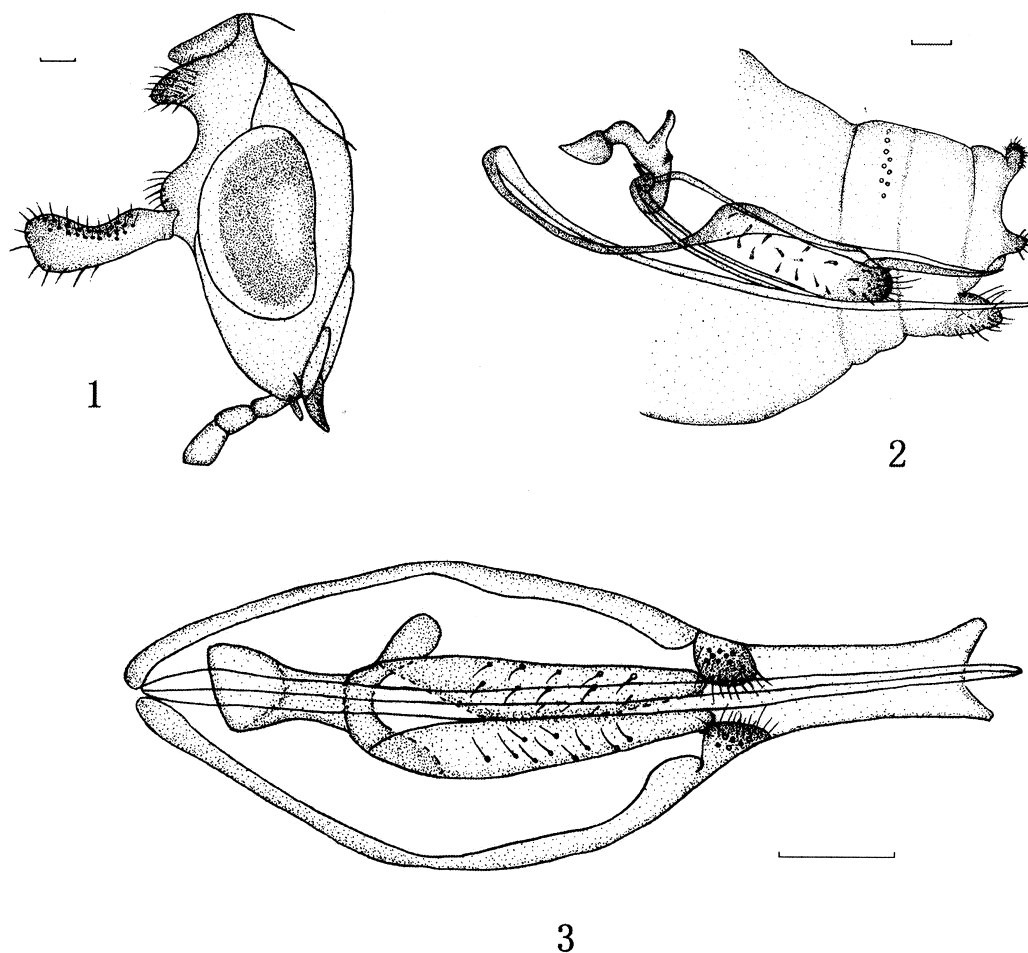
***Heteroconis terminalis* (Banks, 1913)**
 (Figs. 1-3)

Malacomyza terminalis Banks, 1913: 220.
Niphadicera terminanlis (Banks) - Withycombe 1925: 6.
Heteroconis terminalis (Banks) - Meinander 1972: 90.

Material examined. – 18 males, 35 females (16 males, 33 females CAU, 2 males, 2 females ZRC), Nada, Hainan Province, South China, coll. C.-K. Yang, F.-S. Li & Z.-M Ping, 7~12 Dec.1974; 2 males, 3 females (CAU), Xinglong, Hainan Province, South China, coll. C.-K. Yang & F.-S. Li, 20-21 Dec.1974; 3 males (CAU), Jianfengling, Hainan Province, South China, coll. C.-K. Yang, 16 Dec.1974; 1 females (CAU), Menghai, Yunnan Province, South China, coll. C.-K. Yang, 19 Apr.1981; 2 males (CAU), Pingxiang, Guangxi Province, South China, coll. C.-K. Yang, 12 May.1963.

