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## The Genitalia of Two *Bombylius*-species (Diptera, Bombyliidae)

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**Abstract** The genitalia of *Bombylius major* LINNAEUS and *Bombyllus shibakawae* MATSUMURA are described and illustrated. The form of male aedeagus, the lengths of male tergum 9 and female terga 8–9, number of stout setae on female tergum 10, and form of spermatheca are useful in separating species.

**Key words:** Morphology; taxonomy; genitalia; *Bombylius*; *major* and *shibakawae*.

THEODOR (1983) discussed the genitalia of *Bombylius* and illustrated the following parts and species: gonopod (*ater*, *major* and *montanus*); epandrium and cercus (*anthophoroides* and *major*); aedeagus (*anthophoroides*, *ater* and *montanus*); terga 9–10 (*cruciatus*); spermatheca and genital fork (*androgynus*, *argentifrons*, *ater*, *discoideus*, *fuscus*, *major*, *punctatus*, *vulpinus* and sp. [near *venosus*]). It is shown by him in *Bombylius* that the spermatheca varies considerably in form and structure with species. HULL (1973) also illustrated the gonopod, aedeagus and epandrium of *major*.

This paper deals with the genitalia of *Bombylius major* in more detail and *B. shibakawae* for the first time.

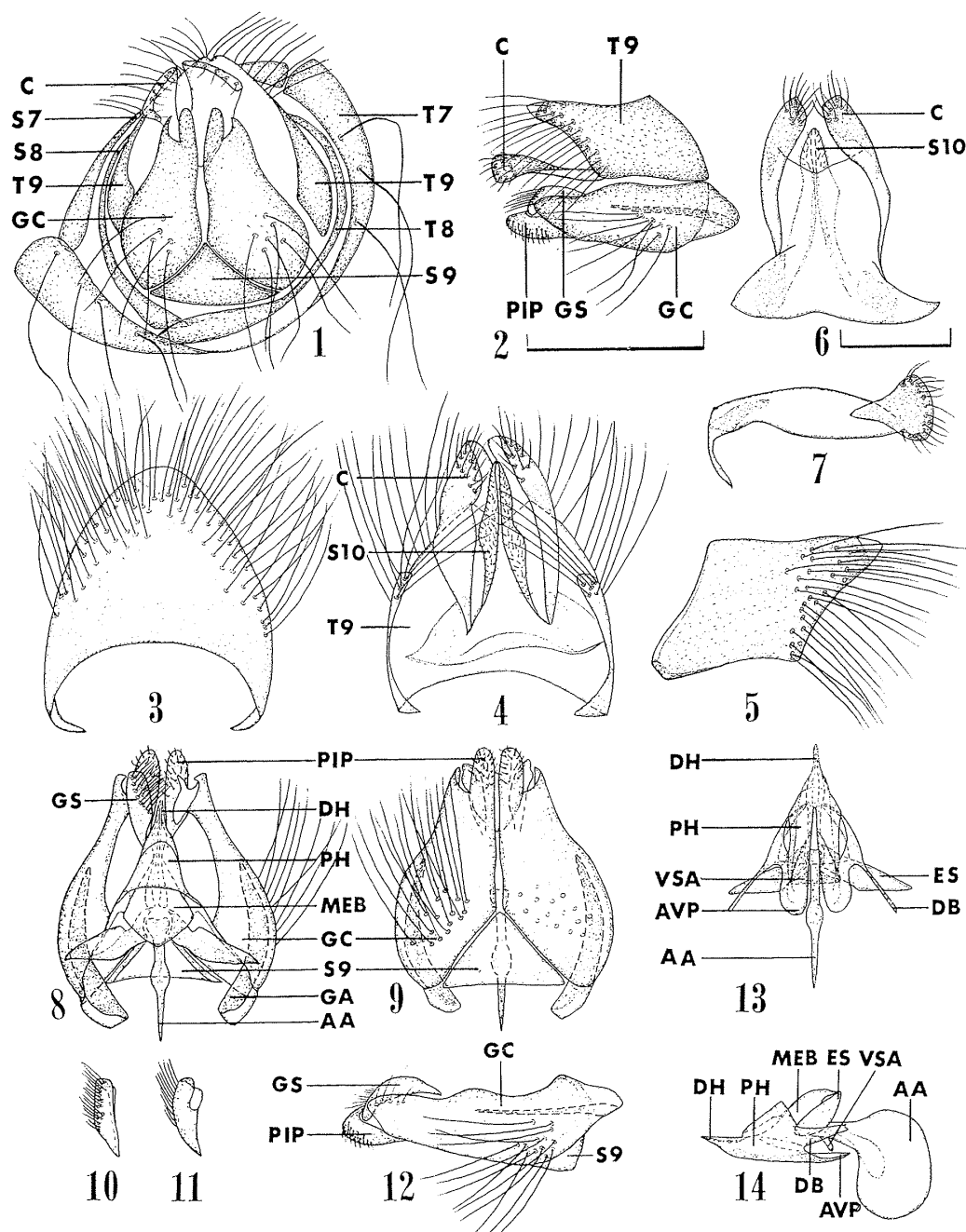
The explanations of abbreviations used in text-figures are given under Figs. 1–14, 15–19 and 20–29, respectively.

