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Genitalia of the Japanese Species of *Anthrax* and *Brachyanax* (*Diptera, Bombyliidae*)

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ABSTRACT—The genitalia of the Japanese species of *Anthrax* (5 species) and *Brachyanax* (1 species) are studied for the first time. The male genitalia of *Anthrax* are furnished with useful specific characters in many structures. One of them is a dorsal sclerite just before the gonostyli, and this sclerite varies markedly between species. Besides the spermatheca and genital furca, which are peculiar to each species, various segments of the female genitalia (e. g. , tergum 8, sternum 8, etc.) vary considerably with species and it is taxonomically desirable to study them in every species of *Anthrax*.

INTRODUCTION

The aim of this paper is to clarify the genitalia of the Japanese *Anthrax* and *Brachyanax* from the taxonomic point of view. Up to the present, 4 species of *Anthrax* and 2 species of *Brachyanax* were known from Japan, but their genitalia have not been examined previously. The male of *Anthrax jezoensis* Matsumura, 1916 and the female of *Anthrax putealis* Matsumura, 1905 were not available for the present study. There is one undetermind species of *Anthrax* from Japan whose male genitalia are examined here.

There is confusion in the literature with identification of *Anthrax aygula* and *A. distigma*. The species *A. distigma* in Brunetti [2], Engel [3], and Hisamatsu [9] is referred to *A. aygula* in Shiraki [15]. The species *A. aygula* in Engel [3] and Hisamatsu [9] is referred to *A. distigma* in Shiraki [15] and Hardy [7]. We follow tentatively Brunetti [2], Engel [3], and Hisamatsu [9] in this respect, although the name *distigma* disagrees with the three or four isolated spots in the wing of the species *A. distigma* as determined by them. In order to assist with identification, a photograph of the wing of each species is included in this paper. For this purpose, see also Engel [3], Shiraki & Aoki [15], and Hisamatsu [9]. No full redescription has been given for any species of Japanese *Anthrax* and *Brachyanax*, apart from genitalia studied in the present article.

This paper establishes that a comparison of genitalia is essential for the identification of *Anthrax* species.

LIST OF THE JAPANESE SPECIES OF *ANTHRAX* AND *BRACHYANAX*

(after Bowden [1], Zaitzev [17], Hirashima *et al.* [8] and Evenhuis [4, 6])

Argyramoeba boninensis Matsumura, 1916 and *Anthrax yamashiroensis* Matsumuta, 1916 have been transferred to the genus *Brachyanax* Evenhuis, 1981, and *Anthrax ogasawarensis* Matsumura, 1916 to the genus *Exhyalanthrax* Becker, 1916 (after Evenhuis [4]). Then, B. yamashiroensis has been treated as a junior synonym of *Brachyanax aterrimus* (Doleschall, 1858) (after Evenhuis [6]).

Genus *Anthrax* Scopoli, 1763, Entom. carniolica: 358. Type species: *Musca morio* Scopoli, 1763 [=*anthrax* (Schrank, 1781)]. A case of misidentified type species.

1. *A. aygula* Fabricius, 1805, Syst. antl.: 121. Type locality: Guinea. Distribution: Saudi Arabia, Yemen, Egypt, China, Japan, Hawaii, Afrotropical Region (widespread), Sokotra. Japanese name: Kôya-tsuriabu.
2. *A. distigma* Wiedemann, 1828, Aussereurop. zweifl. Insekt. 1: 309. Type lacality: Java. Distribution: Japan (Hoshu, Shikoku, Kyusyu, Okinawa), Taiwan, China, Myanmar, Sulawesi, Sri Lanka, India, Java, Sumatra, Philippines. Japanese name: Hoshi-tsuriabu.
3. *A. jezoensis* Matsumura, 1916, Thous. Ins. Jap. Addit. 2: 279. Type Locality: Japan (Hokkaido). Distribution: Japan (Hokkaido, Honshu), Taiwan. Japanese name: Ezo-kuro-tsuriabu.
4. *A. putealis* Matsumura,1905, Thous. Ins. Jap. Vol. 2: 82. Type locality: Hokkaido or Honshu. Distribution: Japan (Hokkaido, Honshu). Japanese name: Tsumaaki-tsuriabu.

Genus *Brachyanax* Evenhuis, 1981, Pac. Insects 23: 190. Type species: *Brachyanax thelestrephones* Evenhuis, 1981 by original designation.

1. *B. aterrimus* (Doleschall, 1858), Natuurkd. Tijdschr. Ned.-Indië, Ser. 4, 17: 93 (*Anthrax*). Type locality: Sulawesi (Makassar) (after Evenhuis [6]). Distribution: 'widespred in the western Pacific and exhibits

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much variation' (after Evenhuis [4]). Japanese name: Yamashiro-kuro-tsuriabu. [=*Anthrax yamashiroensis* Matsumura, 1916, Thous. Ins. Jap. Addit. 2: 280. Type locality: Japan (Honshu: Kyoto)].

2. *B. boninensis* (Matsumura, 1916), Thous. