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## Aleyrodidae of Taiwan

### Part I. *Rhachisphora* QUAINANCE et BAKER

Chiun-Cheng KO, Tung-Ching HSU and Wen-Jer WU

Department of Plant Pathology & Entomology, National Taiwan University, Taipei, Taiwan 107, Republic of China

**Abstract** *Rhachisphora* QUAINANCE et BAKER of Taiwan including 5 named species and 3 new species are reviewed: *R. ardisiae* (TAKAHASHI, 1935), *R. koshunensis* (TAKAHASHI, 1933), *R. machili* (TAKAHASHI, 1932), *R. maesae* (TAKAHASHI, 1932), *R. reticulata* (TAKAHASHI, 1933), *R. alishanensis* KO, n. sp., *R. sanhsianensis* KO, n. sp. and *R. taiwana* KO, n. sp. A key is presented with accompanying illustrations and photographs.

**Key words:** Aleyrodidae; *Rhachisphora*; Taiwan; taxonomy; new species.

### Introduction

In the global catalogue of whitefly (MOUND & HALSEY, 1978), there were 14 species of *Rhachisphora* recorded in the world, 5 of which were recorded in Taiwan previously. Examination of the whole materials in Taiwan has revealed 3 new species and 2 new combinations excluded from *Rhachisphora*. *Rhachisphora* was originally used by QUAINANCE and BAKER (1917) as a subgenus of *Dialeurodes*, to accommodate species whose puparia have a submarginal row of setae and a dorso-median rhachis. It was later regarded as a full genus by TAKAHASHI (1952) in the original description of the species *malayensis* (MOUND & HALSEY, 1978). It is an Old World genus with most species having been described from the Oriental and Austro-Oriental Regions (MARTIN, 1988). However, such species as *fici* TAKAHASHI and *kuraruensis* TAKAHASHI clearly lack rhachis. It is advisable to put them into the genus *Dialeurodes*. MOUND and HALSEY (1978) indicated that though *Rhachisphora* was treated as a full genus, some of the species included, such as *capitatis* CORBETT and *fici* TAKAHASHI, did not appear to be congeneric with *trilobitoides*. However, they were retained until revisionary studies would be made.

From 1987 to 1990, under the project "Insect Fauna of Taiwan", an extensive collection of whitefly "pupal cases" were made by the authors throughout Taiwan especially in the high mountain areas. There are still many valuable materials waiting for studies.

The taxonomy of whitefly is based on the exuviae of the fourth instar larvae. The following descriptions use the standard whitefly terminology, which is visually explained by BINK-MOENEN (1983) and MARTIN (1985). New biological data are given for the 5 named species with asterisks.

### Depositories

- BMNH British Museum (Nat. Hist.) (U. K., London)  
 HBL Hikosan Biological Laboratory (Japan, Fukuoka)  
 NTU National Taiwan University (R. O. C., Taipei)  
 TARI Taiwan Agricultural Research Institute (R. O. C., Taichung)  
 TNSM National Science Museum (Nat. Hist.) (Japan, Tokyo)

### *Rhachisphora* QUAINANCE et BAKER

*Dialeurodes* (*Rhachisphora*) QUAINANCE et BAKER, 1917, 430. Type species: *Dialeurodes* (*Rhachisphora*) *trilobitoides*, by original designation.

*Rhachisphora*: TAKAHASHI, 1952, 22 [raised to genus]; MOUND & HALSEY, 1978, 186; MARTIN, 1985, 333; MARTIN, 1988, 80.

*Pupal case*. Elliptical or oval, yellow, light brown to black in color; marginal wax tubes represented by rounded or irregular short tooth-like projections; waxen secretion usually absent, though peculiar waxen dorsal figures sometimes present; dorsal disk with prominent rhachis and with thickened ridges radiating from it, representing the body segments; no large pores present. Thoracic tracheal folds distinct; the pore area composed of an outer ring, and within this there is a smaller pore opening, which is usually armed with teeth; vasiform orifice broadly subcordate, without comb of teeth, but its caudal margin sometimes forms a projection; submarginal area armed with a row of setae, and sometimes other setae also present on dorsum.

### Key to the Taiwanese Species of *Rhachisphora*

1. Dorsal ridges well defined, mostly reaching the margin ..... 5
- Dorsal ridges not reaching the margin ..... 2
2. Pupal case markedly elongated, more than twice as long as wide (Figs. 5 A, 28) ..... *R. reticulata* (TAKAHASHI)
- Pupal case not more than twice as long as wide ..... 3
3. Abdominal ridges without denticles; marginal setae numerous and different in character, some slightly knobbed and others somewhat lanceolate (Figs. 2 A, 10, 21) ..... *R. koshunensis* (TAKAHASHI)
- Abdominal ridges with denticles; marginal setae uniform in character ..... 4
4. Thoracic tracheal pore entirely closed, semilunar (Fig. 1 B); median area of dorsum broadly blackish longitudinally (Figs. 1 A, 9) ..... *R. ardisiae* (TAKAHASHI)
- Thoracic tracheal pore very small, not complete (Fig. 3 B); no broadly blackish area on the median area of dorsum (Figs. 3 A, 11) .. *R. machili* (TAKAHASHI)
5. Thoracic tracheal fold armed with an egg-shaped sinus (Figs. 7 B, 36) ..... *R. sanhsianensis* n. sp.

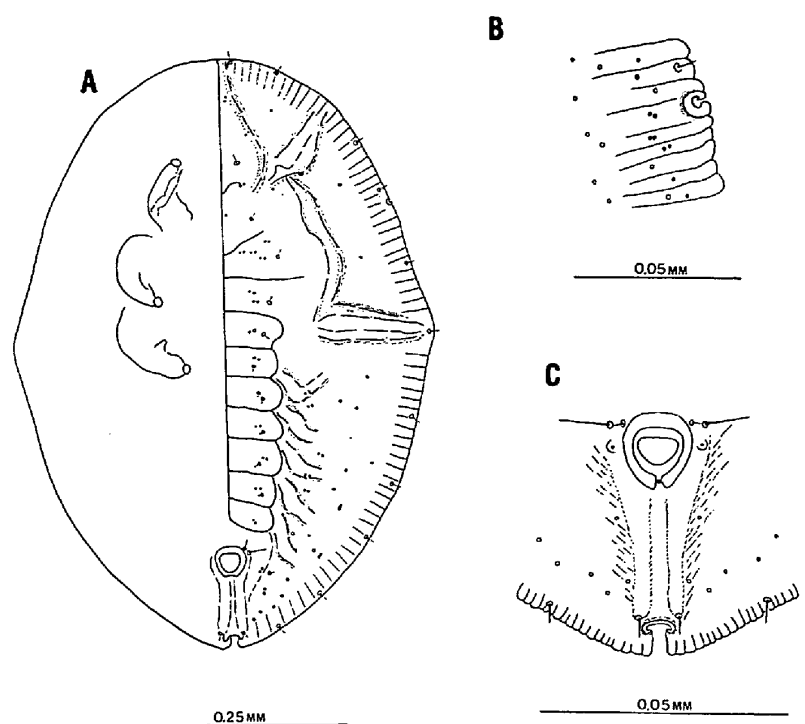


Fig. 1. *Rhachisphora ardisiae*. — A, Fourth instar; B, tracheal pore area; C, posterior area.