Remarks. – According to the original description (Banks, 1913), there is one projection on the frons between the antennae, but according to Whithycombe (1925) there are two on the latero-dorsal portions of the frons. This species is recorded for the first time from China by Liu & Yang (2002). In the Chinese specimens, there are two projections on the latero-dorsal portions of the frons (Fig. 1). It can be easily distinguished from other species of the genus by the following features: Antennae bicolorous, six or eight basal and the last apical segments whitish, the others dark brown. Scape of male with dorsal depression bearing short hairs. Ninth sternite of male genitalia very narrow (Figs. 2, 3). Styli more than twice as long as broad in lateral view, with short and thick hairs, but long hairs present distally. Hypandrium absent, or probably fused with styli. Ductus receptaculi of female genitalia sclerotized and running from caudal part of abdomen forwards to fourth segment and then ending in a simple unpaired structure.

Distribution. – Hainan, Yunnan and Guangxi, South China; India.



Figs. 1-3. *Heteroconis terminalis* (Banks). Male. 1. head, lateral view, 2. terminalia, lateral view, 3. genitalia, ventral view. Scales 0.1mm.

***Heteroconis electrina*, new species**
(Figs. 4-6)

Material examined. – Holotype – male (CAU), Diaoluoshan, Hainan Province, South China, coll. S-K. Liu, 29 Apr. 1965.

Description. – Head yellowish brown. Eyes black. Frons between antennae with a process, which is shorter than half length of scape and nose-like in lateral view (Fig. 4). Eight basal and the last apical segments of antennae whitish, the others dark brown. Scape more than three times as long as broad, and without dorsal groove. Pedicel nearly twice as long as broad. Four basal segments of maxillar palpi brown, their distal segments and entire labial palpi yellow brown.

Thorax pale ochrous with brown shoulder spots.

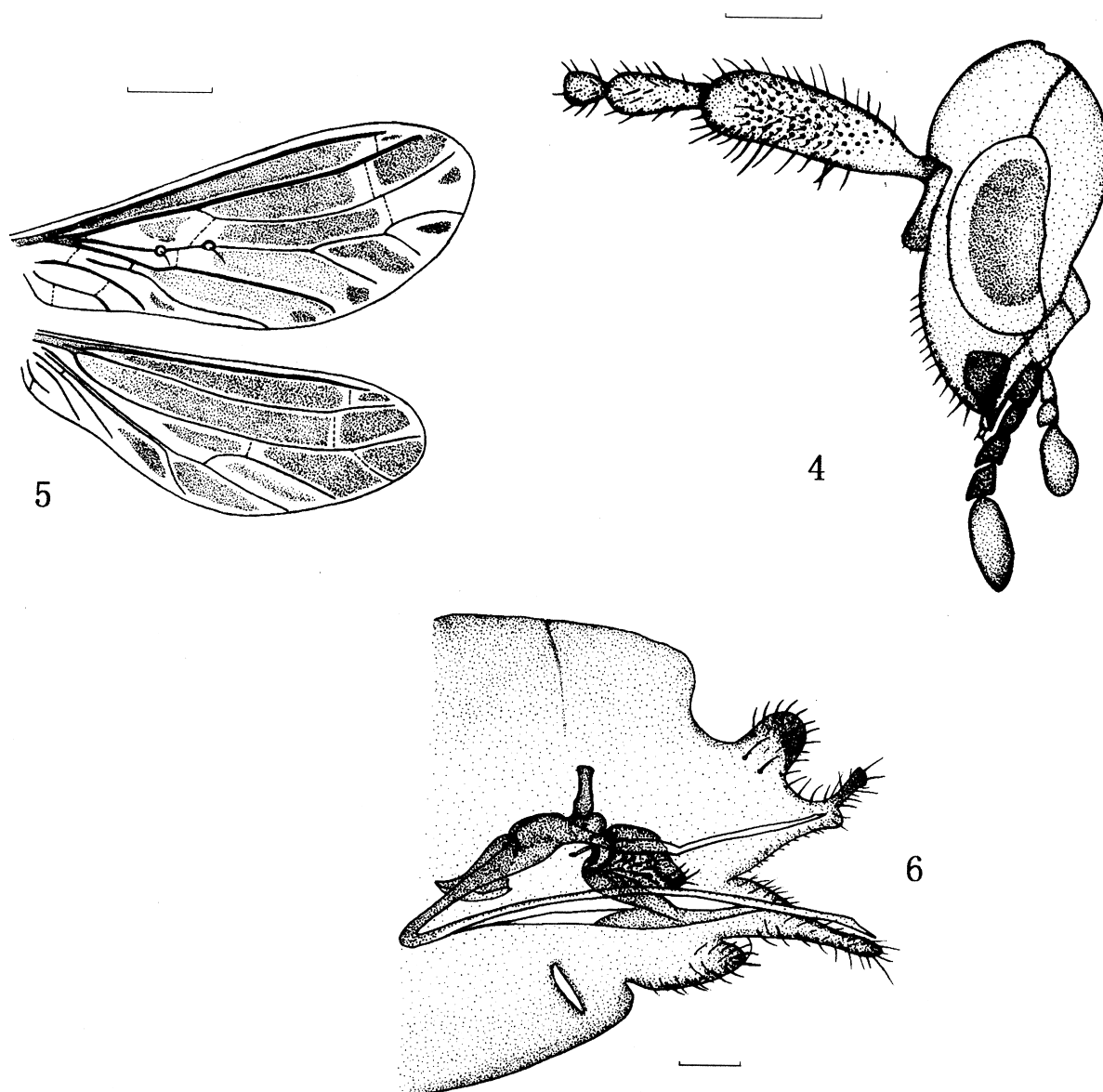
Length of fore wing 2.3 mm, of hind wing 2.1mm. Membrane of wings fuscous with hyaline bands along most veins, which

