

## Seven New Species of *Kinnara* Distant (Hemiptera: Fulgoroidea: Kinnaridae), with Notes on Antennal Sensilla and Wax Glands

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**Ai-Ping Liang (2002)** Seven new species of *Kinnara* Distant (Hemiptera: Fulgoroidea: Kinnaridae), with notes on antennal sensilla and wax glands. *Zoological Studies* 41(4): 388-402. Seven new species of the Oriental planthopper genus *Kinnara* Distant (Hemiptera: Fulgoroidea: Kinnaridae) are described and illustrated: *K. albipennis* sp. nov. (southwestern China: Yunnan); *K. fusca* sp. nov. (southern China: Hubei, Guangxi), *K. ochracea* sp. nov. (southern China: Hainan), *K. sabahensis* sp. nov. (Malaysia: Sabah), *K. trimaculata* sp. nov. (southern India), *K. unimaculata* sp. nov. (Thailand: Trang), and *K. vientianensis* sp. nov. (Laos: Vientiane). A diagnosis of the genus and a checklist of all known species are provided. New data on the ultrastructural morphology of the antennal sensilla, wax glands, rostral apex, and hind pretarsus of several species are given from scanning electron microscope observations. The autapomorphies and plesiomorphies of the genus are summarized. <http://www.sinica.edu.tw/zool/zoolstud/41.4/388.pdf>

**Key words:** *Kinnara*, Kinnaridae, Antennal sensilla, Wax glands, Monophyly.

In a previous paper (Liang 2001), the current author presented a brief review on the taxonomy of the planthopper family Kinnaridae and described a new species, *Adolenda fuscofasciata* Liang, belonging to the tribe Adolendini Emeljanov, 1984, of the subfamily Kinnarinae, from Yunnan and Guangxi in southwestern China. In the present paper, I describe 7 new species of *Kinnara* Distant, the type genus of the Kinnaridae, and redescribe the genus.

The genus *Kinnara* Distant, 1906 (a replacement name for *Pleroma* Melichar, 1903 [Distant, 1906a]) was established for a distinctive genus of Oriental planthopper with many unique characters (see later remarks). *Kinnara* is of special interest in that it is the type genus of the family Kinnaridae, and it combines characters of both the Cixiidae and the Achilidae (Muir 1922). The genus had been placed in the family Cixiidae until Muir (1925) formally erected the family Kinnaridae. *Kinnara* is the only genus of the tribe Kinnarini Muir, 1925, of the subfamily Kinnarinae (Emeljanov 1984). Twenty-three *Kinnara* species (including the 7 new species described below in this paper) are known now from the Oriental region (Melichar 1903,

Distant 1906b 1912 1916, Bierman 1907, Muir 1913 1922 1923, Metcalf 1945, Fennah 1978, see also the checklist below).

While sorting and identifying Kinnaridae from material in the Insect Collection of the Institute of Zoology, Chinese Academy of Sciences, Beijing (IZCAS) and elsewhere, I found 7 new species of *Kinnara* from southern China, Laos, Thailand, Malaysia (Sabah), and southern India. In order to expand the knowledge on the morphology of the Kinnaridae, I also made observations on the ultrastructural morphology of the antennal sensilla, wax glands, rostral apex, and hind pretarsus of several *Kinnara* species through the use of a scanning electron microscope. The purposes of the present paper are to describe the 7 new species of *Kinnara* which were recently found from the Oriental region, to provide some new data on the ultrastructural morphology of *Kinnara* species, and to tentatively discuss the monophyly and the phylogenetic position of the genus.

### MATERIALS AND METHODS

*Specimens studied:* The specimens studied in the course of this work are deposited in the following institutions whose names are abbreviated in the text as follows: BPBM: Bernice P. Bishop Museum, Honolulu, Hawaii, USA; CAS: California Academy of Sciences, San Francisco, CA, USA; IZCAS: Institute of Zoology, Chinese Academy of Sciences, Beijing, China; NCSU: Department of Entomology Insect Collection, North Carolina State University, Raleigh, NC, USA; NU: Department of Biology Insect Collection, Nankai University, Tianjin, China; TMNH: Tianjin Museum of Natural History, Tianjin, China; and USNM: [US National Museum] National Museum of Natural History, Smithsonian Institution, Washington, DC, USA.

*SEM:* For scanning electron microscopy (SEM), dry, pinned museum specimens were employed. The specimens were cleaned with 10% KOH for 1-2 min, then washed in distilled water, mounted on aluminum stubs with double-sided sticky tape, air-dried at room temperature, and coated with gold-palladium using a sputter coater. Observations were made using a JEOL 5200LV (Japanese Electronic and Optical, Tokyo, Japan) and a Zeiss DSM 950 (Carl Zeiss, Jena, Germany) scanning electron microscope, operated at accelerating voltages of 10-25 kV.

*Terminology:* The terminology followed that of Kramer (1950).

## DESCRIPTIVE TAXONOMY

### Genus *Kinnara* Distant, 1906

*Pleroma* Melichar, 1903: 41. Type species: *Pleroma ceylonica* Melichar, 1903: 42, pl. 1, fig. 12, 12a-c, by original designation.

*Kinnara* Distant, 1906a: 8; Metcalf 1945: 242; Fennah 1956: 476; Chou et al. 1985: 27. Replacement name for *Pleroma* Melichar, 1903.

*Description:* Head (Figs. 12, 14, 16, 18, 20, 23) short and small, much narrower than pronotum; vertex (Figs. 12, 14, 16, 18, 20, 23) transversely broad and nearly trapezoidal, with carinate lateral, anterior, and posterior margins leaving disc concave, lateral carinate margins converging anteriorly and diverging ventrally; frons (Figs. 13, 15, 17, 19, 21, 72) narrowest between eyes, abruptly strongly expanded laterad towards frontoclypeal suture, and then a little narrowed to postclypeus, lateral margins strongly carinate, without median carina, with distinct median ocellus; postclypeus

(Figs. 13, 15, 17, 19, 21, 72) shorter than frons, with disc strongly convex and strongly keeled centrally, lateral margins carinate; anteclypeus very narrow and sharp, convex, keeled centrally; rostrum long, extending beyond hind coxae, basal segment longer than apical segment, rostral apex consisting of 2 lateral lobes separated by dorsal stylet groove, each lateral lobe possessing a terminal field of about 9 basiconic sensilla (Figs. 73, 74); eyes (Figs. 60-62) with sparse inter-ommatidial piles (excluding marginal areas); antennae (Figs. 63, 66) with very small scape, pedicel short and subglobose, with more than 15 distinct sensory plaque organs distributed over entire surface, each plaque having 15-30 long, concentric, digitate processes separated by smooth, relatively large, tooth-shaped cuticular denticles and long hair-like microtrichia (Figs. 63, 65-68, 70, 71); gena with a subantennal cross ridge below antenna on which a row of spinous processes is present (Figs. 63, 64, 66, 69) and a conical, laterally directed process between the subantennal cross ridge and antenna; pronotum (Figs. 12, 14, 16, 18, 20, 23) very short and narrow, strongly sloping laterad and then curved down, anterior and posterior margins carinate, with indistinct median carina; mesonotum (Figs. 12, 14, 16, 18, 20, 23) broad, moderately convex, anterior area with very small rounded cuticular tubercles (Fig. 79), apical area slightly depressed, disc very weakly tricarinate with lateral carinae obsolete, lateral depressed margins with cuticular protuberances (Fig. 80); legs slender, moderately long, hind tibiae without lateral spines, spines at distal end of basitarsus forming continuous row; black-tipped spines at end of posterior tibiae, basal and apical joints of posterior tarsi numbering 7-8, 7, and 6-7, respectively; hind pretarsus with 1 long seta on each unguis and 1 pair of very short and small setae on arolium (Figs. 75-78); forewings (Figs. 22, 23) somewhat narrow with rounded apical margins, distinct membranous margin (excluding claval margin), and a distinct subtriangular stigma (see Muir 1922 1925) on costal margin beyond middle, venation as in figures 22 and 23, claval Y vein with very short common apical stalk, R joining M for a short distance, with 9 apical cells; hindwings a little wider than forewings, venation as in figure 24; male abdominal tergites narrow, chevron-shaped; female abdominal sterna 6-8 fused together.

Male genitalia with pygofer (Figs. 25, 30, 35, 40, 49, 54) in lateral aspect narrow and high, upper 1/3 very narrow, dorsal margin very short and ventral margin long, with a slender, posterodorsally

directed process, "pygofer appendage", arising from posterior margin near base; genital styles (Figs. 27, 33, 38, 42, 52, 57) simple, elongate, or short and broad, with or without apical process; aedeagus (Figs. 28, 29, 34, 39, 45, 46, 53, 58, 59) complex, lacking apical flagellum, apex with semi-membranous or sclerotized processes; anal tube (Figures 25, 26, 30-32, 37, 40, 43, 44, 51, 56) long, with apex sometimes produced ventrally, being spinous or forked.

Female genitalia as in figures 82 and 83. Ovipositor incomplete.

*Wax gland pores in adult females:* Like most other fulgoromorphans, female adults of kinnarid species secrete wax. Distinct filamentous wax threads can usually be seen on abdominal tergites 6-8 in female kinnarid adults. The wax in the fulgoromorphans is secreted through distinct sclerotized structures that act as molds to produce structurally different forms of wax at different positions on the body. These wax-producing structures have been termed pores and ducts, and the types and distributions of these structures are very useful characters for taxonomic identification and phylogenetic inferences (O'Brien et al. 1991, Liang 2002, Liang and O'Brien 2002).

In this study, the wax gland pores in female adults of *K. albipennis* sp. nov., *K. bakeri* Muir, *K. ceylonica* (Melichar), *K. flavofasciata* Distant, *K. ochracea* sp. nov., and 2 unidentified *Kinnara* species (one from Borneo and the other from southern India) were investigated with scanning electron microscopy.

As in most other kinnarids, abdominal tergites 6-8 (Figs. 84, 85) in the female adults of *Kinnara* species are elevated, chevron-shaped, and divided medially into 2 plates, bearing large amounts of white filamentous wax threads (Figs. 86, 87). The entire surface of abdominal tergites 6-8 is covered with numerous small wax gland pores delimited by reticulate ridges (Figs. 86-97). Each wax gland pore unit is composed of a main polygonal depression joined by 1-3 (2 and 3 being the more common numbers encountered) locular structures (Figs. 89-93, 95). The polygonal depressions are relatively large and may be pentagonal, hexagonal, or triangular. The number of the sides of the polygonal depression relates to the number of the surrounding locular structures. The polygonal depression usually has more sides when it is joined by more locular structures. When the wax is completely cleaned, the dorsal surface of these polygonal depressions can be seen to possess a reticulate microsculpture composed of folds or

pleats (Figs. 90, 91, 93). It is from the polygonal depressions that the wax is extruded as fine threads (Figs. 86, 87).

In *K. ceylonica* (Melichar), *K. bakeri* Muir, and *Kinnara* sp. (from Borneo), the shape and pattern of the wax gland pores in the marginal areas of abdominal tergites 6-8 differ from those in other areas of the tergites. Both the locular structures and the polygonal depressions in the marginal areas of the tergites are quite slender and elongate and are arranged in a pattern of 1 polygonal depression joined by 1 locular structure (Figs. 92, 93). The locular structure in marginal areas of the tergites is extremely elongate and is nearly pouch-like.

In *K. ochracea* sp. nov., the wax gland pores are elongate and nearly hexagonal in shape. Each wax pore unit (Fig. 94) consists of 2 main, nearly crescent or kidney-shaped depressions separated by a very slender, narrow, elongate, locular structure in its center. There is a ridge separating the main depression and the central locular structure. There are very fine pits on the reticulated ridges. In addition, no differences were found between the wax gland pores on the marginal areas and on other areas of abdominal tergites 6-8 in *K. ochracea* sp. nov.

The ultrastructural morphology of the wax gland pores found in the 6 *Kinnara* species (Figs. 86-97) are generally uniform, including their shape, distribution, and arrangement. *K. flavofasciata* Distant (Figs. 89-93) shares a very similar pore pattern with that of the unidentified *Kinnara* species from Borneo (Fig. 95), and the pores seen in *K. albipennis* sp. nov. (Figs. 96, 97) are very similar to those in the unidentified *Kinnara* species from southern India (Fig. 88). The pores seen in *K. ochracea* sp. nov. greatly differ and are very specific. Compared to typical porous wax gland pores found in many other kinnarid species (Liang 2001 2002 unpubl. data) and in many species of the Meenoplidae (Bourgoin 1997, Liang unpubl. data), wax gland pores in species of *Kinnara* are extremely modified and represent a unique structural organization among kinnarids. This supports *Kinnara* being a monophyletic group. The wax gland pore pattern in *K. ochracea* sp. nov. apparently signifies a further divergent evolutionary trend within *Kinnara*.

*Biology:* In common with most planthopper groups, no biological data are currently available for species of *Kinnara*.

*Distribution:* Species of *Kinnara* are currently known from southern and northeastern India, Sri

Lanka, southern China (Yunnan, Guangxi, Hubei, Hainan), Taiwan, Vietnam (Fennah 1978), Laos (Vientiane), Thailand (Trang), the Philippines (Negros Island, Basilan, Zamboanga, and Dapitan [Mindanao]), Malaya Peninsula (including Singapore), Borneo, Java, and Sumatra. The genus has a typical Oriental group distribution.

*Remarks:* Species of *Kinnara* can be easily distinguished from other kinnarids by the combination of the following characters: (1) forewings (Figs. 6, 9, 11, 22, 23) with a subtriangular stigma on costal area beyond middle; (2) forewings with membranous costal and claval margins and numerous, very short, fine veinlets (Figs. 22, 23); (3) frons (Figs. 13, 15, 17, 19, 21, 72) strongly expanded laterad towards frontoclypeal suture; (4) genae (Figs. 63, 64, 66, 69) with a subantennal cross ridge on which a row of spinous processes is located and a laterally directed, conical process between the subantennal cross ridge and antenna; (5) hind tibiae without lateral spurs; (6) male pygofer (Figs. 25, 30, 35, 40, 49, 54) with a slender, elongate, dorsoposteriorly directed process, 'the pygofer appendage'; (7) abdominal tergites 6-8 in female adults (Figs. 84, 85) modified into large, wax-secreting plates; (8) abdominal sterna 6-8 in female adults fused into 1 sternum (a development associated with modification of the wax-secreting plates on abdominal tergites 6-8); and (9) the presence of special wax gland pores on abdominal tergites 6-8 in female adults (see above, Figs. 86-97). Of these characters 1, 2, 3, 4, 6, and 9 are unequivocal autapomorphies of *Kinnara* and strongly support the monophyly of the genus.

Structurally, species of *Kinnara* also exhibit many plesiomorphic features of fulgoromorphans, including the presence of median ocelli (Figs. 13, 15, 17, 19, 21); a long rostrum; the presence of wax-secreting plates on abdominal tergites 6-8 in female adults (Figs. 84, 85); the presence of star-shaped antennal sensilla (Figs. 63, 65-68, 70, 71); and hind pretarsus with 1 long seta on each unguis; and 1 pair of very short and small setae on the arolium (Figs. 75-78).

In conclusion, the monophyly of *Kinnara* is strongly supported by a series of very distinctive autapomorphies, but the genus also possesses many plesiomorphic traits. The total morphological data suggest that *Kinnara* is an isolated, more derived lineage within the Kinnaridae and is possibly the sister group of all other Kinnaridae, as advocated by Bourgoïn (1993).

*Kinnara* can be easily distinguished from

other kinnarid genera in the Oriental region by characters 1-9 listed above. It differs from *Adolenda* Distant in the relatively broad forewings, expanded costal and inner margins, with a distinct subtriangular stigma on costal margin beyond middle, the frons strongly expanded laterad towards the frontoclypeal suture; a relatively broad post-clypeus with lateral carinae expanded laterally; a very weakly tricarinate pronotum; distinct male genitalic structures; and the specific wax gland pores in female adults (see Liang 2001).

### Checklist of *Kinnara* Distant

- Pleroma* Melichar, 1903. Type species: *Pleroma ceylonica* Melichar, 1903. (preoccupied)  
*Kinnara* Distant, 1906a. Replacement name for *Pleroma* Melichar, 1903.  
*albipennis* sp. nov. Southwestern China (Yunnan).  
*bakeri* Muir, 1922. Singapore.  
*brunnea* Muir, 1913. Borneo.  
*ceylonica* (Melichar, 1903). Sri Lanka.  
*doto* Fennah, 1978. Vietnam.  
*flavifrons* Muir, 1913. Java, Borneo.  
*flavipes* (Bierman, 1907). Java.  
*flavofasciata* Distant, 1916. Southern India, the Philippines (Mindanao).  
*fulva* Muir, 1913. Borneo.  
*fumata* (Melichar, 1903). Southern India, Taiwan.  
*fusca* sp. nov. Southern China (Guangxi, Hubei).  
*maculata* Distant, 1912. Southern India.  
*marginalis* Muir, 1922. Borneo.  
*nigrocacuminis* Muir, 1923. Sumatra.  
*nigrolineata* Muir, 1922. The Philippines (Negros Island).  
*ochracea* sp. nov. Southern China (Hainan Island).  
*penangensis* Muir, 1922. Malaysia (Penang Island).  
*sabahensis* sp. nov. Malaysia (Sabah).  
*sordida* Muir, 1913. Borneo.  
*spectra* Distant, 1912. Northeastern India (E. Himalayas, Assam), ?Singapore.  
*trimaculata* sp. nov. Southern India.  
*unimaculata* sp. nov. Thailand (Trang).  
*vientianensis* sp. nov. Laos (Vientiane).

### *Kinnara albipennis* sp. nov.

(Figs. 1, 12, 13, 30-34, 69-71, 96, 97)

*Description:* Length (from apex of vertex to tip



of forewings): ♂ 5.2-5.4 mm; ♀ 6.0-6.2 mm.

General color whitish (Fig. 1); head, body ventrally, and legs somewhat stramineous; mesonotum and abdomen fuscous brown; forewings uniformly powdered whitish; apex of rostrum suffused with fuscous; apex of tibiae and tarsomere III of fore and middle legs brown.

General external characters as in generic description. Vertex (Fig. 12) short, transverse. Frons (Fig. 13) very narrow between eyes in anterior view, moderately expanded laterad towards frontoclypeal suture. Forewings relatively broad. Cuticular structure of wax gland pores in female adults as in figures 96 and 97.

Male genitalia with narrow and high pygofer (Fig. 30), pygofer appendage very elongate, distinctly longer than genital style in lateral view, with basal 2/5 relatively broad, apical 3/5 relatively narrow, apex slightly expanded; genital styles (Figs. 30, 33) relatively short and broad, apex truncate, in ventral view inner margins of left and right styles touching each other but diverging at apex; aedeagus (Figs. 30, 34) with a short, posterodorsally

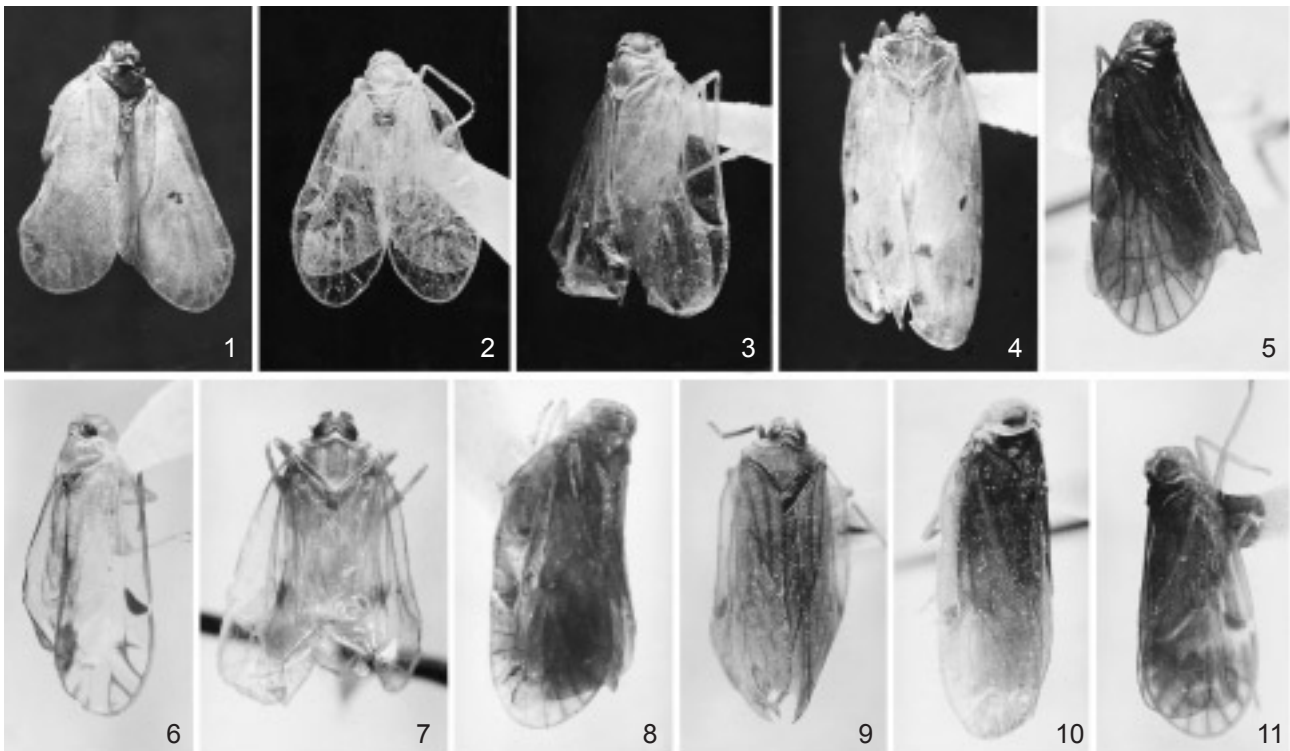
directed process near base of shaft on dorsal margin, with 4 anteriorly directed processes apically: the most external process long, broad, and membranous; the rightmost process narrow and long, lanceolate; the innermost process less than 1/2 length of shaft; and the leftmost process very short; anal tube (Figs. 30-32) with constricted apex forming a ventrally directed process whose basal part is somewhat rod-like and apical part is conical and spine-like.

*Materials examined*: Holotype: ♂, China, Yunnan: Xishuangbanna (22°0'N, 100°8'E), Damenglong, 650 m, 8 July 1958 (L-Y Zheng) (IZCAS). Paratypes: China, Yunnan: 1 ♂, 3 ♀, same data as for holotype (IZCAS).

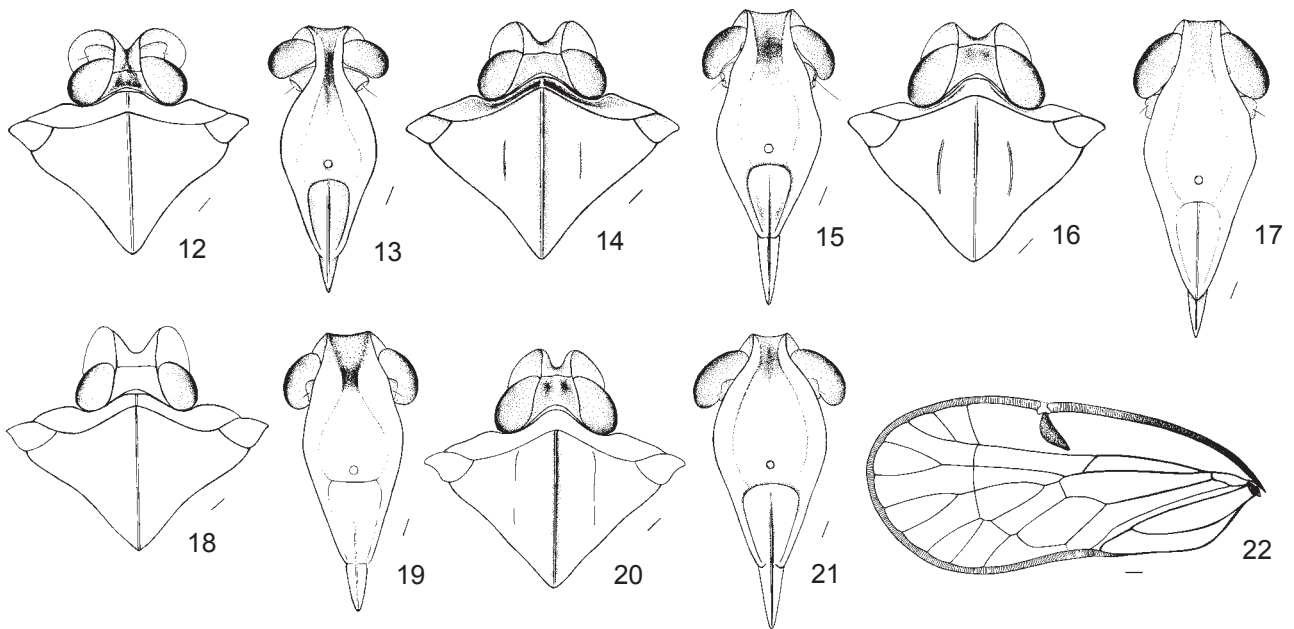
*Etymology*: This new species is named for its uniformly whitish forewings.

*Distribution*: Southwestern China (Yunnan).