### *Bombylius*-species recorded from Japan

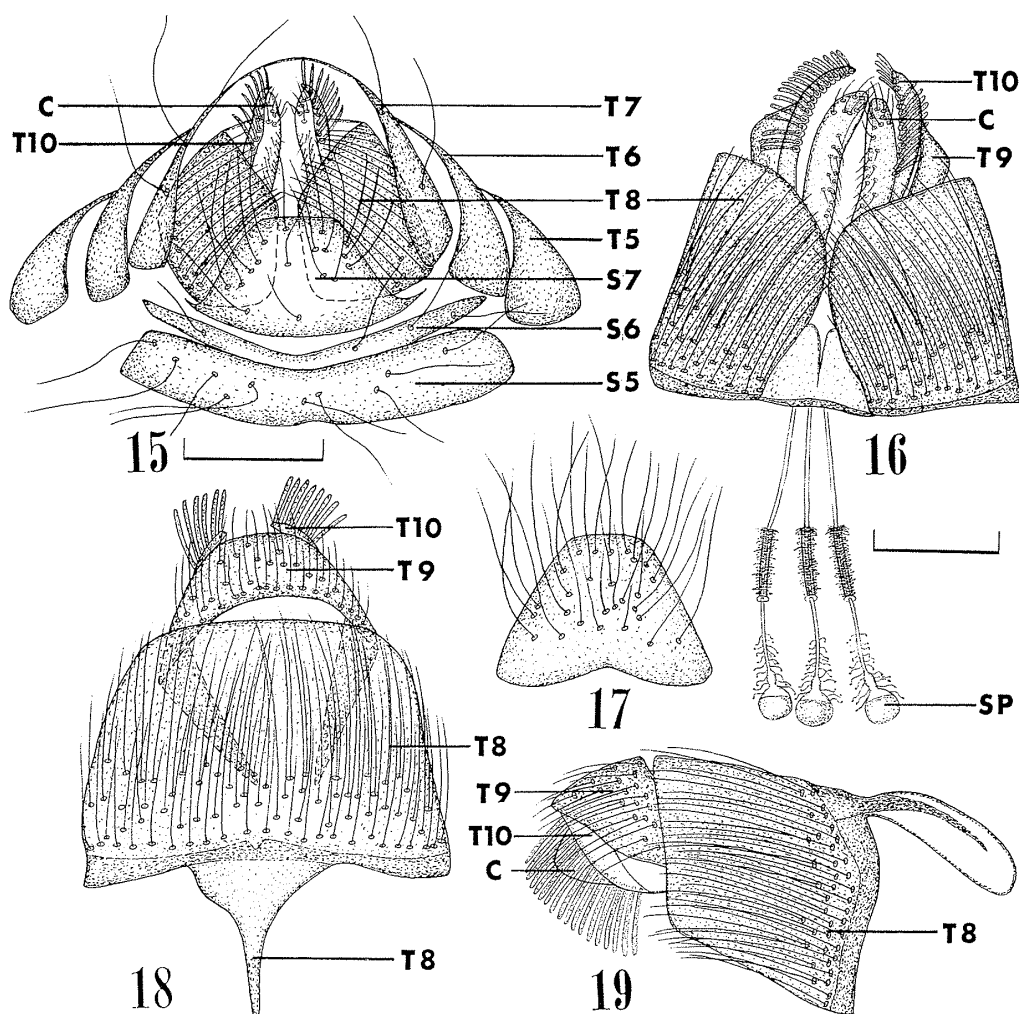
COQUILLETT (1898) recorded two species of *Bombylius* from Japan: *Bombylius major*: “One male and six females (No. 646) agreeing in all respects with specimens from Europe and the United States”; *Bombylius atriceps* LOEW, Berl. ent. Z., 1863, p. 301: “Three males and four females (No. 647) agreeing with specimens from the United States”.