are broad and shaped into hyaline spots at the end of veins in fore wings (Fig. 5). Basal cross-vein r-m and cross-vein m-cu₁ in fore wings between median thickenings, Cu₂ sinuate and running almost parallel with hind margin for some distance. In hind wings, M and Cu₁ connected by a short cross-vein at the point where they separate.

Abdomen grayish brown. Male genitalia: Ninth sternite and ventral process very slender. Styli slight longer than broad in lateral view, with short and thick hairs, while long hairs present distally (Fig. 6). Hyandrium absent, or probably fused with styli. Distal penis with two dorsal apodemes and a downwards directed apophysis.

Female. Unknown.

Etymology. – The specific name refers to the hyaline spots at the distal end of the veins, especially in fore wings.



Figs. 4-6. *Heteroconis electrina*, new species. Male. 4. head, lateral view, 5. wings, 6. terminalia, lateral view. Scales 0.4mm.

Remarks. – The new species closely resemble the Australian species with spots on the fore wings, but the position of the distal cross-vein r-m agrees with that of Asia species. Male genitalia are similar to *H. terminalis* (Banks, 1913) in having very slender ninth sternite and ventral process. The species can be easily identified by the following characters: the nose-like projections between antennae, membrane of fore wings spotted, styli slight longer than broad in lateral view.

Distribution. – Hainan Province, South China.