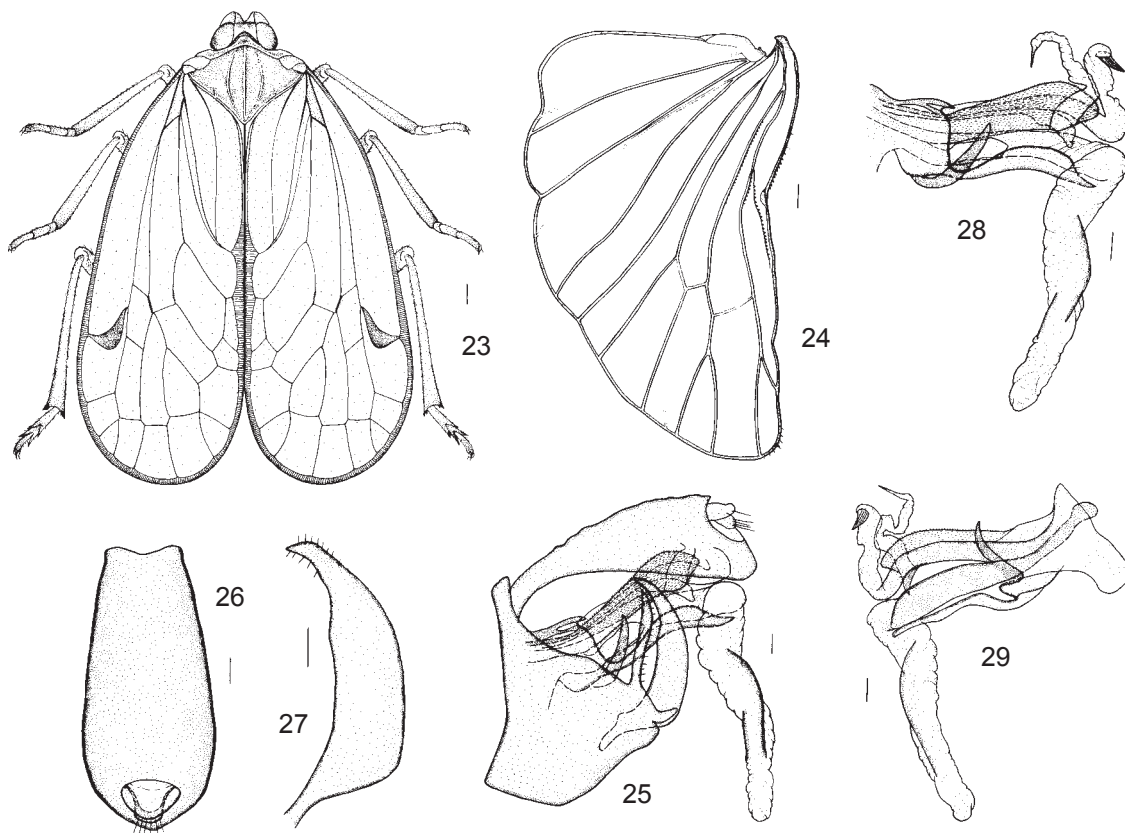
*Remarks*: This species is closely related to *K. spectra* Distant, 1912 from northeastern India but can be distinguished from the latter by the pronotum distinctly dark brown, frons (Fig. 13) much narrower between eyes, and the anal tube with con-



**Figs. 1-11.** Dorsal habitus of *Kinnara* species. 1. *K. albipennis* sp. nov. (♀, paratype, China: Yunnan, IZCAS). 2, 3. *K. ochracea* sp. nov. (♀, ♂, paratypes, China: Hainan, IZCAS, NCSU). 4. *K. trimaculata* sp. nov. (♀, paratype, India, NCSU). 5. *K. fusca* sp. nov. (♀, holotype, China: Guangxi, IZCAS). 6. *K. sabahensis* sp. nov. (♂, holotype, Malaysia: Sabah, USNM). 7. *K. unimaculata* sp. nov. (♂, holotype, Thailand: Trang, BPBM). 8. *K. vientianensis* sp. nov. (♂, holotype, Laos: Vientiane, BPBM). 9. *K. ceylonica* (Melichar) (♀, Sri Lanka, USNM). 10. *K. flavofasciata* Distant (♂, southern India). 11. *K. bakeri* Muir (♂, Singapore).



**Figs. 12-22.** *Kinnara* species. 12-21. Head, pronotum, and mesonotum (dorsal view) and head (ventral view). 12, 13. *K. albipennis* sp. nov. (♀, paratype). 14, 15. *K. fusca* sp. nov. (♀, paratype). 16, 17. *K. ochracea* sp. nov. (♀, paratype). 18, 19. *K. sabahensis* sp. nov. (♂, holotype). 20, 21. *K. trimaculata* sp. nov. (♂, paratype). 22. Left forewing of *K. fusca* sp. nov. (♀, holotype). Scale bars: Figs. 12-21 = 0.1 mm; Fig. 22 = 0.2 mm.



**Figs. 23-29.** *Kinnara ochracea* sp. nov. 23. Female paratype (China: Hainan, IZCAS, dorsal view). 24. Hindwing. 25. Pygofer (lateral view). 26. Anal tube (dorsal view). 27. Genital style (ventrolateral view). 28. Aedeagus (left lateral view). 29. Aedeagus (right lateral view). Scale bars: Figs. 23, 24 = 0.2 mm; Figs. 25-29 = 0.1 mm.

stricted apex forming a ventrally directed, slender process whose basal part is rod-like and apical part is conical and spine-like (Figs. 30-32).

*K. spectra* Distant was described from 1 female collected from the eastern Himalayas. Muir (1922) reported its occurrence in Assam. A male of *K. spectra* and study of the male genitalia are needed to determine its status and its relation with *K. albipennis* sp. nov.

Muir (1922) identified 1 male and 1 female specimen collected from Singapore as *K. spectra* and provided the illustrations of the male genitalia of the Singapore male specimen. The anal tube of *K. spectra* Distant sensu Muir (1922) does not extend ventrally. However, Muir's (1922) identification, as he himself stated, cannot be regarded as being correct unless the males of *K. spectra* from the type locality are found and studied.

***Kinnara fusca* sp. nov.**

(Figs. 5, 14, 15, 22)

*Kinnara fumata* Melichar; Fennah 1956: 476; Chou et al. 1985: 27, fig. 24. [Misidentifications]

**Description:** Length (from apex of vertex to tip of forewings): ♀ 5.6-5.8 mm.

General color fuscous (Fig. 5); head, pronotum, thorax ventrally, and legs ochraceous, abdomen brown, mesonotum and forewings uniformly blackish fuscous; frons with brown or fuscous suffusion; frons and postclypeus with lateral carinae, postclypeus and anteclypeus with median carinae, fore and middle legs with tarsal segments, brown; rostrum with apex suffused with fuscous.

General external characters as in generic description. Vertex (Fig. 14) short, transverse. Frons (Fig. 15) between eyes moderately broad in anterior view, lateral carinate margins moderately expanded laterad above frontoclypeal suture.

**Male:** Unknown.

**Materials examined:** Holotype: ♀, China, Guangxi: Jinxiu (24°1'N, 110°1'E), Mt. Dayao, 15 June 1982 (X-L Wang) (IZCAS). Paratypes: China, W. Hupeh [Hubei] Prov.: 2 ♀ ♀, Lichuan, Suisapa, 1000 m, 29 July 1948 (Gressitt and Djou) (CAS).

**Etymology:** This new species is named for its general fuscous appearance.

**Distribution:** Southern China (Guangxi, Hubei).

**Remarks:** This species can be distinguished by its general fuscous color (Fig. 5). Externally it is similar to *K. flavofasciata* Distant, 1916 from southern India, but can be distinguished by the uniformly

fuscous forewings. It is also similar to *K. bakeri* Muir, 1922 from Singapore and to *K. marginalis* Muir, 1922 from Borneo but can be separated from the latter 2 species by its much larger body.

Fennah (1956) identified 1 male specimen collected at Suisapa, Lichuan District, W. Hupeh [Hubei], China as *K. fumata* Melichar, 1903. This record was later listed by Chou et al. (1985). When studying Fennah's (1956) types of the Chinese Fulgoroidea deposited at the California Academy of Sciences, San Francisco (CAS), I was unable to find the male specimen studied by Fennah (1956). But at CAS I found 2 female specimens which were collected from the same locality as the male specimen studied by Fennah (1956). These 2 female specimens and the male specimen studied by Fennah (1956) belong to 1 species, although Fennah (1956) gave no description on the male specimen he had. My study showed that Fennah's (1956) identification on the Chinese male specimen as *K. fumata* Melichar, 1903 was misidentified and that the Chinese species of *K. fumata* Melichar, 1903 sensu Fennah (1956) actually represents an undescribed species.

***Kinnara ochracea* sp. nov.**

(Figs. 2, 3, 16, 17, 23-29, 66-68, 72, 73, 76-78, 94)

**Description:** Length (from apex of vertex to tip of forewings): ♂ 5.0-5.2 mm; ♀ 5.4-5.8 mm.

General color ochraceous (Figs. 2, 3), mesonotum sometimes brown, apex of rostrum and tarsal segments of fore and middle legs usually brown.

General external characters as in generic description. Vertex (Fig. 16) relatively small and narrow. Frons (Fig. 17) moderately expanded towards frontoclypeal suture. Forewings relatively broad. Antenna and sensilla on pedicel as in figures 66-68. Hindwing venation as in figure 24. Hind pretarsus as in figures 76-78. Cuticular structure of wax gland pores in female adults as in figure 94.

