

## ADDITIONAL NOTES ON MALE GENITALIA OF RACHICERIDAE (DIPTERA)<sup>1</sup>

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*Abstract.* The male genitalia of 1 species of *Gymnorhachicerus* and 2 species of *Rachicerus* are described and illustrated and the validity of the former genus, which is monotypic, is established. A key to the living and fossil genera of Rachiceridae is given.

Nagatomi (1984) described and illustrated the male genitalia of Rachiceridae based on 2 species of *Rachicerus* Walker. This paper treats 2 additional species of *Rachicerus* plus the monotypic genus *Gymnorhachicerus* Frey.

I have not seen specimens of fossil Rachiceridae; the knowledge given in this paper is derived from Hennig (1938, 1967).

The geographical distribution of this family has been discussed by Hennig (1938, 1967) and Nagatomi (1982b).

*Abbreviations used in Fig. 1-17* are as follows: **B**, basistyle (=gonocoxite); **BDP**, basistylar dorsomesal anterior process (=gonocoxal apodeme); **C**, cercus; **CY**, "cylinder" between dorsohorizontal plane and posteroventral process (in aedeagus); **D**, dististyle (=gonostylus); **DB**, dorsal bridge; **DHP**, dorsohorizontal plane (=aedeagal dorsoanterior plate); **PA**, posterior part of aedeagus; **S10**, sternum 10; **T8**, tergum 8; **T9**, tergum 9; **VVP**, ventrovertical plane (=anterior bar of aedeagus or aedeagal apodeme).

### LIVING AND FOSSIL GENERA OF RACHICERIDAE

The genera of Rachiceridae are listed. Their diagnoses are given by Hennig (1938, 1967) and Nagatomi (1970, 1982c).

***Chrysothemis*** Loew, 1850, *Programm K. Realschule Mezeritz* 1850: 39 (type-species: *Chrysothemis speciosa* Loew, 1850, fossil from Baltic amber). This is a monotypic genus. It may possibly be a senior synonym of *Lophyrophorus* Meunier, 1902, but is treated here as a "nomen dubium" (after Hennig 1967).

***Gymnorhachicerus*** Frey, 1954, *Notul. Entomol.* 34: 7 (type-species: *Gymnorhachicerus pilosus* Frey, 1954, from Burma, by original designation). This is a monotypic genus.

***Lophyrophorus*** Meunier, 1902, *Ann. Sci. Nat. Zool., Paris* 16: 398 (type-species: *Lophyrophorus flabellatus* Meunier, 1902, fossil from Baltic amber). This is a monotypic genus.

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***Paleorachicerus*** Nagatomi, 1970, *Pac. Insects* 12: 420 [type-species: *Electra formosa* Loew, 1850, fossil from Baltic amber (automatic)]. This was a new name proposed for *Electra* Loew, 1850, *Programm K. Realschule Mezeritz* 1850: 39, which was preoccupied by *Electra* Lamouroux, 1816, and *Electra* Stephens, 1829. It was a monotypic fossil genus, but Frey (1954) added 1 new extant species (= *Electra relictus* Frey) based on 1♂, 1♀ from the Philippines. However, because the male antennal flagellum is broken off, it is uncertain if this living species is a true *Paleorachicerus*. In *Paleorachicerus relictus* (Frey), the metapleura are pilose. *Paleorachicerus* may be a junior synonym of *Lophyrophorus*, but it would be hasty to conclude this at present.

***Rachicerus*** Walker, 1854, *List Dipt. Br. Mus.* 5, Suppl. 1: 103 [type-species: *Rachicerus fulvicollis* Walker, 1854 from N America (USA: Georgia), by monotypy].

Synonyms:

*Antidoxion* Snellen van Vollenhoven, 1863, *Versl. Meded. K. Akad. Wet., Afd. Natuurkd.* 15: 1 (type-species: *Antidoxion fulvicornis* Snellen van Vollenhoven, 1863, from Java, by monotypy).

*Rhachicerella* Enderlein, 1912, *Mitt. Zool. Mus. Berlin* 16: 167 (type-species: *Rachicerus honestus* Osten Sacken, 1877, from N America, by original designation).