- Thoracic tracheal fold without egg-shaped sinus . . . . . 6
- 6. Vasiform orifice without projection; lingula exposed (Figs. 8 C, 39) . . . . .  
 . . . . . *R. taiwana* n. sp.
- Vasiform orifice more or less showing a projection; lingula not exposed . . . . 7
- 7. Pupal case elliptic (Figs. 4 A, 12, 24); thoracic tracheal openings without  
 sinus (Fig. 4 B) . . . . . *R. maesae* (TAKAHASHI)
- Pupal case oval (Figs. 6 A, 13, 30); thoracic tracheal openings with semicircular  
 sinus (Fig. 6 B) . . . . . *R. alishanensis* n. sp.

***Rhachisphora ardisiae* (TAKAHASHI, 1935)**

(Figs. 1, 9, 20)

*Dialeurodes ardisiae* TAKAHASHI, 1935, 50–51.

*Rhachisphora ardisiae*: MARTIN, 1985, 333.

*Distribution.* Taiwan (\*Hapan, \*Nanjenshan, Pintung), Papua New Guinea.

*Identification of pupal case.* This species is characterized by the presence of broad longitudinal blackish area on the median part of dorsum. A pair of blackish ridges present on cephalothorax, diverging longitudinally on the median area. Abdominal rhachis distinct, not reaching the margin, with chitinized denticles in a transverse row on the anterior margin of the 2nd–6th ridges. Twenty-

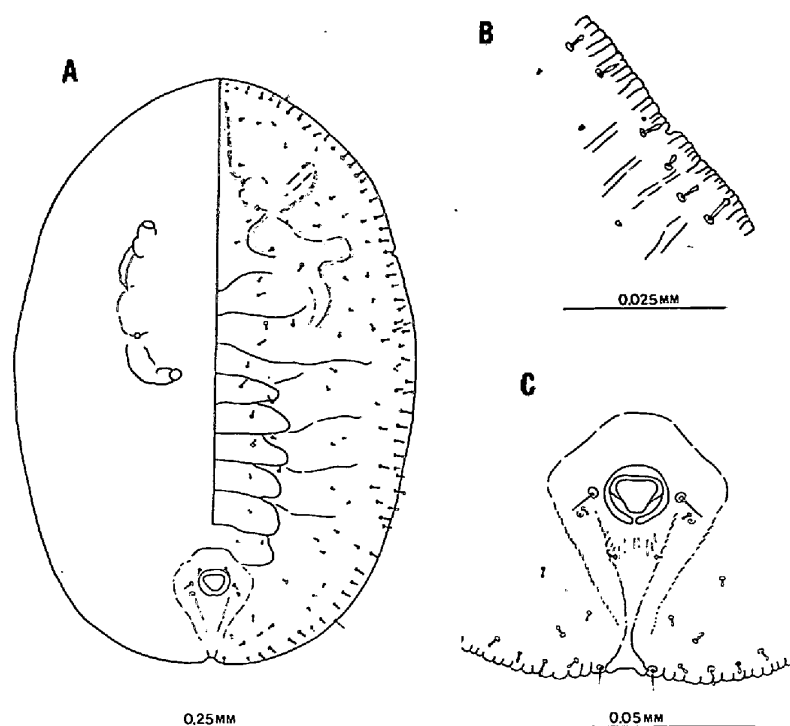


Fig. 2. *Rhachisphora koshunensis*. — A, Fourth instar; B, tracheal pore area; C, posterior area.

six pointed lanceolate setae arranged in a single row along the whole margin.

*Notes.* MARTIN (1985) placed *ardisiae* in *Rhachisphora* based upon a single specimen. The authors checked their specimens with the type material in TARI; because of the presence of distinct rhachis on the abdomen, it is doubtless that the species should be placed in *Rhachisphora*. Puparia were not common on the undersides of leaves. The cephalothorax of 2 specimens from Hapan were perforated by T-shaped emergence slit of the adult, but no adults were observed. Wax secretions were not visible, and no ant attendance was observed.

*Host plants.* Myrsinaceae: *Ardisia (Bladhia)* sp., \**Maesa* sp.

*Specimens examined.* Hapan: 6 pupal cases on undetermined host, 8–VIII–1989 (C. C. Ko coll.); Nanjenshan: 1 pupal case on *Maesa* sp., 24–II–1990 (C. C. Ko coll.) (All in NTU).

### *Rhachisphora koshunensis* (TAKAHASHI, 1933)

(Figs. 2, 10, 21–23)

*Dialeurodes (Rachisphora [sic]) koshunensis* TAKAHASHI, 1933, 6–7.

*Distribution.* Taiwan (Chiai, \*Chuyunshan, \*Kentingkunyaen, Kueitzuchiaio, Ouluanpi).

*Identification of pupal case.* This species is characterized by abdominal rhachis

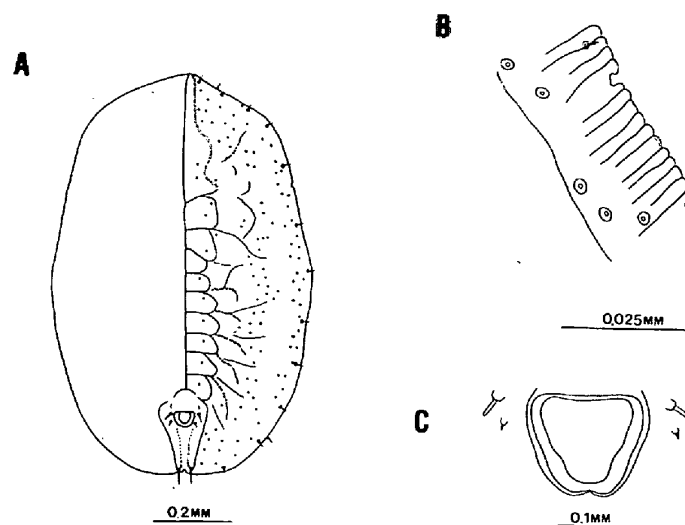


Fig. 3. *Rhachisphora machili*. — A, Fourth instar; B, tracheal pore area; C, posterior area.

distinct, without denticles, and not reaching the margin. Many short knobbed setae and fewer somewhat lanceolate setae arranged nearly in a row along the margin.

*Notes.* The puparia were found in moderate numbers on the undersides of leaves. The cephalothoraces of many specimens from Chyunshan were perforated by an irregular emergence hole of a parasite. In Kentingkyuen, only a few adults were observed. Wax secretions were not prominent, light yellow, and no ant attendance was observed.

*Host plants.* Lauraceae: \**Cinnamomum insulari-montanum*; *Cinnamomum reticulatum*; *Cinnamomum zeylanicum*; *Machilus* sp.

*Specimens examined.* Kentingkyuen: 17 pupal cases on *Cinnamomum reticulatum*, 22-I-1990 (W. J. WU coll.); Chyunshan: 19 pupal cases on *Cinnamomum insulari-montanum*, 25-IV-1990 (C. C. KO coll.) (All in NTU).

### *Rhachisphora machili* (TAKAHASHI, 1932)

(Figs. 3, 11)

*Dialeurodes* (*Rachisphora* [sic]) *machili* TAKAHASHI, 1932, 16-18.