Male genitalia with pygofer (Fig. 25) having very narrow upper part in lateral view, pygofer appendage (Fig. 25) slender and narrow, somewhat sinuate and slightly shorter than genital style in lateral view; genital styles (Figs. 25, 27) elongate, longer than pygofer appendage in lateral view, apical part distinctly narrow and slender; aedeagus (Figs. 25, 28, 29) with relatively short shaft, and a posterodorsally directed process near middle of shaft on lateroventral margin, apex with 3 membranous processes: one being elongate, broad, and ventrally directed and the other 2 being

short, small, and dorsally directed with ventrally directed spinous apex; anal tube (Fig. 26) relatively short and broad, broadening from base to apex in dorsal view, apex rounded, not produced ventrally.

**Materials examined:** Holotype: ♂, [China], Hainan Is., Ta Han, 24 June 1935 (L Gressitt) (NCSU). Paratypes: China, Hainan Is.: 1 ♂, 2 ♀, same data as for holotype except 22, 23, 25 June 1935; 1 ♂, Dwa Bi, 20 July 1935 (L Gressitt) (IZCAS, NCSU); 1 ♀, Jianfengling (18°7'N, 108°8'E), 700-900 m, 10 Apr. 1980 (S-Z Ren) (NU); 1 ♀, Jianfengling, 14 May 1997 (M-F Yang) (IZCAS); 1 ♀, Mt. Diaoluo, 28 Mar. 1964 (S-L Liu) (TMNH).

**Etymology:** This new species is named for its

general ochraceous color.

**Distribution:** Southern China (Hainan Is.).

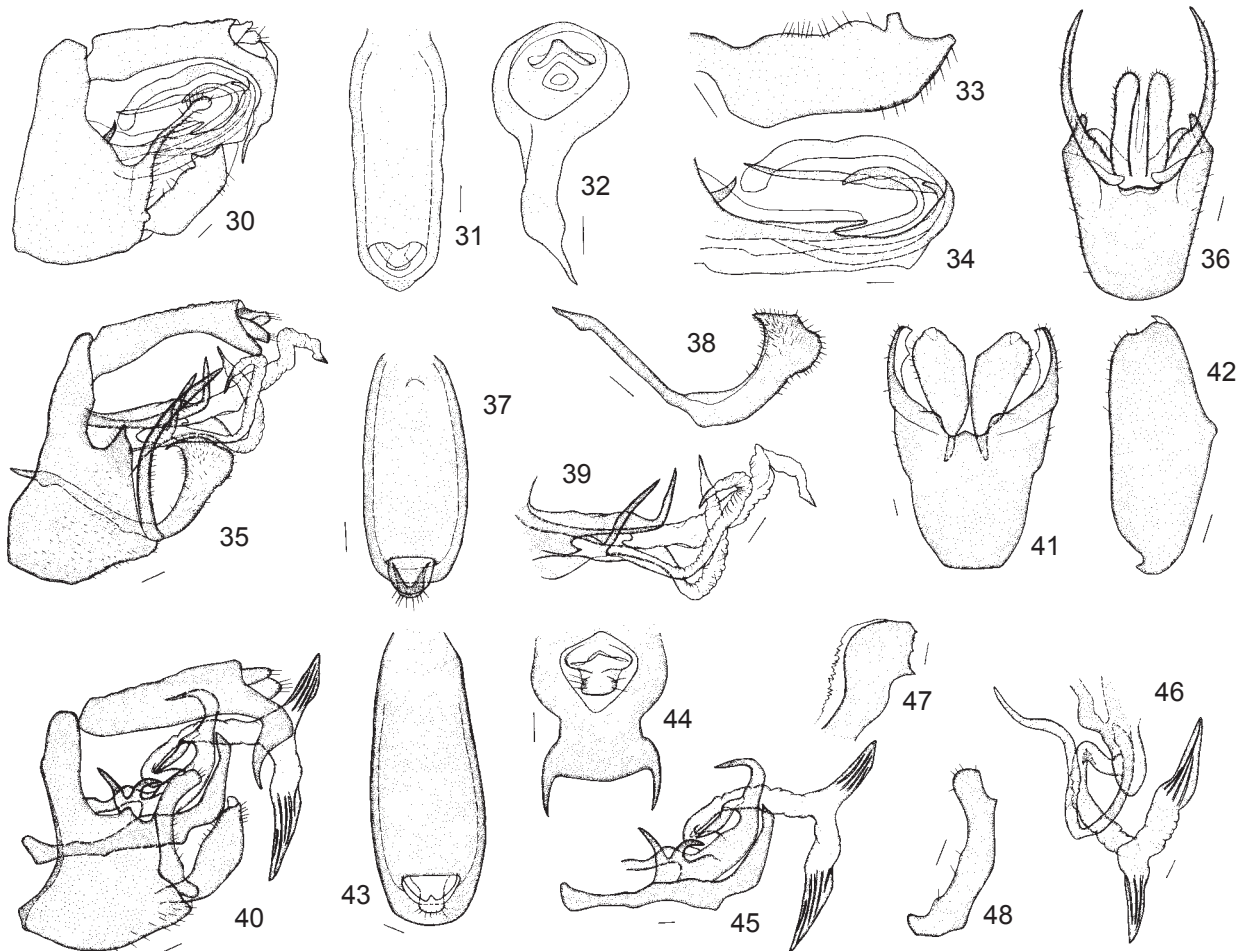
**Remarks:** This species can be easily distinguished from its congeners by its general ochraceous color, male genitalic structures (Figs. 25-29), and the very peculiar shape of the wax gland pores in female adults (Fig. 94).

***Kinnara sabahensis* sp. nov.**

(Figs. 6, 18, 19, 35-39)

**Description:** Length (from apex of vertex to tip of forewings): ♂ 6.8 mm.

Head, pronotum, and mesonotum reddish ochraceous; forewings hyaline, a subtriangular



**Figs. 30-48.** Male genitalia of *Kinnara* species. 30-34. *K. albipennis* sp. nov. 30. Pygofer (lateral view). 31. Anal tube (dorsal view). 32. Apex of anal tube (caudal view). 33. Genital style (ventrolateral view). 34. Aedeagus (lateral view). 35-39. *K. sabahensis* sp. nov. 35. Pygofer (lateral view). 36. Pygofer (ventral view). 37. Anal tube (dorsal view). 38. Genital style (lateral view). 39. Aedeagus (lateral view). 40-48. *K. trimaculata* sp. nov. 40. Pygofer (lateral view). 41. Pygofer (excluding aedeagus) (ventral view). 42. Genital style (ventrolateral view). 43. Anal tube (dorsal view). 44. Apex of anal tube (caudal view). 45. Aedeagus (left lateral view). 46. Aedeagus (right lateral view). 47. Right ventral process of aedeagus (ventral view). 48. Pygofer appendage (lateral view). Scale bars = 0.1 mm.



stigma on costal region near middle, outer, and inner membranous margins, an apical patch on inner margin, areas surrounding apical cellular veins brown or fuscous brown (Fig. 6); rostrum ochraceous, apex suffused with fuscous; legs ochraceous; abdomen and pygofer brown.

Vertex (Fig. 18) relatively short and broad. Frons (Fig. 19) between eyes relatively broad, moderately expanded laterad towards fronto-clypeal suture. Other external characters as in generic description.

Male genitalia with pygofer (Figs. 35, 36) having very narrow upper half in lateral view, posterior margin deeply excavated near middle forming a distinct angulate process beyond the excavation, pygofer appendage very elongate, much longer than genital style in lateral view, tapering gradually from base to acute apex; genital styles (Figs. 35, 36, 38) relatively short, very slender and nearly parallel-sided in ventral view, apical half distinctly expanded and anterodorsally directed in lateral view; aedeagus (Figs. 35, 39) with 5 apical processes: 2 inner processes short, sclerotized and spinous and 3 outer processes long, broad,

and membranous, apices of 2 sclerotized and spinous; anal tube (Fig. 37) relatively short and broad in dorsal view, apex not produced ventrally.

*Material examined:* Holotype: ♂, Malaysia: Sabah, Kinabalu National Park, summit trail below Carson Camp., 1980-2700 m, 16 Sept. 1983 (G Hevel, J Hevel, and W Steiner) (USNM).

*Etymology:* This new species is named for its occurrence in Sabah, Malaysia.