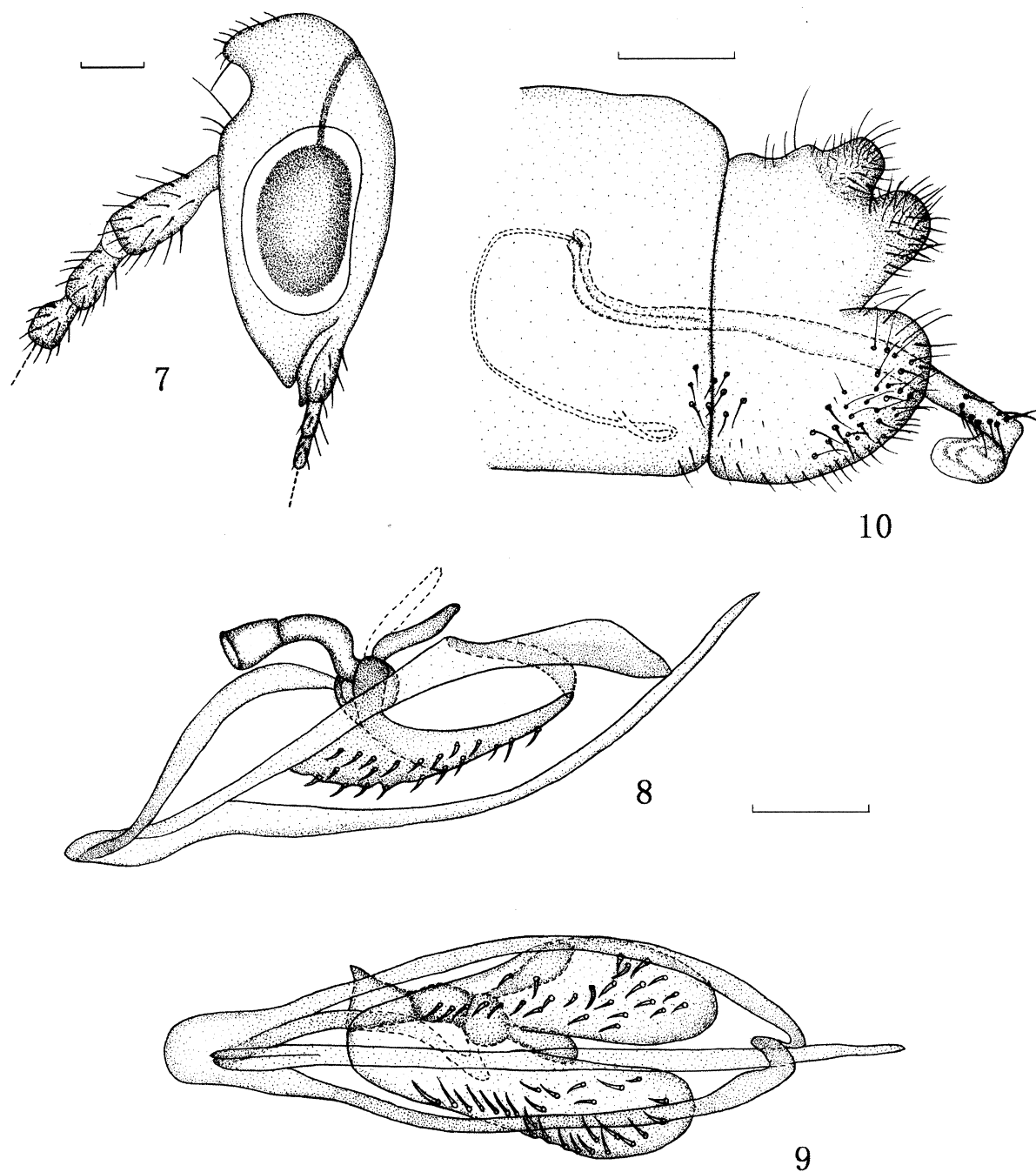
***Heteroconis hainanica*, new species**

(Figs. 7-10)

Material examined. – Holotype – male (CAU), Sanya, Hainan Province, South China, coll. F.-S. Li, 18 Dec. 1978.

Allotype – female (CAU), same data as holotype.

Paratypes – 1 female (CAU), same data as holotype; 2 females (CAU), Maling, Hainan Province, South China, coll. C.-K.



Figs. 7-10. *Heteroconis hainanica*, new species. 7. male head, lateral view, 8. male genitalia, lateral view, 9. male genitalia, ventral view, 10. female genitalia, lateral view. 9st = ninth sternite; vp = ventral process; hy = hypandrium; st = stylus; p = penis; dap = dorsal apodeme of penis. Scales 0.1mm.

18 Dec.1974; 3 females (CAU), Jianfengling, Hainan Province, South China, coll. C.-K. Yang, 16 Dec.1978; 1 female (ZRC), Xinglong, Hainan Province, South China, coll. F.-S. Li, 20 Dec.1978.

Description. – Head yellowish brown. Eyes black. Frons with two projections above antennae. Five basal segments of antennae whitish, the others dark brown. Scape about three times as long as broad, and without dorsal groove. Pedicel two and a half times as long as broad (Fig. 7). Four basal segments of maxillar palpi brown, their distal segments and entire labial palpi light brown.

Thorax pale ochrous with brown shoulder spots.

Length of fore wing 2.5 mm, of hind wing 2.1mm. Membrane of wings fuscous without distinct spot. Veins similar to *Heteroconis electrina*, new species.

Abdomen grayish brown. Male genitalia: Ninth sternite narrow, ventral process very slender and obviously bent upwards, forked at base. Hypandrium slender, curved forwards, connected between ninth sternite and penis (Figs. 8, 9). Styli in lateral view long, bent upwards and narrowed distally, with short and thick hairs, but no long hairs present distally. Distal penis with two long dorsal apodemes.

Female genitalia (Fig. 10): very similar to *H. terminalis* in having a tubular ductus receptaculi, but bent forwards at base, where as it is bent backwards in *H. terminalis*.

Etymology. – The specific name refers to Hainan Province of South China, where the type specimens were recorded.