*Rhyphomorpha* Walker, 1861, *J. Proc. Linn. Soc. Lond.* 5: 275 (type-species: *Rhyphomorpha bilinea* Walker, 1861, from Molucca Is, by monotypy).

*Rachicerus* contains 66 species from the entire world but is not known from Africa, Australia, Chile, and Argentina. There are 6 species that are limited in distribution to New Guinea, New Britain, and the Molucca Is, and which are distinguished from the rest of *Rachicerus* by having the vein  $M_2$  absent or rudimentary (Nagatomi 1982c). The type-species of "*Rhyphomorpha*" (= *bilinea*) belongs to this group.

KEY TO LIVING AND FOSSIL GENERA OF RACHICERIDAE

- |        |                                                                                                                                                               |                                            |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| 1.     | Each segment of ♂ antennal flagellum with bifurcate lower process; ♀ antennal flagellum without lower process, neither pectinate nor serrate .....            | 2                                          |
|        | Each segment of ♂ antennal flagellum with lower process not bifurcate, simple; ♀ antennal flagellum with a row of lower processes, pectinate or serrate ..... | 3                                          |
| 2 (1). | Male antennal flagellum with inner lower processes much shorter than outer, more or less rudimentary .....                                                    | <b>Paleorachicerus</b> (= <i>Electra</i> ) |
|        | Male antennal flagellum with inner lower processes nearly as long as outer .....                                                                              | <b>Lophyrophorus</b>                       |
| 3 (1). | Metapleura pilose .....                                                                                                                                       | <b>Rachicerus</b>                          |
|        | Metapleura bare .....                                                                                                                                         | <b>Gymnorhachicerus</b>                    |

MALE GENITALIA OF RACHICERIDAE

The notes given below are an addition to Nagatomi (1984) in which the male genitalia of Rachiceridae are described and illustrated on the basis of 2 species of *Rachicerus* and the distinguishing family characters are mentioned.