MATSUMURA (1916) described *Bombylius atriceps* from Hokkaido and *Bombylius shibakawae* (as a new species) from Honshu. However, *atriceps* illustrated by MATSUMURA is similar to or may be identical with *major*.

We have no specimen of *atriceps* (= *fulvibasis*, of authors, not MACQUART [after PAINTER & PAINTER, 1965]) and the relation between *atriceps* and *major* or that between *atriceps* and *shibakawae* is unknown to us. *Bombylius shibakawae* is easily



Figs. 1–14. *Bombylius major*, male. — 1, Apex of abdomen, posterior view; 2, ditto, lateral view; 3, tergum 9, dorsal view (not flattened); 4, cerci, sternum 9, ventral view; 5, tergum 9, lateral view; 6–7, cerci and sternum 10, dorsal and lateral views; 8, gonocoxites, gonostylus and aedeagus (right gonostylus is removed), dorsal view; 9, gonocoxites, gonostyli and sternum 9, ventral view; 10–11, gonostylus (which is upside-down), dorsal and lateral views; 12, gonocoxite, gonostylus and sternum 9, lateral view; 13–14, aedeagus, ventral and lateral views. AA, aedeagal apodeme; AVP, anterior ventral process (in phallus); C, cercus; DB, dorsal bridge; DH, distiphallus; ES, endophallic sclerite; GA, gonocoxal apodeme; GC, gonocoxites; GS, gonostylus; MEB, membranous endophallic body; PH, phallus; PIP, posterior inner ventral process; S7–S10, sterna 7–10; T7–T9, terga 7–9. VSA, fan-like ventral sclerite (in aedeagal apodeme). [Scale 0.75 mm for Figs. 1–2; 0.5 mm for others.]