*Distribution.* Taiwan (Chihpenwenchuan, Chinyang, Hsintien, \*Houtung, \*Linchang, \*Lotung, \*Nanjenshan, Tungshih, Wulai, Yangmingshan).

*Identification of pupal case.* This species is characterized by cephalothorax with a shallow median ridge and 2 pairs of very short truncate setae. Abdominal rhachis eminent, not reaching the margin, with some small blunt rounded chitinized denticles. Twenty-four very short lanceolate setae arranged in a row along the

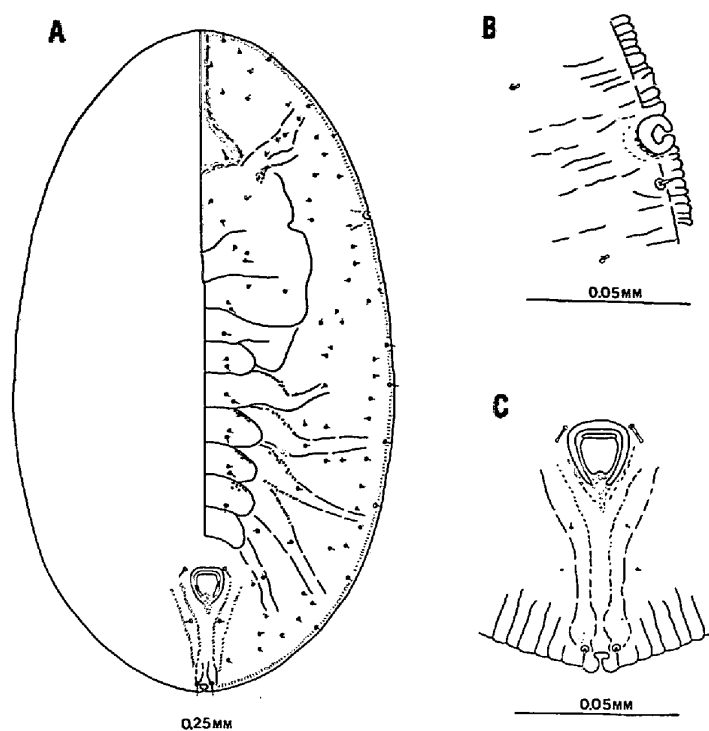


Fig. 4. *Rhachisphora maesae*. — A, Fourth instar; B, tracheal pore area; C, posterior area.

whole margin, reaching a little beyond the margin. Antennae fairly long, somewhat extending beyond the margin.

*Notes.* This species is not abundant on *Machilus*. Examination of materials collected at Linchang proved that there are many specimens perforated by emergence holes of parasites. No wax secretions were found, and no ant attendance was observed.

*Host plants.* Lauraceae: \**Machilus kusanoi*; *Machilus* sp.

*Specimens examined.* Chihpenwenchuan: 4 pupal cases on *Machilus* sp., 26-IX-1989 (C. C. Ko coll.); Houtung: 1 pupal case on *Machilus kusanoi*, 30-VII-1986 (C. C. Ko coll.); Hsintien: 2 pupal cases on *Machilus* sp., 7-II-1987 (C. C. Ko coll.); Linchang: 8 pupal cases on *Machilus* sp., 25-II-1990 (C. C. Ko coll.); Lotung: 2 pupal cases on *Machilus* sp., 15-II-1990 (C. C. Ko coll.); Nanjenshan: 1 pupal case on undetermined host, 24-II-1990 (C. C. Ko coll.) (All in NTU).

### *Rhachisphora maesae* (TAKAHASHI, 1932)

(Figs. 4, 12, 17, 24-27)

*Dialeurodes* (*Rachisphora* [sic]) *maesae* TAKAHASHI, 1932, 18-19.

*Distribution.* Taiwan (\*Chiaochiwenchuan, \*Chuyunshan, \*Jihyuetan, \*Longtung, \*Lushanwenchuan, \*Nanshanchi, \*Shuanglienpei, Wulai, \*Wushe).

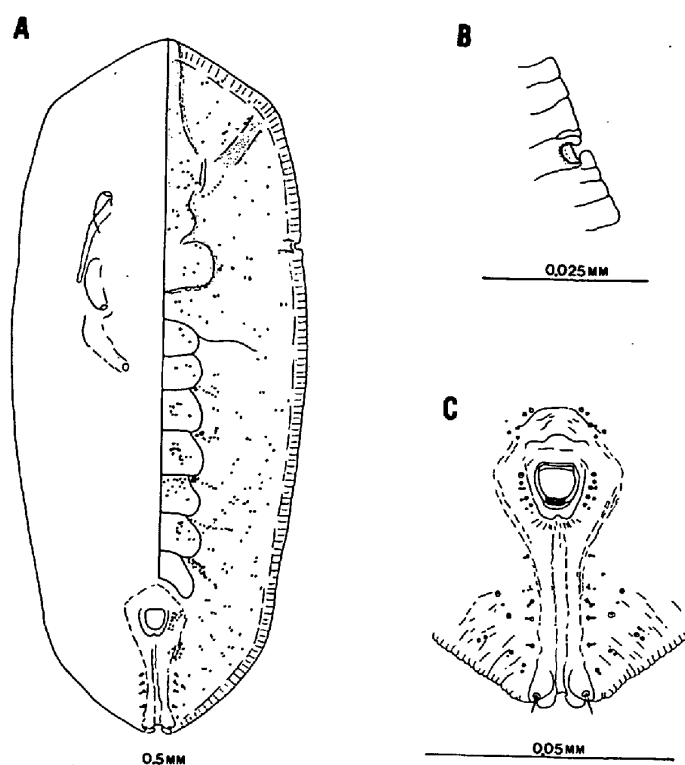


Fig. 5. *Rhachisphora reticulata*. — A, Fourth instar; B, tracheal pore area; C, posterior area.

*Identification of pupal case.* This species is characterized by abdominal rhachis much developed, nearly reaching its culmination; some small blunt chitinized denticles present. Dorsum with faint small polygonal markings. Thirteen paired setae arranged in a single row along the margin, reaching beyond the margin. Caudal margin of vasiform orifice forming a projection.

*Notes.* This species is widely distributed in Taiwan. They are occasionally found with *Aleurotuberculatus* sp. on the undersides of leaves. In the materials collected at Chutyuhu, Jihyuetan, Nanjenshan and Nanshanchi, there are a few emergence holes of parasites. Wax secretions were not prominent, and no attending ant was observed.

*Host plants.* Myrsinaceae: *Maesa japonica*; \**Maesa tenera*.