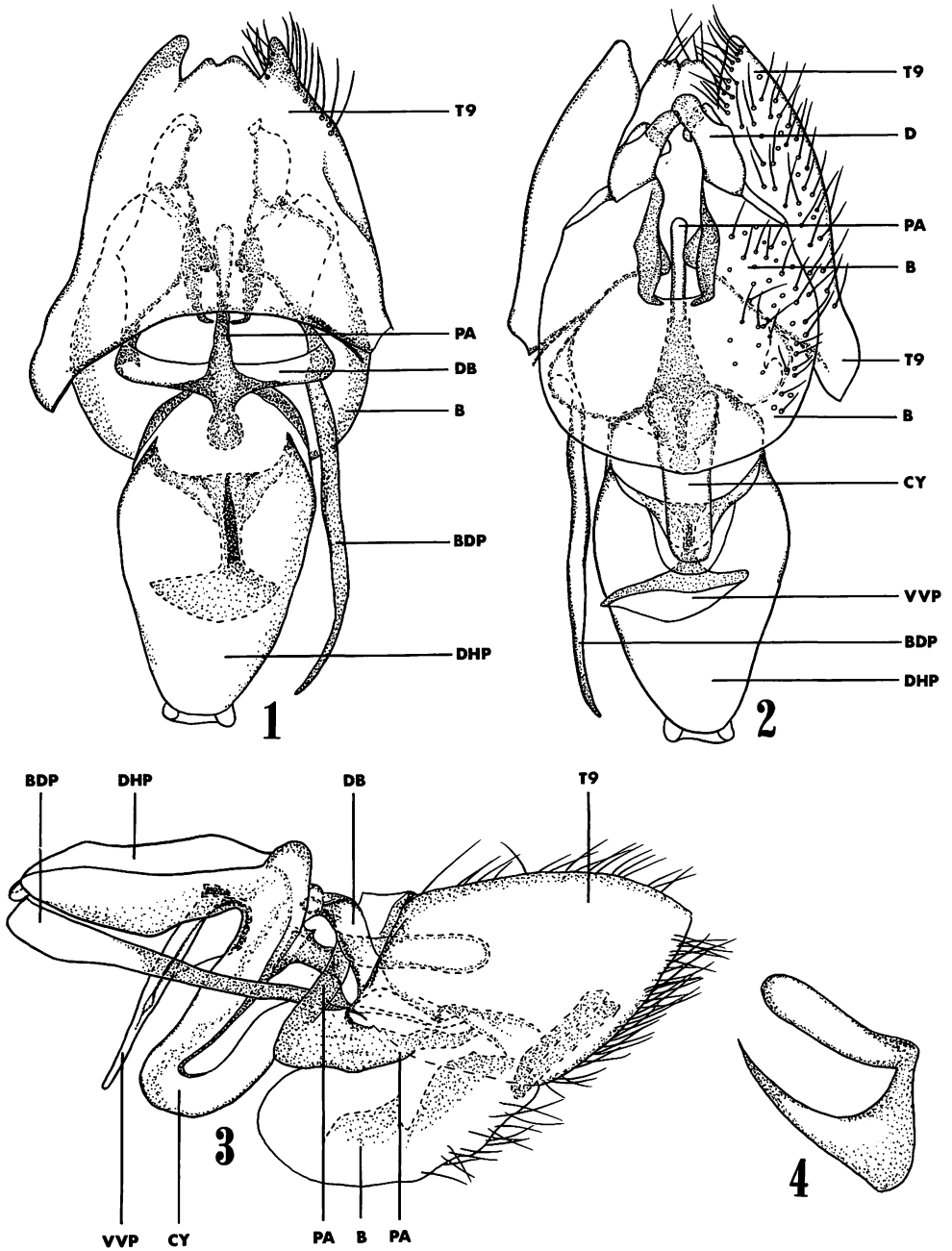


FIG. 1-4. *Gymnorhachicerus pilosus*, ♂: 1-3, genitalia (excluding tergum 8), dorsal, ventral and lateral views; 4, posterior part of aedeagus, lateral view. It must be noted that one of the basistylar dorsomesal anterior processes is broken off at anterior portion in Fig. 1-2 and the anterolateral margin of tergum 9 is not necessarily definite in outline in Fig. 3.