Remarks. – The new species is allied to *H. terminalis* (Banks, 1913) in having two process above antennae, a slender ninth sternite and ventral process of male genitalia, and a tubular ductus receptaculi of female genitalia, but it may be separated from the latter species by the following features in male: scape of male antennae without dorsal groove, only five basal segments of antennae whitish, styli bent upwards and slightly narrowed distally.

Distribution. – Hainan Province, South China.

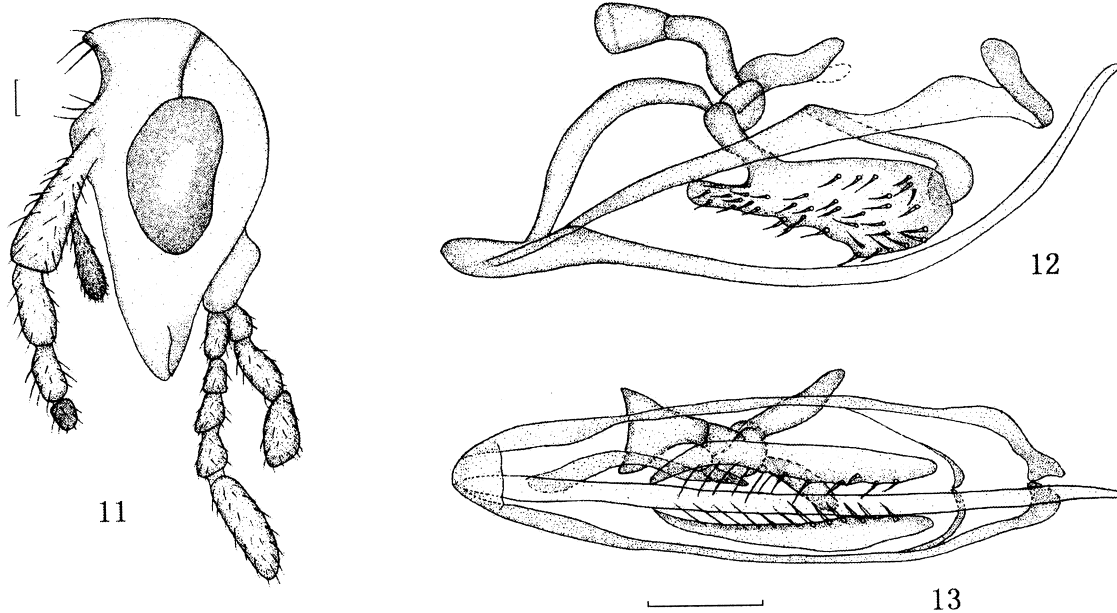
***Heteroconis tricornis*, new species**
(Figs. 11-13)

Material examined. – Holotype – male (CAU), Guangzhou, Guangdong Province, South China, coll. C.-K. Yang, 27 Dec.1974.

Description. – Head brown. Eyes black. Frons with two projections above antennae and one between antennae the former one short, the latter one piliferous, about as long as scape and ampliate distally (Fig. 11). Three basal segments of antennae whitish, the others dark brown. Scape about three times as long as broad, and no dorsal groove present. Pedicel two and a half times as long as broad. Four basal segments of maxillar palpi brown, their distal segments and entire labial palpi light brown.

Thorax pale brown with dark shoulder spots.

Length of fore wing 2.5 mm, of hind wing 2.1mm. Membrane of wings fuscous without any distinct spot. Veins similar to *Heteroconis electrina*, new species.



Figs. 11-13. *Heteroconis tricornis*, new species. Male. 11. head, lateral view, 12. genitalia, lateral view, 13. genitalia, ventral view. Scales 0.1mm.

Abdomen grayish brown. Male genitalia: Ninth sternite narrow, ventral process very slender, unforked and obviously bent upwards (Figs. 12, 13). Hypandrium slender, curved forwards, connected between ninth sternite and penis. Styli in lateral view about two times as long as broad, forked basally and ampliate distally. This structure with thick hairs, but no long hairs present distally. Distal part penis with two long dorsal apodemes.

Female. Unknown.

Etymology. – The specific name refers to the three projections on frons.

Remarks. – The three projections clearly distinguish this species from the others of the genus, its male genitalia are very similar to *H. terminalis* (Banks, 1913), *Heteroconis maculatus* new species and *H. hainanica* new species in having a slender ninth sternite and ventral process, but styli in lateral view about two times as long as broad in lateral view, forked basally and ampliate distally.

Distribution. – Guangdong Province, South China.