*Specimens examined.* Chiaochiwenchuan: 6 pupal cases on *Maesa* sp., 14-II-1990. (C. C. Ko coll.); Chutyuhu: 3 pupal cases on undetermined host, 12-VI-1990 (C. C. Ko coll.); Chuyanshan: 2 pupal cases on *Maesa tenera*, 26-IV-1990 (C. C. Ko coll.); Jihyuetan: 5 pupal cases on *Maesa japonica*, 23-XII-1985 (C. C. Ko coll.); Longtung: 8 pupal cases on *Maesa* sp., 17-II-1990 (C. C. Ko coll.); Lushanwenchuan: 10 pupal cases on *Maesa* sp., 28-X-1989 (C. C. Ko coll.); Nanjenshan: 2 pupal cases on *Maesa* sp., 24-II-1990 (C. C. Ko coll.); Nanshanchi:

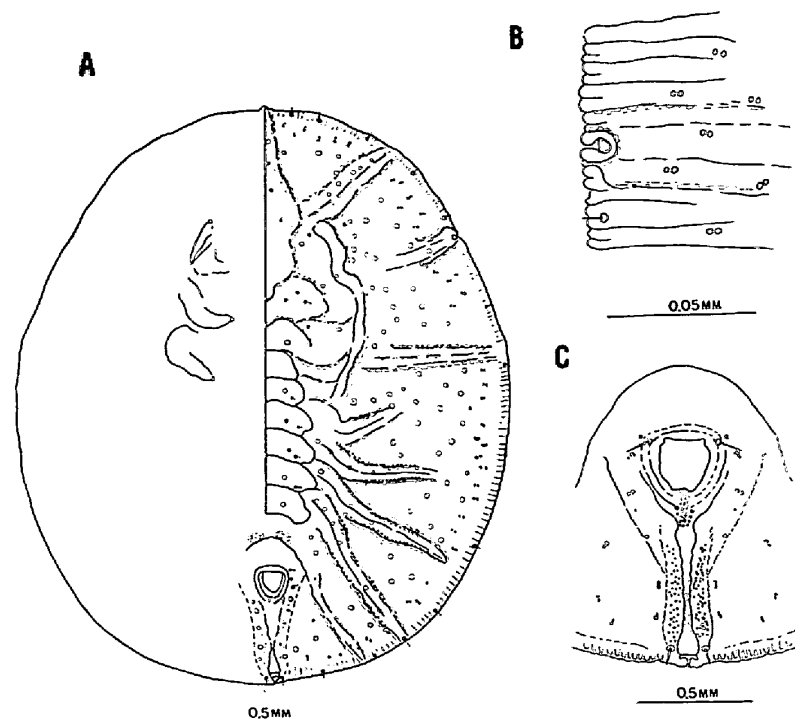


Fig. 6. *Rhachisphora alishanensis* n. sp. — A, Fourth instar; B, tracheal pore area; C, posterior area.

6 pupal cases on *Maesa* sp., 28-X-1989 (C. C. Ko coll.); Shuanglienpei: 2 pupal cases on *Maesa* sp., 15-II-1990 (C. C. Ko coll.); Wulai: 7 pupal cases on *Maesa* sp., 8-II-1987 (C. C. Ko coll.); Wushe: 3 pupal cases on *Maesa tenera*, 6-IX-1986 (C. C. Ko coll.) (All in NTU).

### *Rhachisphora reticulata* (TAKAHASHI, 1933)

(Figs. 5, 28-29)

*Dialeurodes* (*Rachisphora* [sic]) *reticulata* TAKAHASHI, 1933, 7-8.

*Distribution.* Taiwan (Kanko, \*Nanjenshan).

*Identification of pupal case.* This species is readily interpretable by the pupal case much elongated in outline, more than twice as long as wide. A pair of ridges present on cephalothorax, diverging anteriorly. Abdominal ridges a little developed, short, not reaching the margin. Dorsum densely with numerous small irregular cells and seemingly reticulated; many small rounded chitinized papillae present on dorsum, most of them being paired.

*Notes.* This species is comparatively rare on the undersides of leaves. Only one specimen has been collected together with moderate number of *Dialeurodes* sp. on the host plant. Wax secretions were not visible, and no ant attendance was observed.



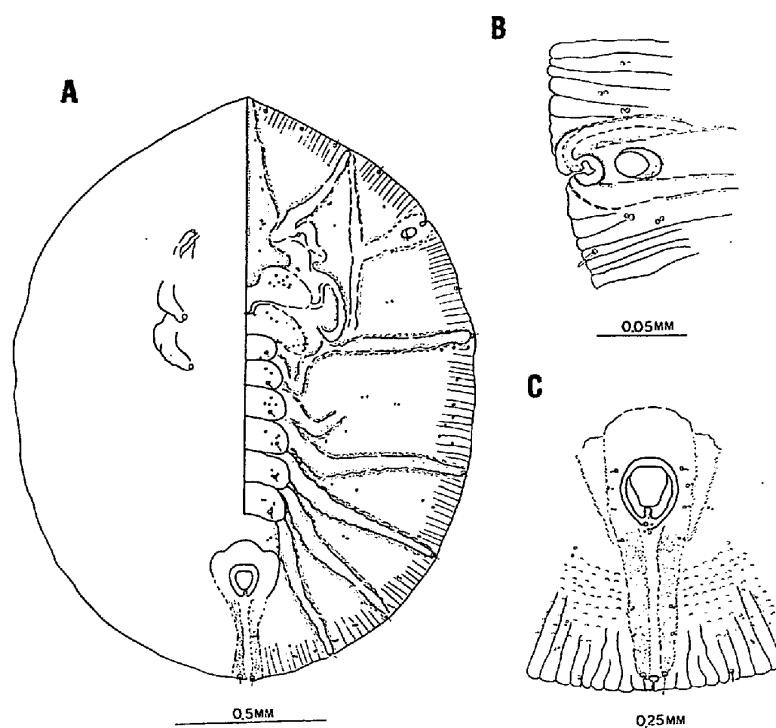


Fig. 7. *Rhachisphora sanhsianensis* n. sp. — A, Fourth instar; B, tracheal pore area; C, posterior area.

*Host plants.* Lauraceae: \**Beilschmiedia erythrophloia*; *Machilus* sp.

*Specimens examined.* Nanjenshan: 1 pupal case on *Beilschmiedia erythrophloia*, 24-II-1990 (C. C. Ko coll.) (NTU).

***Rhachisphora alishanensis*<sup>1)</sup> Ko, n. sp.**

(Figs. 6, 13, 18, 30-33)

**Pupal case.** Light brown to dark brown, oval, slightly pointed anteriorly, 1.88 mm long, 1.62 mm wide, widest at about abdominal segment I. Margin crenate, slightly emarginate between terminations of ridges. Thoracic and caudal tracheal openings each composed of an outer ring, heavily chitinized, and within the ring there is a smaller pore opening, with 2 small pointed teeth; internal margin with several minute teeth on the mesal side, armed with a semicircular sinus. Anterior and posterior marginal setae present, very fine.

**Dorsum.** Whole of dorsum bearing disc pores densely and evenly and many smaller paired pores sparsely scattered on the subdorsum area. Cephalothorax with a prominent median ridge on the anterior part, and a pair of ridges extending midway to the margin; a pair of longitudinal, heavily chitinized folds extending to the 2nd abdominal ridges, forming a distinct segment on cephalothorax. Two

1) *Alishanensis* — derived from geographic name, indicating the type locality Alishan.