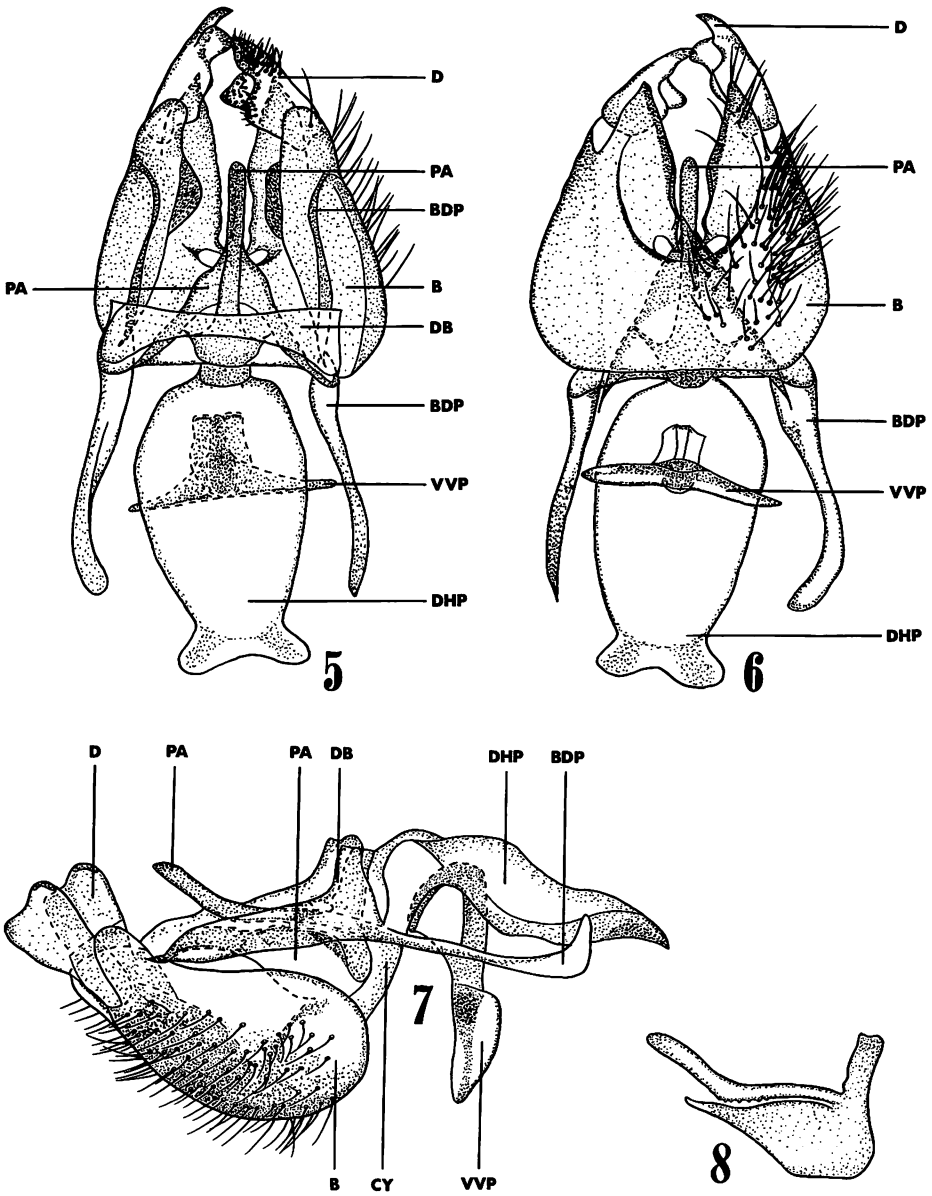


FIG. 5-8. *Rachicerus fluidus*, ♂: 5-7, genitalia (excluding terga 8-9, sternum 10 and cerci), dorsal, ventral and lateral views; 8, posterior part of aedeagus, lateral view.

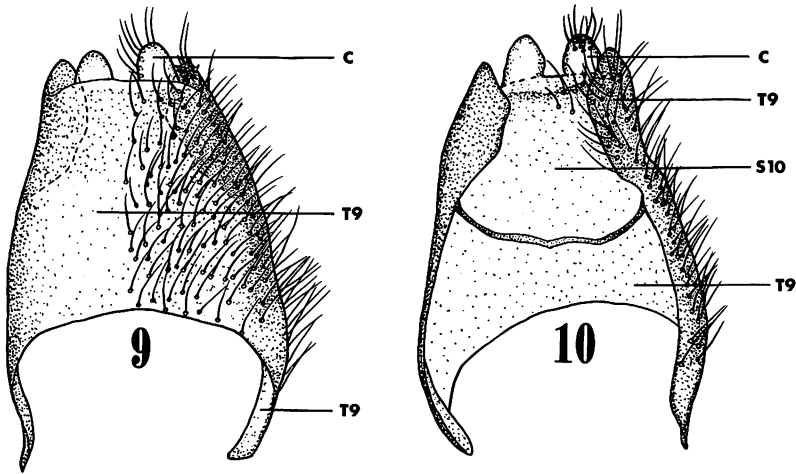


FIG. 9–10. *Rachicerus fluidus*, ♂: tergum 9, sternum 10 and cerci, dorsal and ventral views.

### Genus *Gymnorhachicerus*

Fig. 1–4

The male genitalia of *Gymnorhachicerus pilosus* are very different from those of *Rachicerus* (based on 4 species) and the following may form a sound generic diagnosis of *Gymnorhachicerus*.

Aedeagus with a long, strongly curved (=U-shaped) “cylinder” between dorsohorizontal plane and posteroventral process and 2 boltlike “tubes,” an upper one between dorsohorizontal plane and dorsal bridge and a lower one from anterodorsal part of “cylinder” to mid part between dorsal and ventral posterior processes. Posterolateral part of tergum 9 not developed ventromesally into a flap.