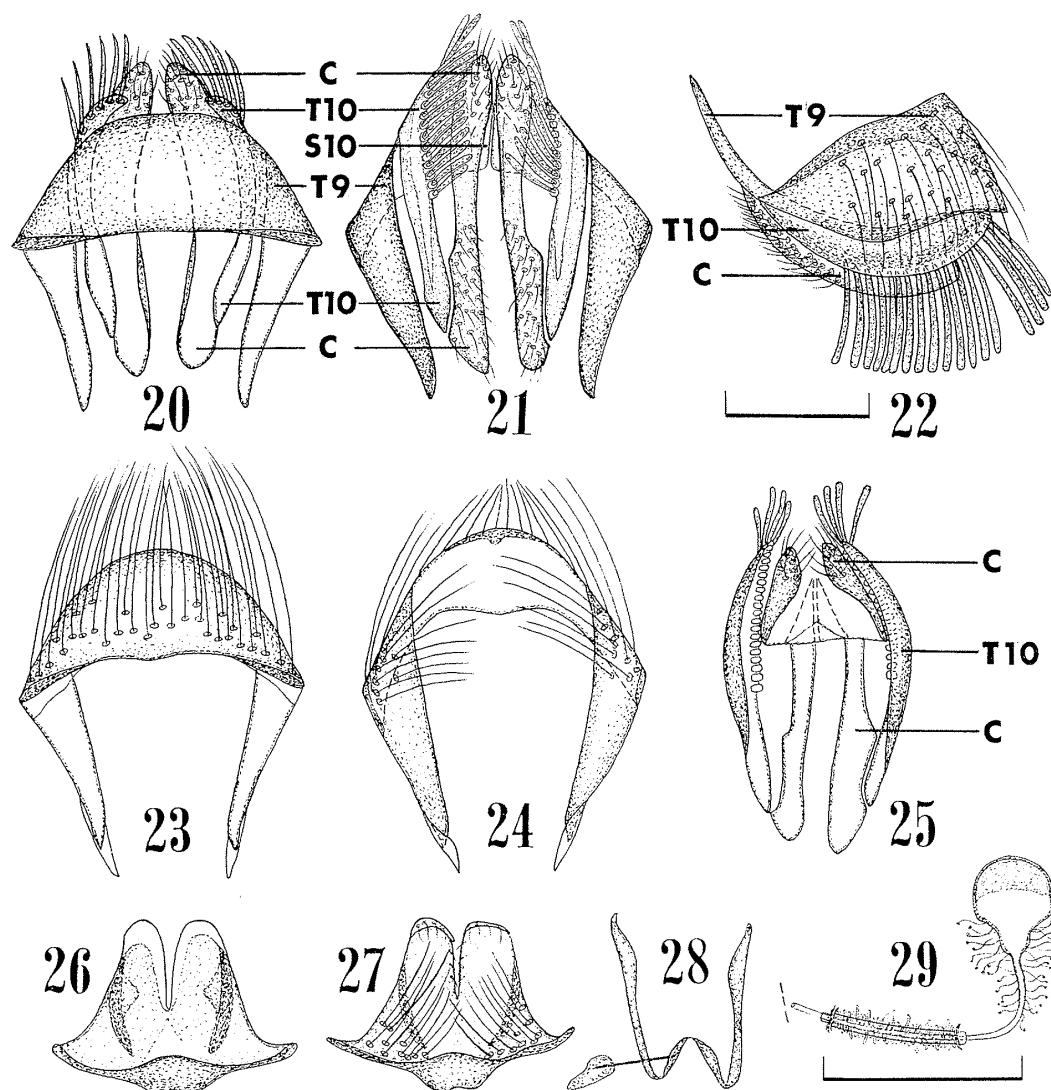
Figs. 15–19. *Bombylius major*, female. — 15–16, Apex of abdomen, posterior and ventral views; 17, sternum 7, ventral view; 18–19, terga 8–10 and cercus, dorsal and lateral views. C, cercus; SP, spermatheca; T5–T10, terga 5–10; S5–S7, sterna 5–7. [Scale 1 mm for Figs. 15 & 17; 0.5 mm for others.]

distinguished from *major* externally (see MATSUMURA, 1916; AOKI, 1950). A re-description of *shibakawae* based on external characters will be given in the future.