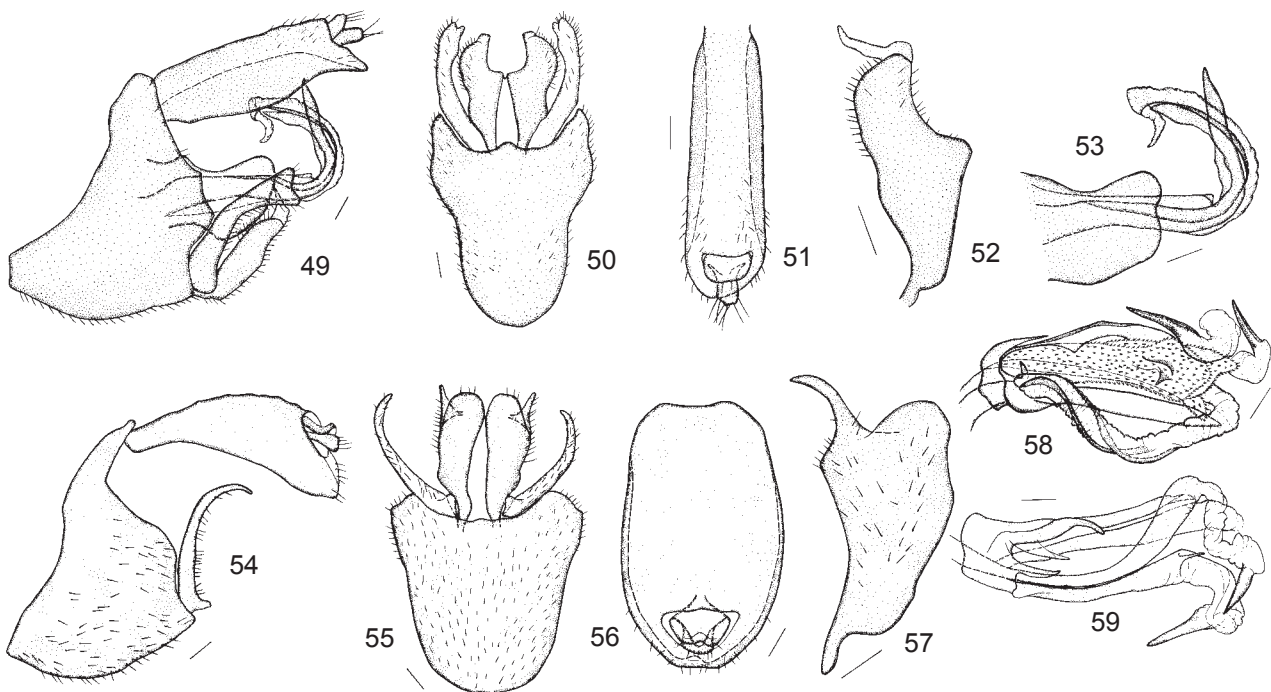
*Distribution:* Malaysia (Sabah).

*Remarks:* This species can be distinguished by its color pattern, especially the fuscous markings on the forewings (Fig. 6) and the shape of the male genitalia (Figs. 35-39). Externally this species is somewhat similar to *K. fulva* Muir, 1913 from Borneo (Mowong), but can be distinguished from the latter by the male anal tube (Figs. 35, 37) whose apex does not extend ventrally to form a spinous process.

***Kinnara trimaculata* sp. nov.**

(Figs. 4, 20, 21, 40-48)

*Description:* Body relatively large and broad,



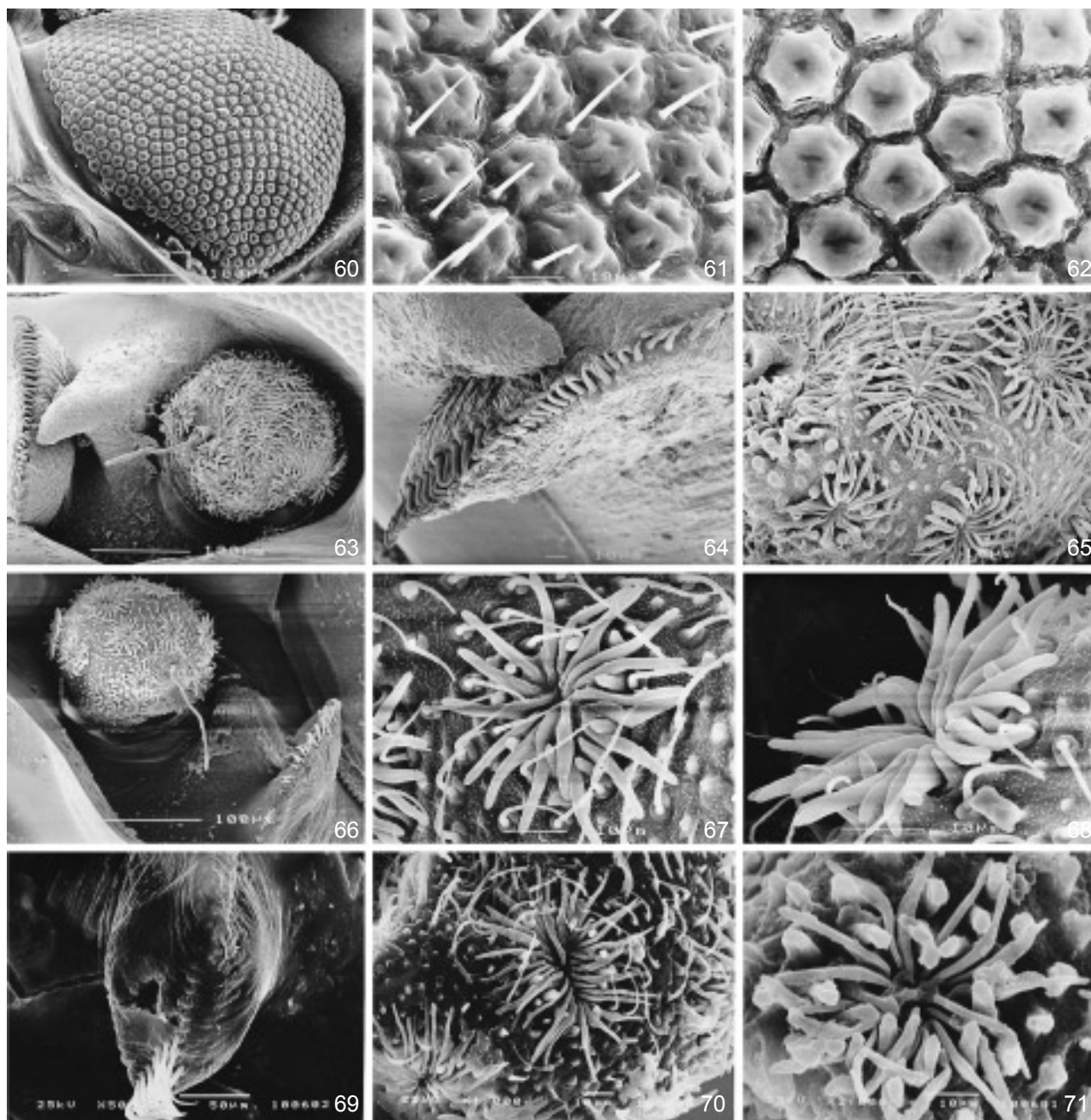
**Figs. 49-59.** Male genitalia of *Kinnara* species. 49-53. *K. unimaculata* sp. nov. 49. Pygofer (lateral view). 50. Pygofer (ventral view). 51. Anal tube (dorsal view). 52. Genital style (ventrolateral view). 53. Aedeagus (lateral view). 54-59. *K. vientianensis* sp. nov. 54. Pygofer (excluding genital styles and aedeagus) (lateral view). 55. Pygofer (ventral view). 56. Anal tube (dorsal view). 57. Genital style (ventrolateral view). 58. Aedeagus (left lateral view). 59. Aedeagus (right lateral view). Scale bars = 0.1 mm.

length (from apex of vertex to tip of forewings): ♂ 6.0-6.4 mm; ♀ 7.0-7.5 mm.

Head, pronotum, body ventrally, and legs ochraceous; mesonotum brownish; forewings whitish, with 3 small fuscous spots (Fig. 4); ventral

part of abdomen and pygofer ochraceous; dorsal part of abdomen brown.

Vertex (Fig. 20) relatively long. Frons (Fig. 21) between eyes relatively narrow, strongly expanded laterad towards frontoclypeal suture.