***Gymnorhachicerus pilosus*** Frey, 1954 (Fig. 1–4). Dististyle not flattened laterally, cylindrical. Basistylar dorsomesal anterior process gradually wider anteriorly (i.e., toward base of abdomen) before dorsal bridge (from a lateral view) and with a large rectangular part near dististyle (from a dorsal view); this rectangular part may correspond to or may be fused with apical outer membrane of basistyle developed dorsally. In posterior part of aedeagus, dorsal process flattened laterally and rounded posteriorly, ventral process conical, abruptly tapering posteriorly; dorsal and ventral processes subequal in length. Tergum 9 with posterolateral part protruding (i.e., with posterodorsal margin having a wide median concavity). Sternum 10 and cercus not examined.

*Specimen dissected.* 1♂ (paratype), BURMA: NE, Kambaiti, 1800 m, 17.VI.1934 (R. Malaise).

### Genus *Rachicerus*

Fig. 5–17 (cf. Fig. 5–14 in Nagatomi 1984)

Nagatomi (1984: 104) wrote, “Anterior part of sternum 10 consists of a pair of plates.” It is now uncertain whether or not this plate (or a thin sclerite in it) belongs to sternum 10.

Examination of 4 species [*galloisi* and *maai* in Nagatomi (1984), and *fluidus* Nagatomi

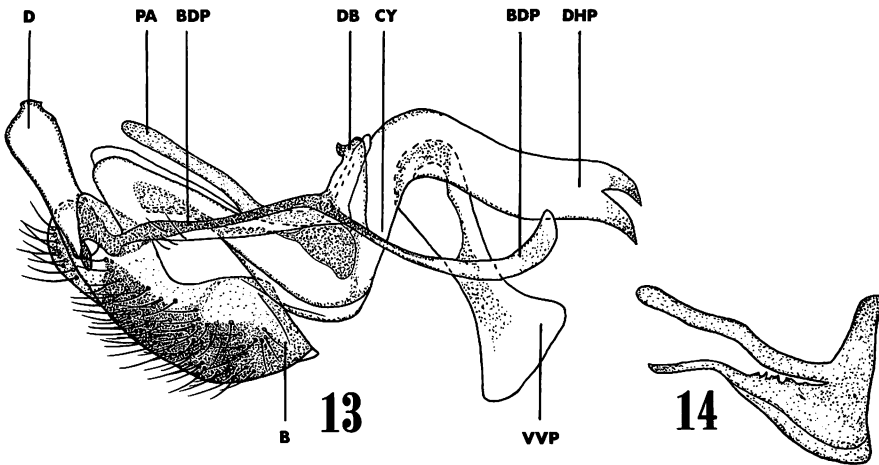
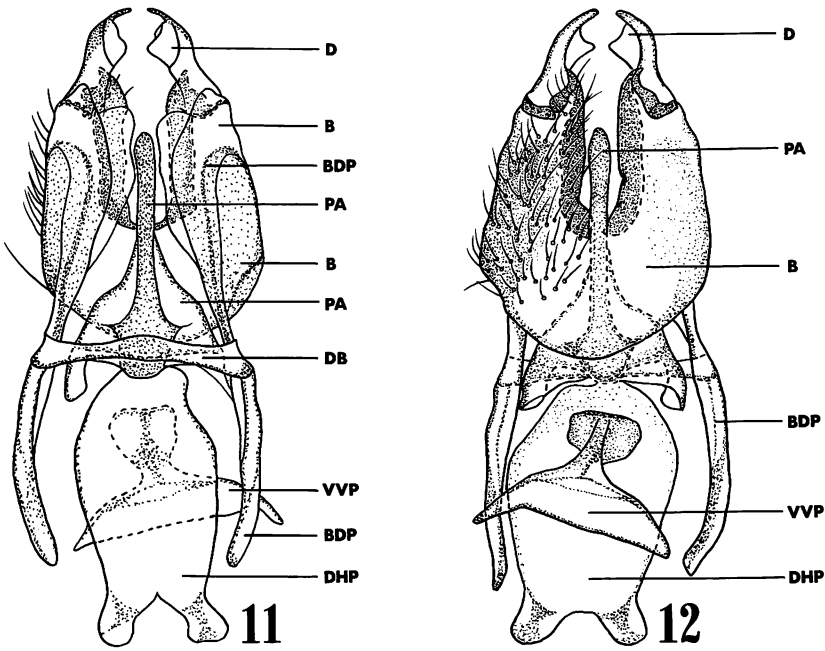