### Genitalia of *Bombylius*

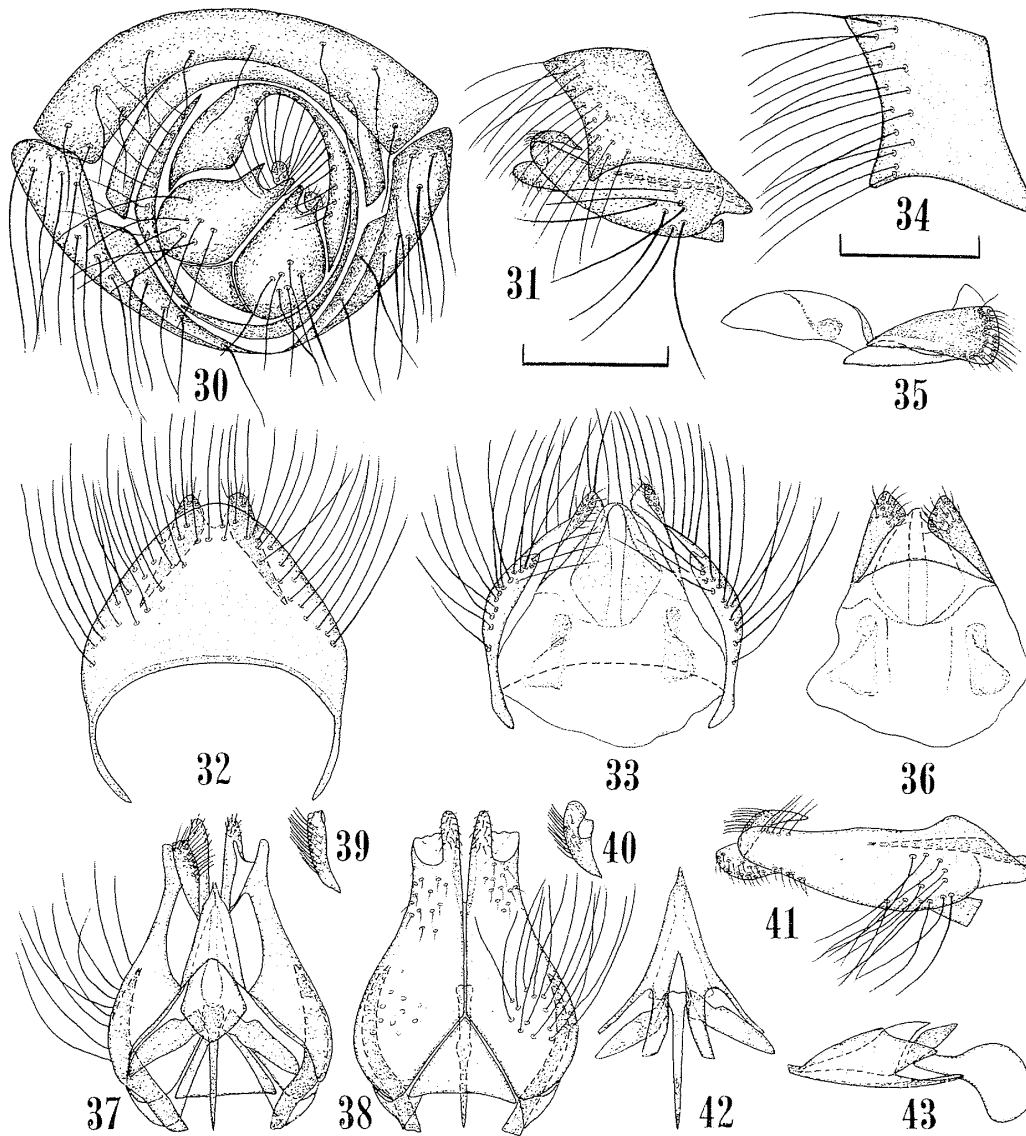
The following common characters are based on two Japanese species, namely, *major* and *shibakawae*.

*Male*. Each cercus (Figs. 4, 6–7, 33, 35–36) band-like, much longer than wide, and with apical portion darker and haired; sternum 10 (Figs. 4, 6, 33) consisting of a pair of membranous median processes directed posteriorly; before cerci and sternum 10, there is a wide membrane (Figs. 6, 33, 35) having a pair of darkened



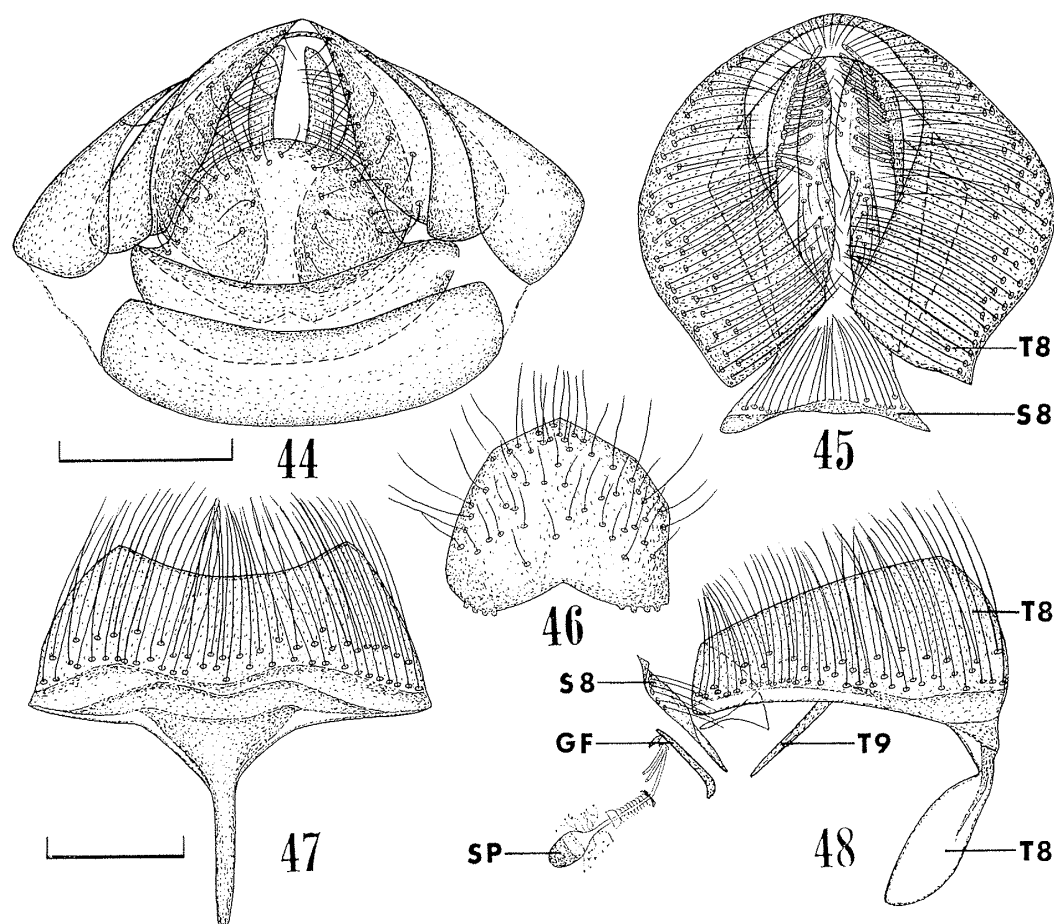
Figs. 20–29. *Bombylius major*, female. — 20–22, Terga 9–10, sternum 10 and cerci, dorsal, ventral and lateral views; 23–24, tergum 9, dorsal and ventral views; 25, cerci and tergum 10 (tergum 9 is removed), dorsal view; 26–27, sternum 8, dorsal and ventral views; 28, genital fork, dorsal view; 29, spermatheca (basal portion is cut off). C, cercus; S10, sternum 10; T9–T10, targa 9–10. [Scale 0.4 mm for Figs. 28–29; 0.5 mm for others.]