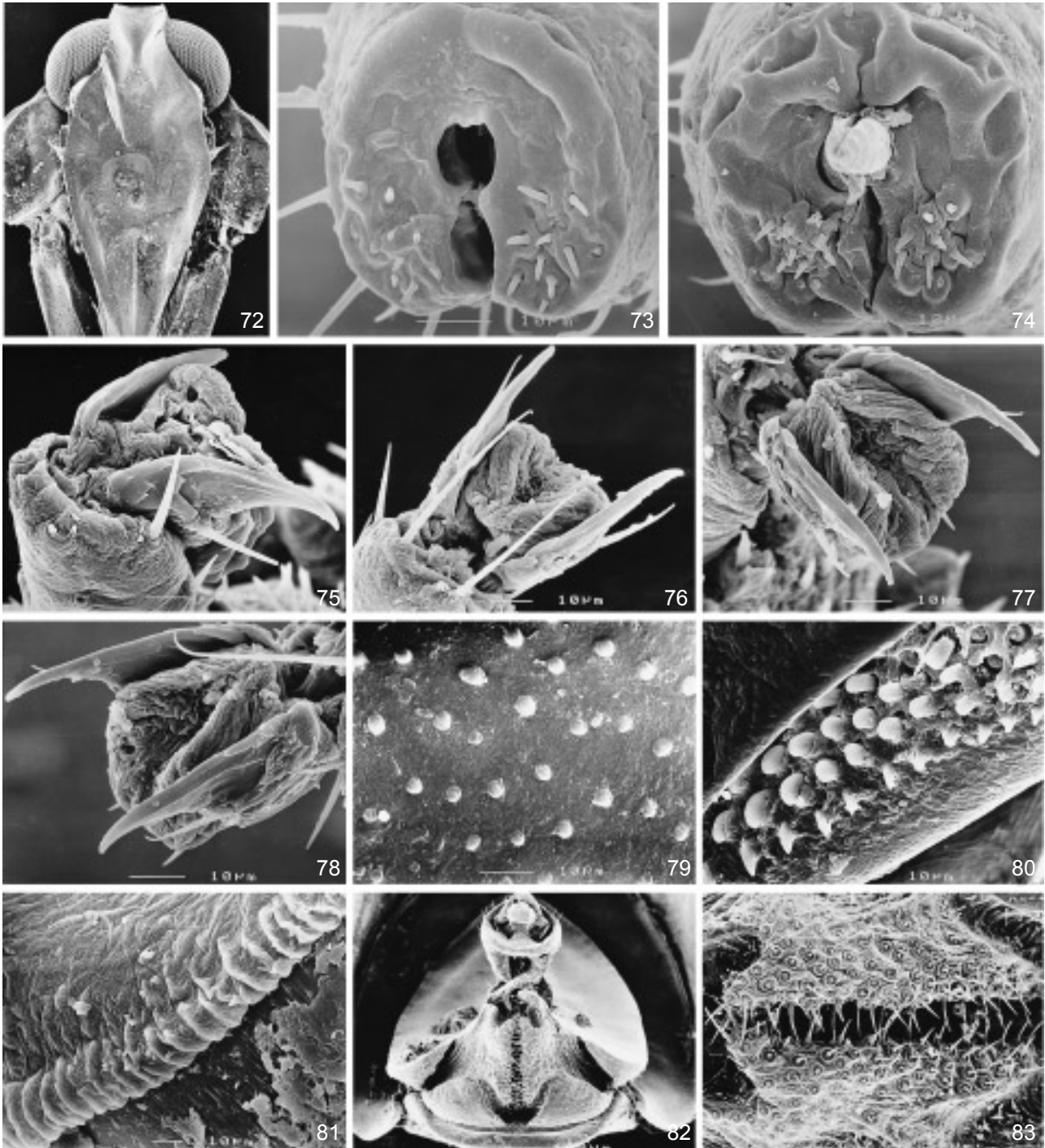
**Figs. 60-71.** Scanning electron micrographs of *Kinnara* species. 60-65. *K. flavofasciata* Distant. 60. Eye. 61. Inter-ommatidial piles. 62. Marginal ommatidia on eye. 63. Gena (lateral view), showing cross ridge and conical process on gena. 64. Cross ridge on gena. 65. Antennal pedicel surface, showing sensory plaque organs, tooth-shaped cuticular denticles, and microtrichia. 66-68. *K. ochracea* sp. nov. 66. Gena (lateral view), showing antenna and cross ridge, and apex of conical process on gena. 67, 68. Sensory plaque organ on antennal pedicel surface. 69-71. *K. albipennis* sp. nov. 69. Cross ridge on gena. 70. Antennal pedicel surface, showing sensory plaque organs, tooth-shaped cuticular denticles, and microtrichia. 71. Sensory plaque organ on pedicel surface.



Other external characters as in generic description.

Male genitalia with upper half of pygofer (Fig. 40) very narrow in lateral view, with a small angu-

lar process on posterior margin in front of pygofer appendage, pygofer appendage (Figs. 40, 48) relatively short, nearly parallel-sided with broad apex, anterior edge with a very small, subapical angular



**Figs. 72-83.** Scanning electron micrographs of *Kinnara* species. 72, 73. *K. ochracea* sp. nov. 72. Head (ventral view). 73. Rostral apex. 74, 75. *K. flavofasciata* Distant. 74. Rostral apex. 75. Pretarsus of hind leg. 76-78. Pretarsi of hind leg of *K. ochracea* sp. nov. 79-83. *K. flavofasciata* Distant. 79. Rounded cuticular tubercles on anterior area of pronotum. 80. Cuticular tubercles on lateral depressed region of mesonotum. 81. Coupling folds on hindwing. 82. Female genitalia (caudal view). 83. Ventral valvula.

process in dorsolateral or ventral view; genital styles (Figs. 40-42) relatively short and broad, very slightly shorter than pygofer appendage in lateral view, nearly triangular in ventral view, apical edge with a very small spinous process near outer edge; aedeagus (Figs. 45-47) with 3 processes: left process with 2 basal branches and 2 apical branches, middle process very elongate and slender, membranous, with extreme basal part sclerotized, dorsally turning from left side to right side and then curving ventrally, and right process with an apical spindle-shaped process with 2 ends sclerotized; anal tube (Figs. 40, 43, 44) with forked and ventrally directed apex, and 2 acute lateral forks in caudal view.

**Materials examined:** Holotype: ♂, S. India: Cherangeda, Nilgiri Hills, 1067 m (3500 ft.), Nov. 1950 (PS N[athan]) (NCSU). Paratypes: S. India: 1 ♂, 4 ♀ ♀, same data as for holotype; 1 ♂, 2 ♀ ♀, Ammatti, S. Coorg, 945 m (3100 ft.), Nov. 1952 (PS Nathan) (NCSU; IZCAS).

**Etymology:** This new species is named for the presence of 3 distinct fuscous spots on the forewings.

**Distribution:** Southern India.

**Remarks:** This species can be distinguished from other known species in the genus by its relatively large size (length ♂ 6.0-6.4 mm; ♀ 7.0-7.5 mm), whitish forewings (Fig. 4) with 3 distinct fuscous spots; and the shape of the male genitalia (Figs. 40-48), especially the anal tube (Figs. 40, 44) with forked and ventrally directed apex and 2 spinous lateral forks acute in caudal view. Externally this new species is similar to *K. maculata* Distant, 1912 from southern India, but differs from the latter in the markings on the forewings.

***Kinnara unimaculata* sp. nov.**

(Figs. 7, 49-53)

**Description:** Length (from apex of vertex to tip of forewings): ♂ 5.3-5.4 mm.

General color ochraceous (Fig. 7); head, pronotum, body ventrally, and legs ochraceous; mesonotum brownish; forewings ochraceous, with 1 pale fuscous spot in middle (Fig. 7); abdomen and pygofer ochraceous.

Vertex distinctly elongate and narrow. Frons between eyes very narrow, strongly expanded laterad towards frontoclypeal suture. Other external characters as in generic description.

Male genitalia with pygofer (Fig. 49) having relatively broad upper part in lateral view; pygofer appendage (Figs. 49, 50) distinctly broad, slightly

constricted mesially, apex expanded and truncated mesially in lateral view; genital styles (Figs. 49, 50, 52) relatively slender, base very narrow, apical 1/3 distinctly excavated on inner margin in ventral view, apex constricted into dorsally directed spinous process; aedeagus (Figs. 49, 53) with 3 apical, anterodorsally directed processes: two lateral ones relatively short and sclerotized and middle one distinctly long and membranous; anal tube (Figs. 49, 51) distinctly elongate and slender in dorsal view, apex rounded.

**Female:** Unknown.

**Materials examined:** Holotype: ♂, Thailand: Trang Prov., Khaophappa Khaochange, 200-400 m, 10 Jan. 1964 (GA Samuelson) (BPBM). Paratype: Thailand: 1 ♂, same data as for holotype (BPBM).

**Etymology:** This new species is named for the presence of a fuscous spot on the forewings.

**Distribution:** Thailand (Trang Prov.).

**Remarks:** This species can be distinguished from other known species in the genus by its ochraceous forewings (Fig. 7) with 1 pale fuscous spot in the middle and by the shape of the male genitalia (Figs. 49-53), especially the distinctly broad pygofer appendage (Figs. 49, 50) with expanded apex truncated mesially in lateral view, and the genital styles with distinct apical, spinous processes. In external appearance, this new species is very similar to *K. ochracea* sp. nov. from Hainan Is. in southern China, but differs from the latter in the forewings having a pale fuscous spot in the middle, the distinctly elongate and narrow vertex, the very narrow frons between the eyes, and in the minutiae of the male genitalia as noted above.