***Heteroconis unicornis*, new species**

(Figs. 14-17)

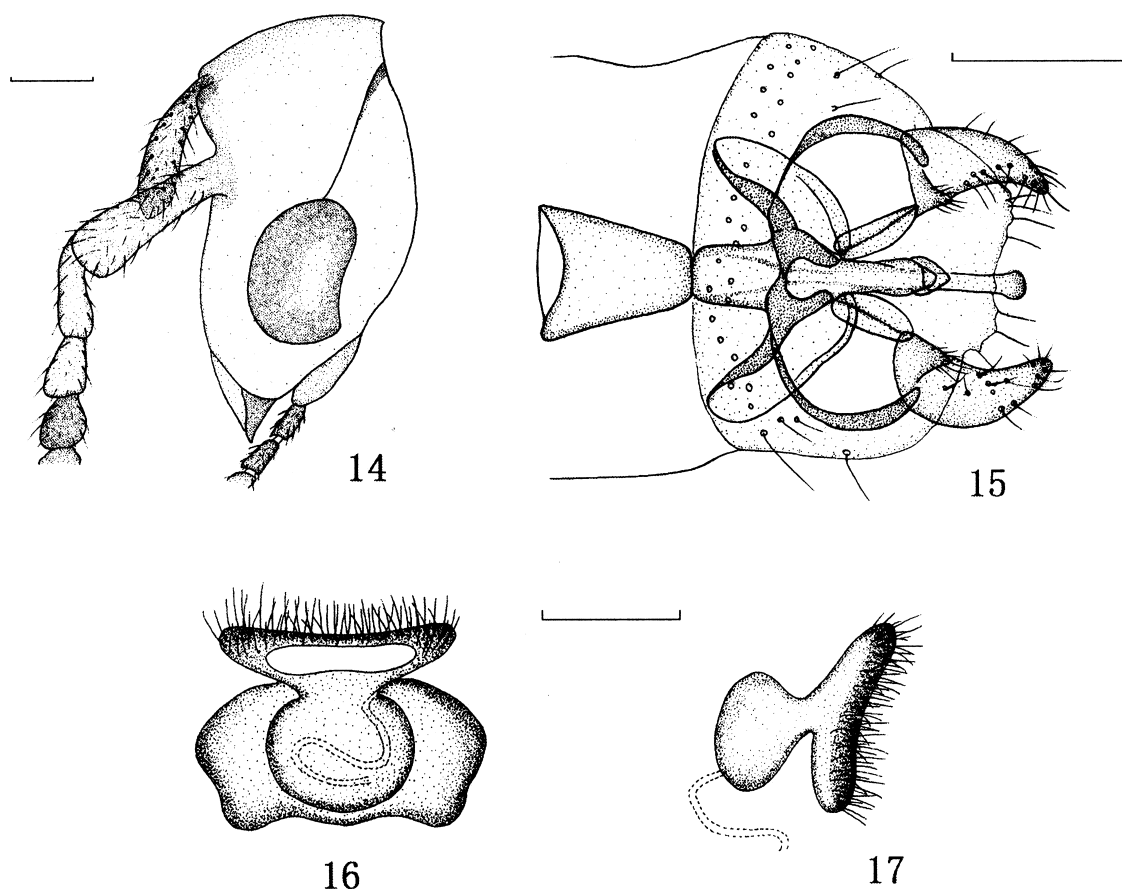
Material examined. - Holotype – male (CAU), Pingxiang, Guangxi Province, South China, coll. C.-K. Yang, 17 May.1963.

Allotype – female (CAU), Ruili, Yunnan Province, South China, coll. C.-K. Yang, 4 May.1981.

Paratypes – 6 females (5 females, CAU, 1 female, ZRC) same data as allotype.

Description. – Head brown. Eyes black. Frons of male with one piliferous horn-like projection between antennae (Fig. 14), which as long as scape and ampliate distally. Three or four basal segments of antennae whitish, the others dark brown. Scape about three times as long as broad, and no dorsal groove present. Pedicel two and a half times as long as broad. Four basal segments of maxillar palpi brown, their distal segments and entire labial palpi light brown.

Thorax pale brown with dark shoulder spots.



Figs. 14-17. *Heteroconis unicornis*, new species. 14. male head, lateral view, 15. male genitalia, ventral view, 16. female genitalia, ventral view, 17. female genitalia, lateral view. 9st = ninth sternite; vp = ventral process; hy = hypandrium; st = stylus; p = penis; dap = dorsal apodeme of penis. Scales 0.1mm except fig. 14 0.2mm.