parts which consist of a cluster of spots, and this membrane may belong to sternum 10. Tergum 9 (=epandrium) (Figs. 2–5, 31–34) in dorsal view rather semicircular (when not flattened) or rather rectangular (when flattened), with apical portion having long hairs. Fused gonocoxites+sternum 9 (Figs. 8–9, 12, 37–38, 41) with Y-shaped median ventral suture; fused gonocoxites rather truncate triangular and widest before middle; each gonocoxite with a posterior inner ventral process, with a stout gonocoxal apodeme, and with long hairs at widest part; sternum 9 triangular.



Figs. 30-43. *Bombylius shibakawae*, male. — 30, Apex of abdomen, posterior view; 31, ditto, lateral view; 32, tergum 9 and cerci (not flattened), dorsal view; 33, cerci, sternum 10 and tergum 9, ventral view; 34, tergum 9, lateral view; 35-36, cerci and sternum 10, lateral and dorsal views; 37, gonocoxites, gonostylus and aedeagus (right gonostylus is removed), dorsal view; 38, gonocoxites and sternum 9 (gonostyli are removed), ventral view; 39-40, gonostylus (which is upside-down), dorsal and lateral views; 41, gonocoxites, gonostylus and sternum 9, lateral view; 42-43, aedeagus, ventral and lateral views. [Scale 0.75 mm for Figs. 30-31; 0.5 mm for others.]