***Kinnara vientianensis* sp. nov.**

(Figs. 8, 54-59)

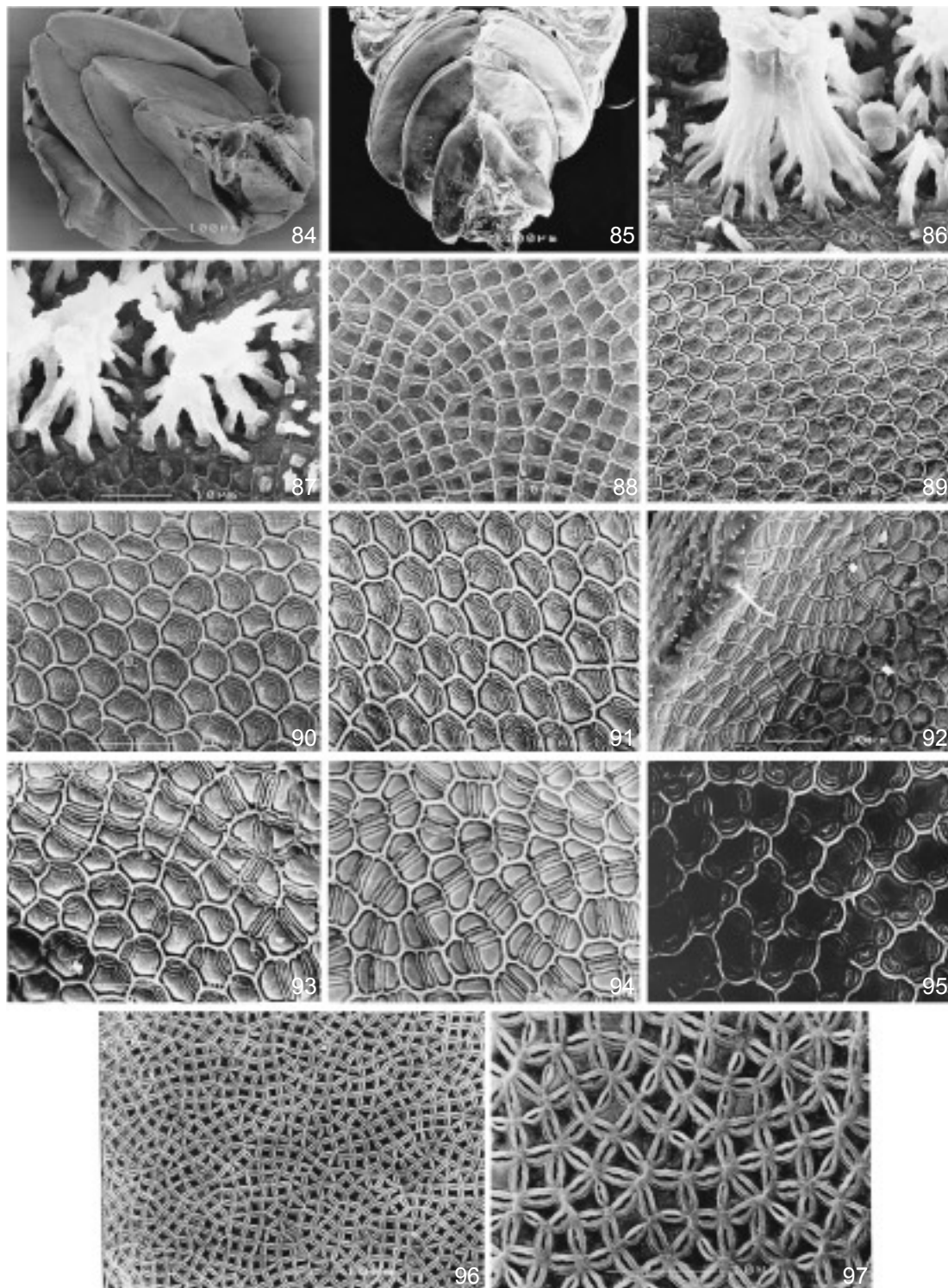
**Description:** Length (from apex of vertex to tip of forewings): ♂ 5.2 mm.

General color dark brown (Fig. 8); head, pronotum, body ventrally, and legs ochraceous; mesonotum suffused with fuscous; forewings dark brown; ventral part of abdomen and pygofer ochraceous; dorsal part of abdomen brown.

Vertex short. Frons between eyes relatively narrow, strongly expanded laterad towards frontoclypeal suture. Carinae on mesonotum relatively distinct. Other external characters as in generic description.

Male genitalia with pygofer (Fig. 54) having very narrow upper part in lateral view; pygofer





**Figs. 84-97.** Scanning electron micrographs of *Kinnara* species, showing wax-secreting plates and wax gland pores in female adults. 84. *K. bakeri* Muir, abdominal tergites 6-8, showing wax-secreting plates. 85-88. *Kinnara* sp. (southern India). 85. Abdominal tergites 6-8, showing wax-secreting plates. 86, 87. Part of dorsal surface of abdominal tergite 7 with wax in situ. 88. Wax gland pores on abdominal tergite 7. 89-93. *K. flavofasciata* Distant. 89. Wax gland pores on abdominal tergite 6. 90, 91. Wax gland pores on abdominal tergite 8. 92. Wax gland pores on marginal area of abdominal tergite 7. 93. Wax gland pores on marginal area of abdominal tergite 8. 94. *K. ochracea* sp. nov., wax gland pores on abdominal tergite 7. 95. *Kinnara* sp. (Borneo), wax gland pores on abdominal tergite 8 (5000x). 96, 97. *K. albipennis* sp. nov., wax gland pores on abdominal tergites 6 and 8.

appendage (Figs. 54, 55) very slender and elongate, posterodorsally directed but apical part posteriorly directed in lateral view, with a small angular process on hind margin at extreme base; genital styles (Figs. 55, 57) with narrow base, expanded toward apex, apex broad, apical margin excavated mesially with outer margin narrowing to relatively long finger-like process; aedeagus (Figs. 58, 59) elongate, shaft armed with many minute spines on surface and with 1 small subapical process, with 1 large, elongate, ventral, posteriorly directed process, base with 2 or 3 short processes, apex with 3 elongate membranous processes: one process extremely elongate, posteriorly directed basally, curved from right side to left side and then anteriorly directed, with blunt apex, and the other 2 processes relatively short, with relatively long, sclerotized apex, the lower one with a short acute process at middle of process in right lateral view; anal tube (Fig. 56) very short and broad in dorsal view, apex rounded.

*Female*: Unknown.

*Material examined*: Holotype: ♂, Laos: Vientiane Prov., Ban Van Eue, 15-31 May 1965 (native collector Rondon - Bishop Mus. Collection) (BPBM).

*Etymology*: This new species is named for its occurrence in the Vientiane Province of Laos.

*Distribution*: Laos (Vientiane Prov.).

*Remarks*: This species can be distinguished from other known species in the genus by its general dark brown color and male genitalic structure (Figs. 54-59), especially the apically very broad genital styles (Figs. 55, 57), with outer margin narrowing to relatively long, finger-like process and the very short and broad anal tube (Fig. 56) in dorsal view. It can be separated from *K. fusca* sp. nov. from Guangxi and Hubei in southern China by its dark brown forewings, the ochraceous median carina on the postclypeus and anteclypeus and the relatively narrow frons between the eyes. It differs from *K. bakeri* Muir from Singapore and *K. marginalis* Muir from Borneo in its larger body size and the shape of the male genitalia (see Muir 1922). The shape of the aedeagus is rather similar to that of *K. ochracea* sp. nov. from Hainan Is. in southern China, especially the shaft covered with minute spines on its surface, but differs in the color of the forewings (Figs. 2, 3, 8) and the shape of the genital styles (Figs. 27, 57).

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## 閩蠟蟬屬 *Kinnara* Distant (半翅目：蠟蟬總科：閩蠟蟬科) 七新種，附觸角感器及蠟腺之特徵記述

梁愛萍

本文對閩蠟蟬屬 *Kinnara* Distant (半翅目：蠟蟬總科：閩蠟蟬科) 之系統學研究進展進行了小結，對屬徵進行了重新描記，編製了已知種名錄，提供了部分種觸角感器、雌性成蟲第6-8腹節背板蠟腺、喙端部、後足端跗節等結構的超微形態電子顯微鏡照片，並記述七個新種，即白翅閩蠟蟬 *K. albipennis* sp. nov. (中國雲南)、褐翅閩蠟蟬 *K. fusca* sp. nov. (中國廣西及湖北)、淡黃閩蠟蟬 *K. ochracea* sp. nov. (中國海南)、沙巴閩蠟蟬 *K. sabahensis* sp. nov. (馬來西亞沙巴)、三斑閩蠟蟬 *K. trimaculata* sp. nov. (印度南部)、一斑閩蠟蟬 *K. unimaculata* sp. nov. (泰國董裏) 及萬象閩蠟蟬 *K. vientianensis* sp. nov. (老撾萬象)，文中描記了新種的外部形態及雄性生殖器結構，並給予新種與其近緣種類的區別特徵。文章還對閩蠟蟬屬 *Kinnara* 的獨有新徵、祖徵及其單系性進行了討論，初步分析顯示，閩蠟蟬屬 *Kinnara* 是一個具有許多獨有新徵的單系群，是閩蠟蟬科 Kinnaridae 中一個較為特化的分支。

**關鍵詞：**閩蠟蟬屬，閩蠟蟬科，觸角感器，蠟腺，單系。

中國科學院動物研究所昆蟲系