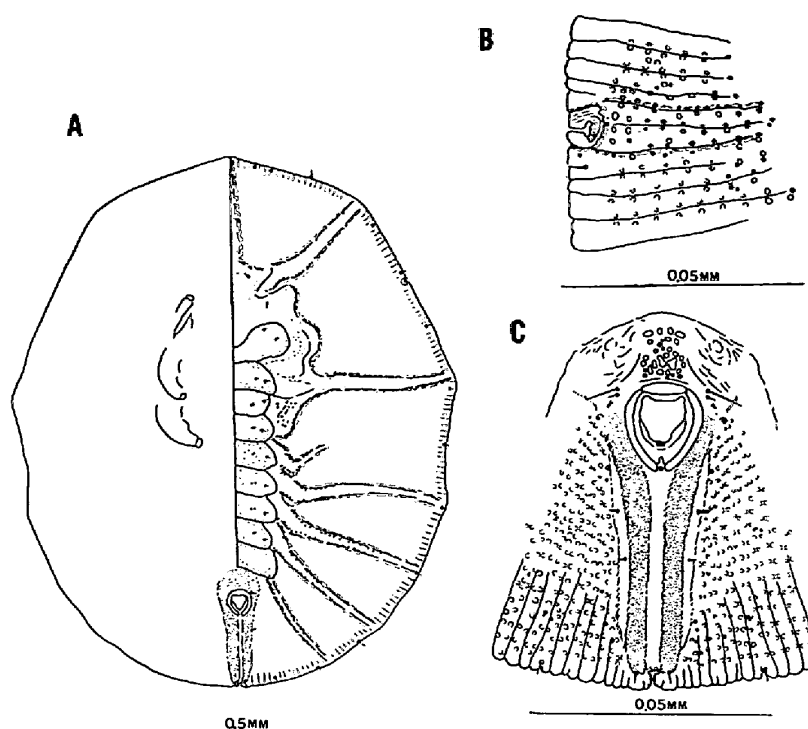


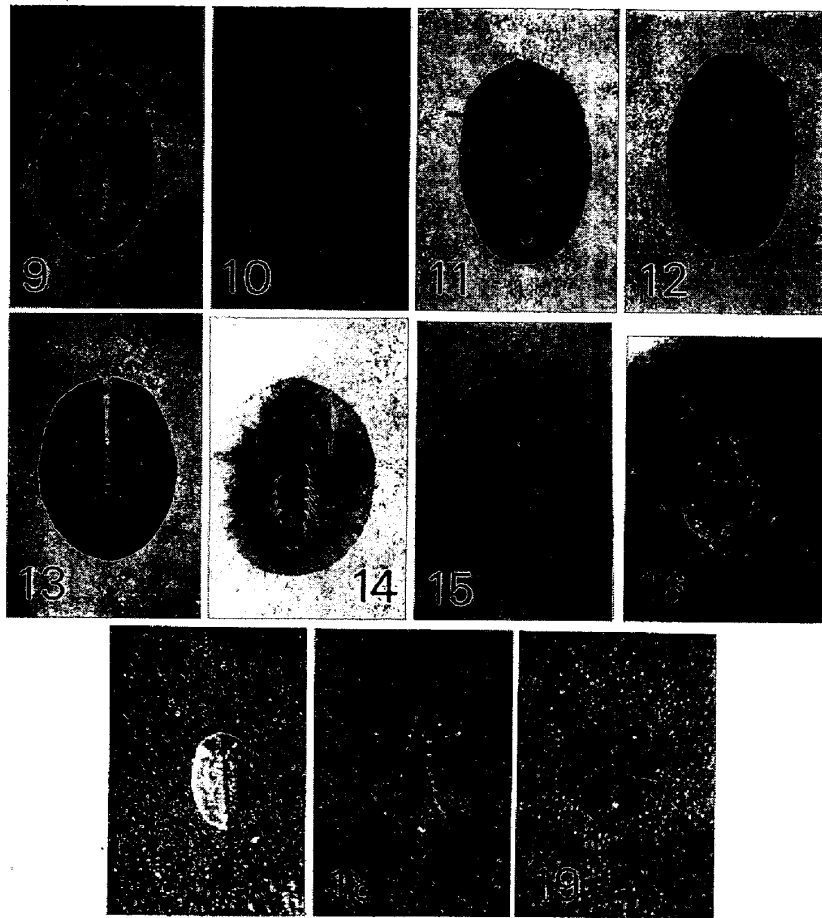
Fig. 8. *Rhachisphora taiwana* n. sp. — A, Fourth instar; B, tracheal pore area; C, posterior area.

pairs of very short lanceolate setae on the median area of each of cephalo- and mesothorax. Longitudinal moulting suture reaching the margin, transverse moulting suture reaching the longitudinal fold. Abdominal ridges eminent, with numerous very short blunt chitinized denticles on each margin, reaching margin. Abdominal segment distinct, 2–5 segments each with a pair of similar lanceolate setae near the hind margin. Twelve pairs of very short pointed-lanceolate setae arranged in a single row along the whole margin, equal in length, reaching a little beyond the margin, and 5 pairs of them are on the cephalothorax. Caudal setae the same as submarginal setae. Vasiform orifice subcordate, longer than wide, narrowed towards the hind end, notched at the hind end, without teeth, its caudal margin forming a projection. Operculum slightly longer than wide, somewhat narrowed on the posterior part, indented on the hind margin, filling most of the orifice. Caudal furrow distinct, expanding basally, with densely cuticular markings. Caudal ridges distinct, without markings. Lingula exposed.

Venter. Thoracic tracheal and caudal folds conspicuous, without spinules, caudal folds as wide as vasiform orifice. Antennae situated mesad of front legs.

*Holotype pupal case.* Taiwan, Alishan, on *Eurya strigillosa* (Theaceae), 26–IV–1990 (C. C. Ko coll.) (NTU).

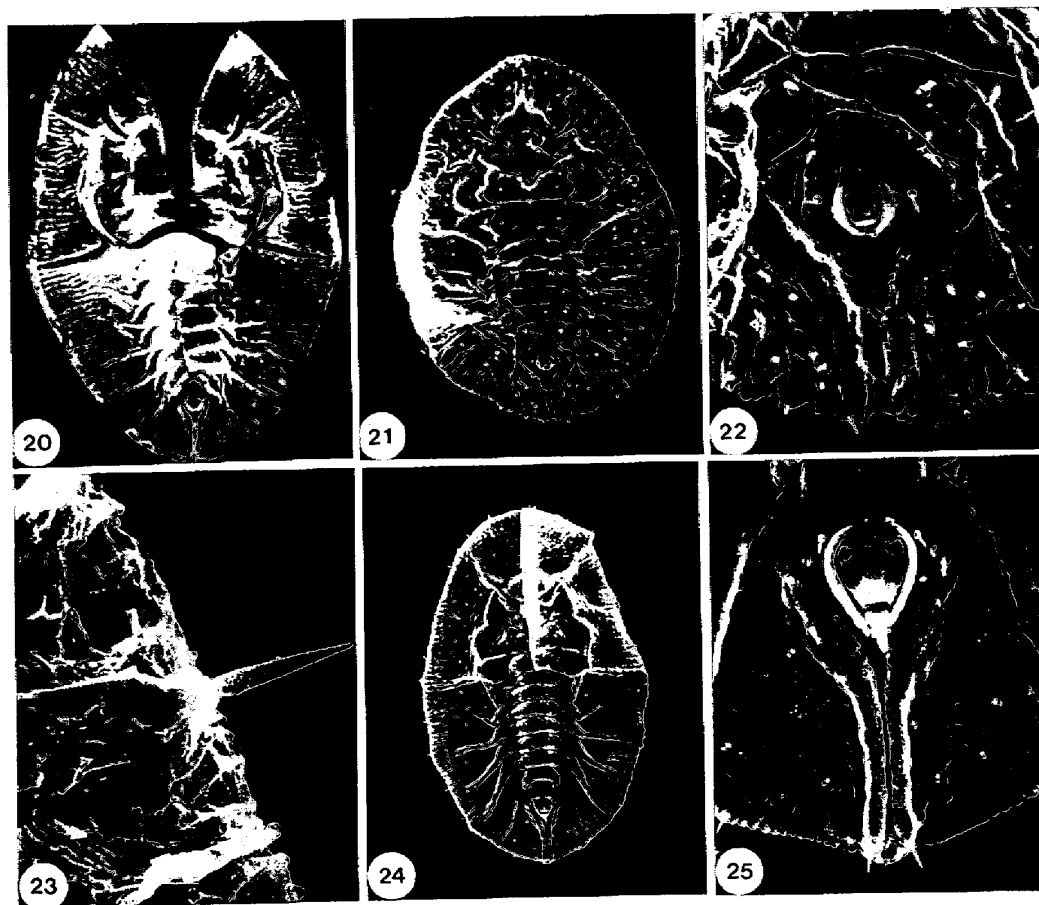
*Paratype pupal cases.* Taiwan, Alishan, 94 pupal cases (on 50 microscope slides), same data as holotype (BMNH; HBL; NTU; TARI; TNSM); 3 pupal