Abdomen yellowish brown Male genitalia in ventral view (Fig. 15): Ninth sternite slender and arched, ventral process long tubular, slightly dilated distally. Styli digitiform and a small projection covered hairs present at the base of each stylus. The foliiform structure between styli and basal dorsal apodemes of penis seem to be hypandrium. Penis with two dorsal apodemes.

Female genitalia (Figs. 16, 17): The gonapophysis lateralis fused into a single plate and with dense hairs. Ductus receptaculi strongly sclerotized.

Etymology. – The specific name refers to the projection between antennae.

Remarks. – Though the only male specimen is mounted on microscope slide so that only ventral view can be viewed, it can be easily distinguished from the above species from China, having the ninth sternite, ventral process of male genitalia and ductus receptaculi of female genitalia of normal length. It differs from other species in the genus by the following characters: one horn-like projection as long as scape between antennae in male; three or four basal and the last distal segments of antennae whitish, the others dark brown; male genitalia, ventral process slender, tubular, and slightly dilated distally, styli digitiform in ventral view.

Distribution. – Guangxi and Yunnan, South China.

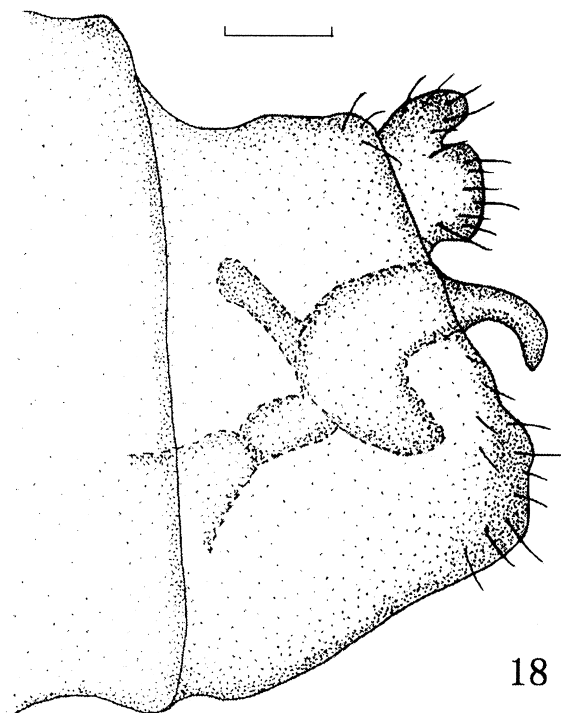
***Heteroconis picticornis* (Banks, 1939)**
(Figs. 18, 19)

Spiloconis picticornis Banks, 1939: 473.

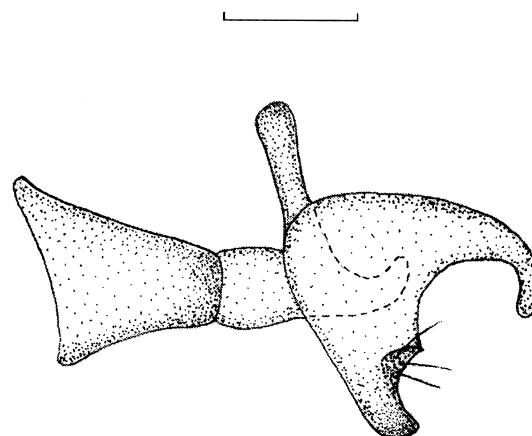
Heteroconis picticornis (Banks) - Meinander, 1972: 88.

Material examined. – 1 male (CAU), Qinglangang, Hainan Province, South China, coll. S.-K. Liu, 8 Jul.1965; 1female (CAU), Nada, Hainan Province, South China, coll. Y. Zhou, 27 Apr.1963; 1 male (ZRC), 1 female (CAU), Jianfengling, Hainan Province, South China, coll. C.-K. Yang and F.-S. Li, 15 Dec.1974; 2 females (1 female, CAU, 1 female, ZRC), Maling, Hainan Province, South China, coll. C.-K. Yang, 18 Dec.1974; 1 male (CAU), Baise, Guangxi Province, South China, coll. F.-S. Li, 1 Jun.1982; 1 female (CAU), Pingxiang, Guangxi Province, South China, coll. C.-K. Yang, 12 May.1963; 1 male (CAU), Guanpin, Yunnan Province, South China, coll. C.-K. Yang, 9 Apr.1981.