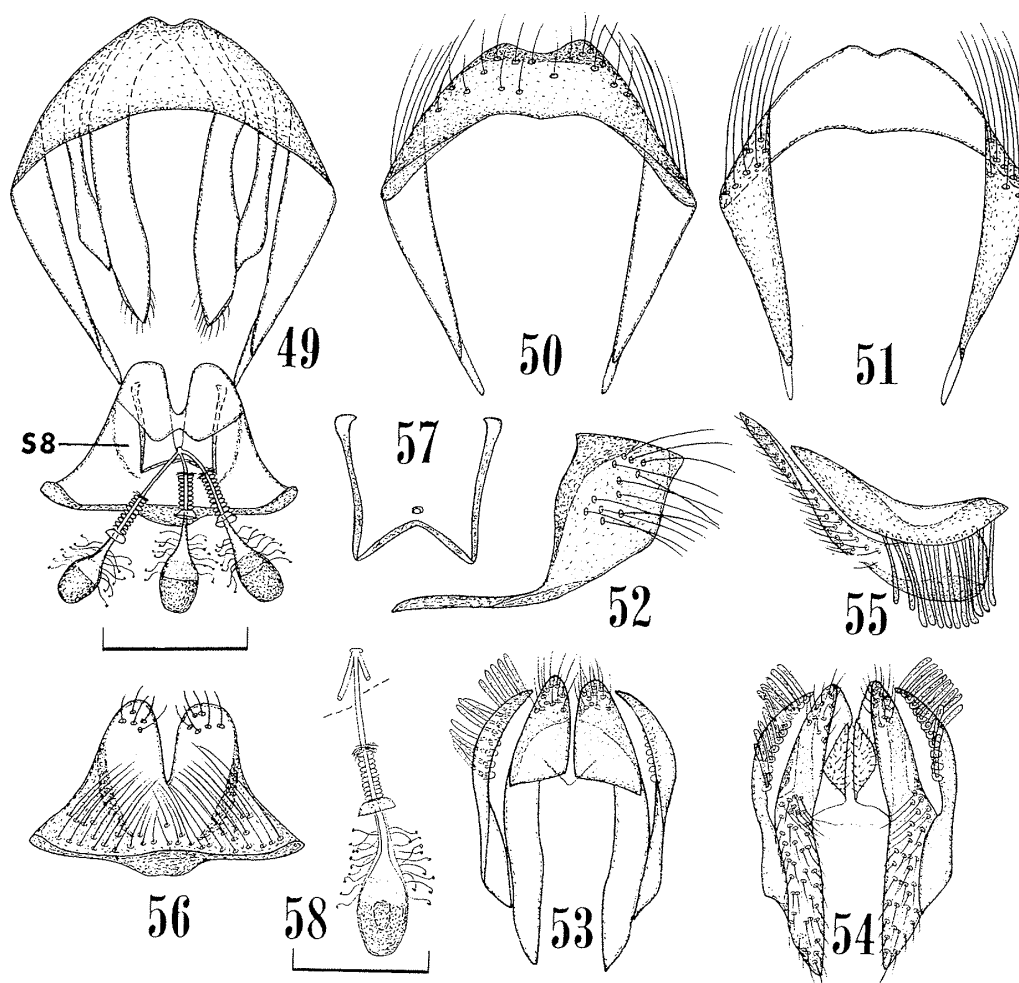
Gonostylus (Figs. 10-11, 39-40) elongate, tapering apically and with strong dorsal hairs (except base and apical portion). Aedeagus (Figs. 8, 13-14, 37, 42-43) with the following parts: phallus or aedeagal sheath (=dorsal plate+paired dorsal bridges+ventral plate+paired ventral anterior processes); aedeagal apodeme;



Figs. 44–48. *Bombylius shibakawae*, female. — 44–45, Apex of abdomen, posterior and ventral views; 46, sternum 7, ventral view; 47, tergum 8, dorsal view; 48, tergum 8, sternum 8, etc., lateral view. [Scale 1 mm for Figs. 44 & 46; 0.5 mm for others.]

paired endophallic sclerites; membranous endophallic body. Phallus triangular in dorsal or ventral view and pointed at apex; dorsal bridge thin; ventral anterior process elongate and large; aedeagal apodeme flattened laterally, widened apically, and with or without a fan-like ventral sclerite near base according to species; endophallic sclerite elongate and large.

*Female.* Cercus (=or possibly cercus+sternum 10) and tergum 10 (Figs. 20–22, 25, 53–55) paired and each of them cord-like and conspicuously long; apical part of cercus folds dorsally and becomes wider and this dorsal part may represent true cercus; apical portion of tergum 10 with a longitudinal row of stout setae (over 10 in number). Cercus longer than tergum 10. Tergum 9 (Figs. 20–24, 49–52) in dorsal view roughly trapezoid, with a pair of antero-lateral long processes folded ventrally and pointed at apex, and with long hairs. Tergum 8 (Figs. 15–16, 18–19, 45, 47–48) in dorsal view roughly trapezoid, with lateral part folded ventrally, with a mid-anterior long process whose base is widened, and with long dense appressed