Figs. 9–19. *Rhachisphora* spp., 4th instar. — 9, *R. ardisiae*; 10, *R. koshunensis*; 11, *R. machili*; 12, *R. maesae*; 13, *R. alishanensis* n. sp.; 14, *R. sanhsianensis* n. sp.; 15, *R. taiwana* n. sp.; 16, *R. koshunensis*; 17, *R. maesae*; 18, *R. alishanensis* n. sp.; 19, *R. taiwana* n. sp.

cases (on 3 microscope slides), Chika, on undetermined host, 2–VII–1989 (C. C. Ko coll.) (NTU); 21 pupal cases (on 17 microscope slides), Tatachia-anpu, on *Eurya strigillosa*, 27–IV–1990 (C. C. Ko coll.) (NTU).

**Biology.** This species is apparently host-specific. Color in life varies from wholly light brown to dark brown on the dorsum especially on the rhachis. The pupal case is much convex, with rhachis rising up very obviously to the naked eye. The puparia are found abundantly on the upper surface of mature leaves. Examination of materials collected at Alishan and Tatachia-anpu proves that there were many adults. The cephalothoraces of many specimens are perforated by the T-shape emergence slits of the adults, and many irregular emergence holes of parasites were observed. Wax secretions are not prominent. No ants were seen in attendance.



Figs. 20–25. *Rhachisphora* spp. — 20, *R. ardisiae*, 4th instar; 21, *R. koshunensis*, 4th instar; 22, *do.*, posterior area; 23, *do.*, submarginal seta; 24, *R. maesae*, 4th instar; 25, *do.*, posterior area.

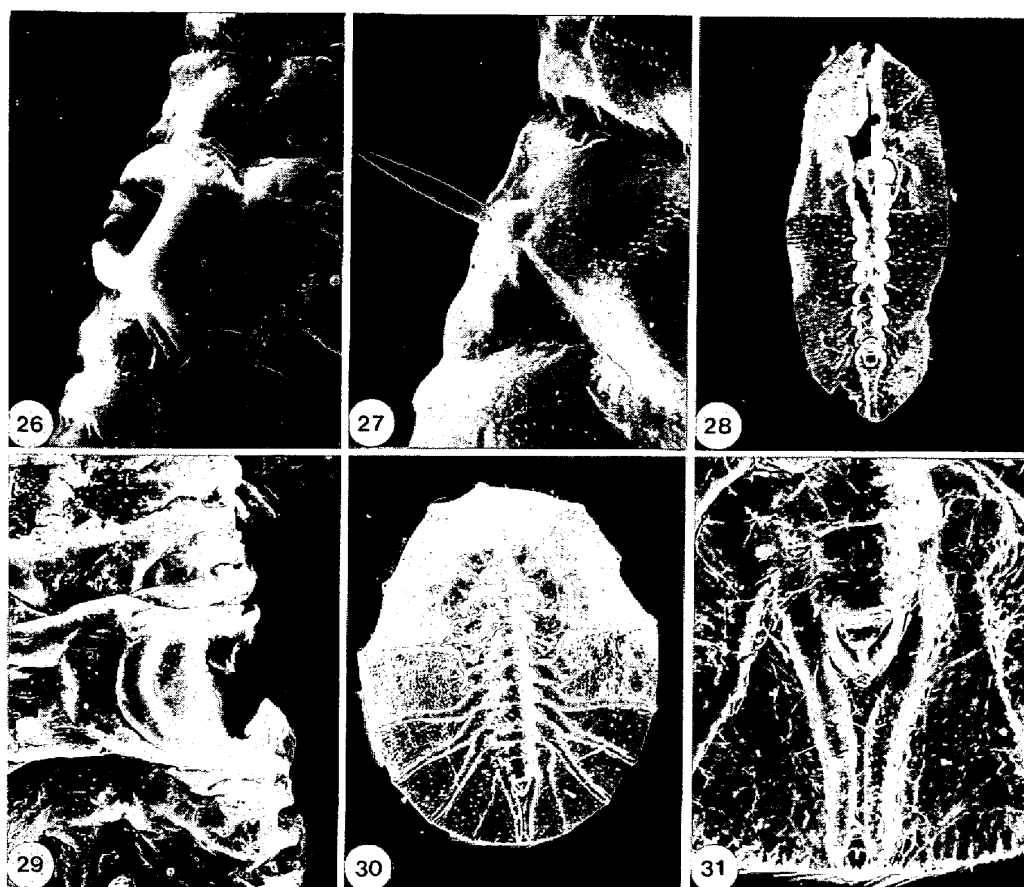
*Rhachisphora sanhsianensis*<sup>2)</sup> KO, n. sp.

(Figs. 7, 14, 34–37)

Pupal case. Dark brown to dark black. Oval, 1.91 mm long, 1.54 mm wide, widest at about abdominal segment I. Margin crenate, slightly emarginate between terminations of ridges. Thoracic tracheal openings peculiar, within margin, forming an outer ring, within which there is a small pore; 2 very small pointed teeth present; internal margin with several very minute teeth on the mesal side, armed with an egg-shaped sinus. Caudal tracheal opening similar to thoracic tracheal one, but without sinus. Anterior and posterior marginal setae present, very slender.

Dorsum. Cephalothorax with a prominent median ridge on the anterior part, a pair of prominent longitudinal folds extending to the first abdominal ridge. Lon-

2) *Sanhsianensis* — derived from geographic name, indicating the type locality Sanhsian.