Remarks. – This species was reported for the first time by Banks (1939) on the basis of specimens from Hannan, China, and was introduced from Hong Kong into USA for biological control of scale insects on citrus orchard. It can be easily identified by the following characters: No corniform structure on frons. Antennal segments 1-8 and 11-12 light, the others dark. Male genitalia (Figs. 18, 19), ninth sternite broad and forming a pair of lateral hooks, ventral process on the ninth sternite and stylis absent. Female genitalia: Gonapophyses lateralis fused into a single plate and ductus receptaculi strongly sclerotized.



18



19

Figs. 18-19. *Heteroconis picticornis* (Banks). Male. 18. terminalia, lateral view, 19. genitalia, lateral view. Scales 0.1mm.

Distribution. – Hainan, Yunnan, Guangxi, Hong Kong, South China.

ACKNOWLEDGMENTS

First, we are very grateful to Prof. Fa-Sheng Li who generously provided numerous dusty-wing specimens for our study. Second, we thank Dr. J. D. Oswald, Dr. M. Meinander, Dr. Gy. Sziráki and other experts who sent us precious amounts of information. This study is supported by the National Science Foundation of China (No. 39899400).

LITERATURE CITED

- Banks, N., 1913. Synopses and descriptions of exotic Neuroptera. *Transactions of the American Entomological Society*, **39**: 201-242.
- Banks, N., 1939. New genera and species of neuropteroid insects. *Bulletin of the Museum of Comparative Zoology*, **85**: 439-504
- Enderlein, G., 1905. Klassifikation der Neuropteren-familie Coniopterygidae. *Zoologischer Anzeiger*, **29**: 225-227.
- Liu, Z. Q. & C. K. Yang, 2002. Coniopterygidae. In: Huang, F. S. (ed.), *Forest Insects of Hainan*. Science Press, Beijing. Pp. 302-304.
- New, T. R., 1987. A new species of *Heteroconis* Enderlein (Neuroptera, Coniopterygidae) from Western Australia. *Australian Entomological Magazine*, **14**: 1-3.
- New, T. R., 1988. Coniopterygidae (Neuroptera) from the Wau area of Papua New Guinea. *Neuroptera International*, **5**: 3-12.
- New, T. R., 1990. The genus *Heteroconis* Enderlein (Insecta: Neuroptera: Coniopterygidae) in New Guinea. *Invertebrate Taxonomy*, **4**: 665-684.
- Meinander, M., 1972. A revision of the family Coniopterygidae (Planipennia). *Acta Zoologica Fennica*, **136**: 1-357.
- Meinander, M., 1990. The Coniopterygidae (Neuroptera, Planipennia). A check-list of the species of the world, descriptions of new species and other new data. *Acta Zoologica Fennica*, **189**: 1-95.
- Meinander, M., 1998. Coniopterygidae (Neuroptera) from South and eastern Africa. *African Entomology*, **6**: 117-146.
- Monserrat, V. J., 1982. Contribución al conocimiento de los coniopterígidos (Insecta, Neuroptera, Coniopterygidae) de la región oriental. *Annali del Museo Civico di Storia Naturale Giacomo Doria, Genoa*, **84**: 9-39.
- Monserrat, V. J., 1989. Contribución al conocimiento de los coniopterígidos de Rio Muni (Guinea Ecuatorial)(Neuropteroidea, Planipennia, Coniopterygidae). *Annali del Museo Civico di Storia Naturale Giacomo Doria, Genoa*, **87**: 157-181.
- Monserrat, V. J. & L. M. Díaz-Aranda, 1988. Contribución al conocimiento de los coniopterígidos de la Isla de Bioko (Guinea Ecuatorial)(Neuropteroidea, Planipennia: Coniopterygidae). *Revue de Zoologie Africaines*, **102**: 493-502.
- Sziráki, Gy., 2001. Coniopterygidae from Vietnam (Neuroptera). *Folia Entomologica Hungarica*, **62**: 51-63.
- Sziráki, Gy., 2002. Coniopterygidae (Neuroptera) from Thailand. *Folia Entomologica Hungarica*, **63**: 53-64.
- Tjeder, B., 1973. Coniopterygidae from the Snow Mountains, New Guinea (Neuroptera). *Entomologisk Tidskrift*, **93**: 186-209.
- Withycombe, C. L., 1925. A contribution towards a monograph of the Indian Coniopterygidae (Neuroptera). *Memoirs of the Department of Agriculture of India, Entomological Series*, **9**: 1-20.