Figs. 49-58. *Bombylius shibakawae*, female. — 49, Terga 9-10, sternum 8, spermatheca, etc., dorsal view; 50-52, tergum 9, dorsal, ventral and lateral views; 53-55, tergum 10, sternum 10 and cerci, dorsal, ventral and lateral views; 56, sternum 8, ventral view; 57, genital fork, dorsal view; 58, spermatheca, dorsal view. [Scale 0.3 mm for Figs. 57-58 0.5 mm for others.]

dorsal hairs. Sternum 8 (Figs. 26-27, 49, 56) W-shaped, largely membranous, with mid-posterior deep concavity, with sclerotized anterior border having widened middle part, with paired darkened longitudinal arcs and with antero-lateral parts haired. Sternum 7 (Figs. 15, 17, 44, 46) triangular, semicircular or trapezoid, with posterior margin rounded or nearly straight according to species, and with long hairs (except anterior part). Genital fork (Figs. 28, 48, 49, 57) consisting of lateral and anterior thin sclerites. Spermathecae (Figs. 16, 29, 48, 49, 58) three in number, and each of them consisting of 1) basal thin duct, 2) granulate part, 3) apical thin duct, and 4) widened head.

### Two Species of *Bombylius*

*Bombylius major* LINNAEUS (1758, Syst. Nat., ed., 10, 1: 606) (Figs. 1–29).

*Distribution.* Hokkaido, Honshu, Shikoku and Kyushu (after AOKI, 1950); Europe, Siberia, Mongolia, Turkey, Iran, Afghanistan, North Africa, Egypt, Algeria, and Morocco (after ZAITZEV, 1989); North America (after PAINTER & PAINTER, 1965); India and W. Pakistan (after BOWDEN, 1975).

*Male genitalia* (Figs. 1–14). Aedeagal apodeme with a fan-like ventral sclerite near base; tergum 9 and apical narrowed part of phallus are longer than those of *shibakawae*; fused gonocoxites and posterior inner ventral process, phallus (=aedeagal sheath) at base and paired anterior ventral processes, and apical part of aedeagal apodeme (in lateral view) are wider than those of *shibakawae*.

*Female genitalia* (Figs. 15–29). A row of stout setae 18 or so in number on tergum 10; sternum 7 rather trapezoid; terga 8–9 longer than those of *shibakawae*. In spermatheca, head gourd-shaped; granulate part different in structure from *shibakawae*; basal and apical thin duct and granulate part are longer than those of *shibakawae*.

*Specimens dissected.* (3 ♂, 3 ♀); *Honshu* (Niigata Pref.): 1 ♂, Kurokawa, N. Echigo, 19. iv. 1976, K. BABA; 1 ♂, Senami, N. Echigo, 30. iv. 1986, K. BABA; 1 ♀, Kurokawa, N. Echigo, 14. iv. 1985, K. BABA; 1 ♀, M. Echigo, 11. vi. 1986, K. BABA. *Kyushu* (Kagoshima Pref.): 1 ♀, Mt. Eboshidake, Taniyama, 17. iv. 1965, R. OHISHI; 1 ♂, Mt. Takakuma, 24. iii. 1968, Akira TANAKA.

*Bombylius shibakawae* MATSUMURA (1916, Thous. Ins. Jap., Addit. 2: 276) (Figs. 30–58).

*Distribution.* Japan (Honshu).

*Male genitalia* (Figs. 30–43). Aedeagal apodeme without a fan-like ventral sclerite near base; tergum 9 and apical narrowed part of phallus are shorter than those of *major*; fused gonocoxites and posterior inner ventral process, phallus at base and paired anterior ventral processes, and apical part of aedeagal apodeme (in lateral view) are narrower than those of *major*.

*Female genitalia* (Figs. 44–58). A row of stout setae 12 or so in number on tergum 10; sternum 7 triangular or semicircular; terga 8–9 shorter than those of *major*. In spermatheca, head elliptical in shape; granulate part different in structure from *major* (see Figs. 29, 58); basal and apical thin duct and granulate part are shorter than those of *major*.

*Specimens dissected.* (2 ♂, 2 ♀); *Honshu* (Hyogo Pref.): 1 ♀, Mt. Futatabi, Kobe, 7. vi. 1965, A. TANAKA; 2 ♂, 1 ♀, Mt. Futatabi, Kobe, 22. v. 1968, A. TANAKA.

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