Figs. 26–31. *Rhachisphora* spp. — 26, *R. maesae*, tracheal pore area; 27, *do.*, submarginal seta; 28, *R. reticulata*, 4th instar; 29, *do.*, tracheal pore area; 30, *R. alishanensis*, 4th instar; 31, *do.*, posterior area.

gitudinal moulting suture reaching the margin, transverse moulting suture forming distinct segments on cephalothorax. Abdominal ridges eminent, without denticles, reaching margin; a pair of stout setae on the hind end of each segment, some minute disc pore sparsely scattered. Eleven pairs of short lanceolate submarginal setae arranged in a single row along the whole margin, six pairs of them being on cephalothorax, the 6th–10th pairs located on each culmination of ridges. Vasiform orifice subcordate, a little longer than wide, narrowed towards the hind end, notched at the hind end, without teeth, its caudal margin showing a median tubercle. Operculum slightly longer than wide, somewhat narrowed on the front and hind margins, filling most of the orifice. Lingula not exposed. Caudal furrow distinct, expanded basally, with densely cuticular markings, much chitinized on each side, caudal ridge distinct, without markings.

*Holotype pupal case.* Taiwan, Sanhsian, on *Machilus kusanoi* (Lauraceae), 22–VI–1990 (C. C. Ko coll.) (NTU).

*Paratype pupal cases.* Taiwan, Sanhsian, 8 pupal cases (on 8 microscope slides),

same data as for holotype (BMNH; HBL; NTU; TARI; TNSM); 81 pupal cases (on 24 microscope slides) on *Machilus kusanoi*, Wulai, 13-VIII-1991 (C. C. Ko coll.) (NTU).

*Biology.* This species is apparently host-specific. The pupal case is much convex, more conspicuous along dorsal ridges, and very obvious to the naked eye. The puparia are found in moderate numbers singly scattered on the upper side of each mature leaf, with the color dark brown in life in contrast to the dark green color of the host plant; they are cryptic in life and not easily detected. There were also *Dialeurodes kuraruensis* (TAKAHASHI) found on the upper surface of the same host. In the materials collected at Wulai, there were many irregular emergence holes of parasites. Wax secretions were not visible. No ant attendance was observed.

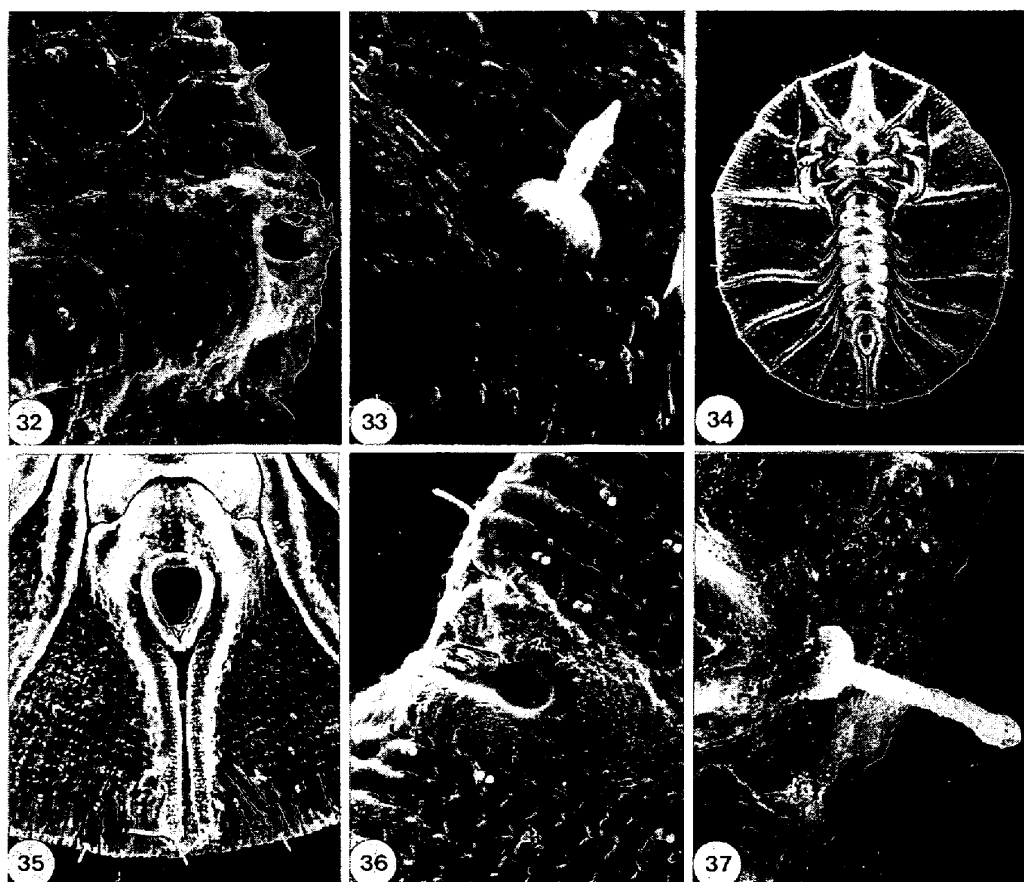
*Rhachisphora taiwana*<sup>3)</sup> KO, n. sp.

(Figs. 8, 15, 19, 38-42)

*Pupal case.* Color variable from brown to black, darker on cephalothorax and 2nd-8th abdominal segments, but light brown on 1st-2nd abdominal segments and median area. Oval, pointed anteriorly, 1.72 mm long, 1.47 mm wide, widest at about abdominal segment I. Margin crenate, slightly emarginate between terminations of ridges. Thoracic and caudal tracheal openings each composed of an outer ring, heavily chitinized, within which there is a small pore, with 2 very small pointed teeth, inner margin armed with small teeth. Anterior and posterior marginal setae present, hair-like, longer than submarginal setae.

*Dorsum.* Whole of dorsum covered with a large number of evenly minute tubercle-like structure. Cephalothorax with a prominent bulging median ridge extending to the anterior part, a pair of longitudinal chitinized fold extending to the 1st abdominal segment, which forms a distinct segment on cephalothorax. Four pairs of very short lanceolate setae on the median area of cephalothorax, each pair of them being on cephalus, pro-, meso- and metathoraces respectively. Longitudinal moulting suture reaching the margin, transverse moulting suture reaching the longitudinal fold. Abdominal ridges eminent, with many very short blunt chitinized denticles on each margin, 1st-2nd and 3rd-6th ridges reaching margin. Abdominal segments distinct, with 1 pair of small setae on each hind margin and 1 pair of paired pores on the middle. Twelve pairs of short pointed lanceolate submarginal setae arranged in a single row along the whole margin, all equal in length, reaching slightly beyond the margin; 6 pairs of them on cephalothorax. Vasiform orifice subcordate, longer than wide, narrowed towards the hind end, notched at the hind end, without teeth, its caudal margin showing a median tubercle. Operculum slightly longer than wide, somewhat narrowed on the posterior part, indented on the front and hind margin, filling most of the orifice.

3) *Taiwana* — derived from geographic name, indicating Taiwan.