FIG. 11-14. *Rachicerus sakishimanus*, ♂: 11-13, genitalia (excluding terga 8-9, sternum 10 and cerci), dorsal, ventral and lateral views; 14, posterior part of aedeagus, lateral view.

and *sakishimanus* Nagatomi in this paper] has shown that the male genitalia are very similar to one another in general.

As described and illustrated by Nagatomi (1984), *galloisi* is easily distinguished from *maai* in male genitalia, but no definite difference is found between *maai* and *sakish-*

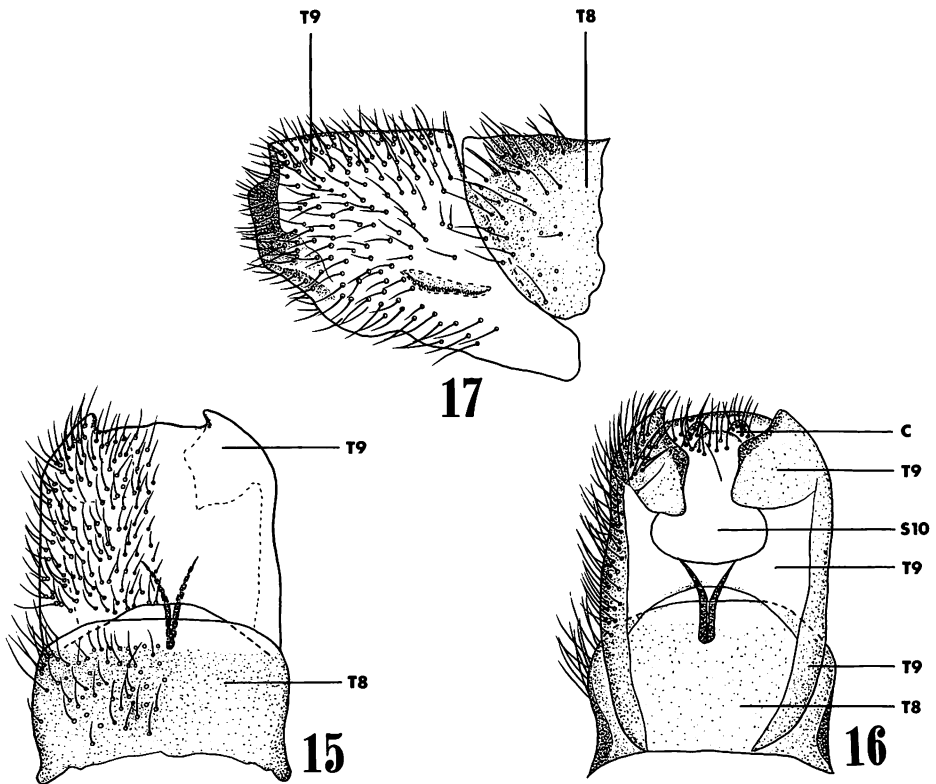


FIG. 15–17. *Rachicerus sakishimanus*, ♂: terga 8–9, sternum 10 and cerci, dorsal, ventral and lateral views.

*imanus*. The male genitalia of *fluidus* are very similar to those of *maai* and *sakishimanus*, although the former can be separated from the latter 2 in some minor respects.

The male genitalia of *Rachicerus* are very different from those of *Gymnorhachicerus* in the following respects: in aedeagus, the “cylinder” between posteroventral process and dorsohorizontal plane is short and straight; there are no boltlike “tubes” between dorsal bridge or posterior process and dorsohorizontal plane; posterolateral part of tergum 9 is developed ventromesally into a flap.