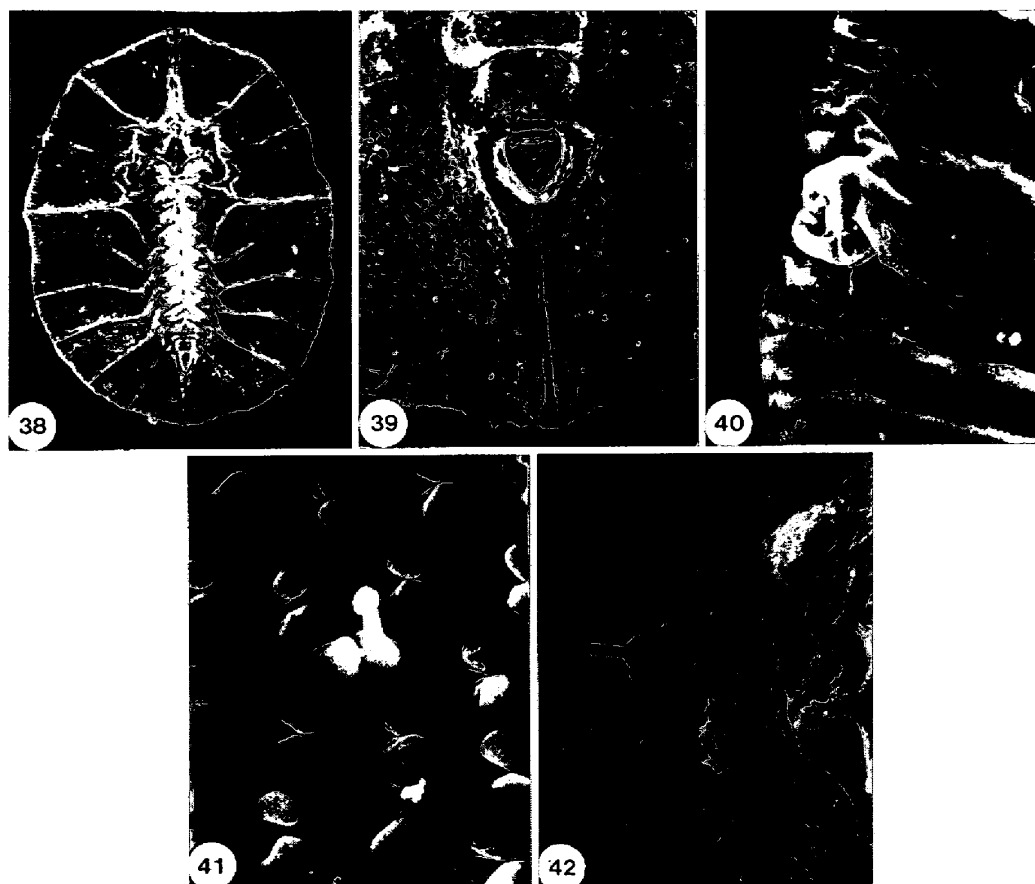
Figs. 32–37. *Rhachisphora* spp. — 32, *R. alishanensis*, tracheal pore area; 33, *do.*, submarginal seta; 34, *R. sanhsianensis*, 4th instar; 35, *do.*, posterior area; 36, *do.*, tracheal pore area; 37, *do.*, submarginal seta.

Lingula a little exposed, ringed with fine hairs. Caudal furrow distinct, slightly expanded basally, with dense cuticular markings, much chitinized on each side, 2 pairs of capitate setae on margin. Caudal ridge distinct, with fewer markings.

*Holotype pupal case.* Taiwan, Tengchih, on *Schima superba* (Theaceae), 1–XI–1989 (C. C. Ko coll.) (NTU).

*Paratype pupal cases.* Taiwan, Tengchih, 19 pupal cases (on 10 microscope slides), same data as for holotype (BMNH; HBL; NTU; TARI; TNSM); 6 pupal cases (on 6 microscope slides) on *Schima superba*, Tengchih, 24–IV–1990 (C. C. Ko coll.) (NTU); Chochi, 10 pupal cases (on 9 microscope slides) on undetermined host, 24–I–1991 (Y. C. SHIAU coll.) (NTU); 26 pupal cases (on 16 microscope slides), Nanjenshan, on *Litsea acuminata* (Lauraceae), 24–II–1990 (C. C. Ko coll.) (NTU); 9 pupal cases (on 6 microscope slides) on *Gordonia axillaris* (Theaceae), Paling, 14–II–1887 (C. C. Ko coll.) (NTU).

*Biology.* This species is apparently scabrous and convex, much the same as *R. alishanensis* and *R. sanhsianensis*. The puparia are found in moderate



Figs. 38–42. *Rhachisphora taiwana*. — 38, Fourth instar; 39, *do.*, posterior area; 40, *do.*, tracheal pore area; 41, *do.*, cephalic seta; 42, *do.*, submarginal seta.

numbers singly on the underside of each mature leaf. In the materials collected at Chochi, Nanjenshan and Tengchih, there are many irregular emergence holes of parasites. Examination of materials collected at Tengchih proves that there are few *Aleuroplatus* sp. Wax secretions are not prominent, if present, forming a perpendicular column. No ant attendance was observed.

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### Index of geographic names

- |   |  |
|---|--|
| Alishan (阿里山, 2,200 m) (Chiai Hsien)          | Longtung (龍洞) (Taipei Hsien)                     |
| Chiai (嘉義市) (Chiai City)                      | Lotung (羅東) (Ilan Hsien)                         |
| Chiaochiwenchuan (礁溪溫泉) (Ilan Hsien)          | Lushanwenchuan (廬山溫泉, 1,400 m)<br>(Nantou Hsien) |
| Chihpenwenchuan (知本溫泉, 150 m) (Taitung Hsien) | Nanjenshan (南仁山, 412 m) (Pintung Hsien)          |
| Chika (七卡, 2,463 m) (Taichung Hsien)          | Nanshanchi (南山溪, 400 m) (Nantou Hsien)           |
| Chinyang (金洋, 100 m) (Ilan Hsien)             | Ouluanpi (鵝鑾鼻) (Pintung Hsien)                   |
| Chochi (卓溪) (Hualien Hsien)                   | Paling (巴陵, 800 m) (Taoyuan Hsien)               |
| Chutyuhu (竹子湖, 634 m) (Taipei City)           | Sanhsian (三峽) (Taipei Hsien)                     |
| Chuyunshan (出雲山, 1,700 m) (Kaohsiung Hsien)   | Shuanglienpei (雙連碑, 500 m) (Ilan Hsien)          |
| Hapan (哈盆, 500 m) (Ilan Hsien)                | Tatachia-anpu (塔塔加鞍部, 2,500 m) (Chiai Hsien)     |
| Houtung (侯硐) (Taipei Hsien)                   | Tengchih (藤枝, 1,510 m) (Kaohsiung Hsien)         |
| Hsintien (新店) (Taipei Hsien)                  | Tungshih (東勢, 650 m) (Taichung Hsien)            |
| Jihyuetan (日月潭, 750 m) (Nantou Hsien)         | Wulai (烏來, 350 m) (Taipei Hsien)                 |
| Kankou (乾溝) (Taipei Hsien)                    | Wushe (霧社, 1,100 m) (Nantou Hsien)               |
| Kentingkunyaen (墾丁公園, 250 m) (Pintung Hsien)  | Yangmingshan (陽明山, 1,000 m) (Taipei City)        |
| Kueitzuchiaio (龜子角) (Pintung Hsien)           |  |
| Linchang (林場) (Taitung Hsien)                 |  |

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