***Rachicerus fluidus*** Nagatomi, 1970 (Fig. 5–10). The male genitalia of this species are similar to those of *sakishimanus* but may be distinguished from the latter as follows: in posterior part of aedeagus, ventral process without a row of dentations but dorsal process with a row of dentations at middle of ventral margin; in posterolateral part of tergum 9, a flap developed ventromesally may be narrower than in *sakishimanus*. Cercus protrudes beyond the posterior margin of tergum 9; it is uncertain whether or not this state is constant. A pair of thin sclerites (or plates including the sclerites) before sternum 10 are absent; it remains undetermined whether or not this state is normal.

*Specimen dissected.* 1♂, PAPUA NEW GUINEA: SE, Mamay Pltn, E of Port Glasgow, 150 m, 13.II.1965 (R. Straatman).

**Rachicerus sakishimanus** Nagatomi, 1982 (Fig. 11–17). The male genitalia of this species are very similar to those of *maai* and comparisons of the 2 species have failed to reveal characters to distinguish them. A pair of thin sclerites (or plates including the sclerites) before sternum 10 may be longer than in *maai*, but it is uncertain whether or not this difference is significant.

*Specimen dissected.* 1♂, RYUKYU IS: Yaeyama Is: Iriomote-jima, Goza-dake, 7.VIII.1983 (A. Nagatomi).

## DISCUSSION

The presence or absence of pile on the metapleura is a very important generic character in Rhagionidae (see Nagatomi 1982a). Examination of male genitalia has proven that this is true of Rachiceridae; *Gymnorhachicerus* is a valid genus.

The male genitalia of 4 species of *Rachicerus* are very similar to one another and are barely distinguishable between one another in some species (e.g., between *sakishimanus* and *maai*). The male genitalia of *fluidus* can be separated from *sakishimanus* and *maai* only in some minor respects, and *fluidus* belongs to the group in which vein  $M_2$  is absent or rudimentary. It is highly probable that this group (which includes the type-species of “*Rhyphomorpha*”) cannot be separated generically from typical *Rachicerus*.

It is very necessary to examine the male antennal flagellum and male genitalia of *Paleorachicerus* (= *Electra*) *relictus* Frey (from the Philippines) in order to clarify its true generic status.

*Acknowledgments.* This paper, together with my earlier works on Rachiceridae, is dedicated to Dr D. Elmo Hardy, Professor Emeritus, University of Hawaii, who is the world authority on Bibionidae and Pipunculidae, a master of the Pacific Tephritidae, the author of 5 volumes on the Diptera of Hawaii, a promoter of team work on the evolution and genetics of the Hawaiian Drosophilidae, and so on. Sincere thanks are expressed to Dr W.A. Steffan and Mr N.L. Evenhuis (Bishop Museum, Honolulu) and Dr W. Hackman (Zoological Museum of the University, Helsinki) for the loan of material and to Miss Yoshiko Ikeshima (Kagoshima University, Kagoshima) who made the drawings.

## LITERATURE CITED

- Hennig, W.** 1938. Die Gattung *Rhachicerus* und ihre Verwandten im Baltischen Bernstein (Dipt.). *Zool. Anz.* **123**: 33–41.
1967. Die sogenannten “niederen Brachycera” im Baltischen Bernstein (Diptera: Fam. Xylophagidae, Xylomyiidae, Rhagionidae, Tabanidae). *Stuttg. Beitr. Naturkd.* **174**: 1–51.
- Frey, R.** 1954. Studien über ostasiatische Dipteren. III. *Notul. Entomol.* **34**: 1–25.
- Nagatomi, A.** 1970. Rachiceridae (Diptera) from the Oriental and Palaeartic regions. *Pac. Insects* **12**: 417–66.
- 1982a. The genera of Rhagionidae (Diptera). *J. Nat. Hist.* **16**: 31–70.
- 1982b. Geographical distribution of the lower Brachycera (Diptera). *Pac. Insects* **24**: 139–50.
- 1982c. Notes on Rachiceridae (Diptera). *Mem. Kagoshima Univ. Res. Center S. Pac.* **3**(1): 39–65.
1984. Male genitalia of the lower Brachycera (Diptera). *Beitr. Entomol.* **34**: 99–157.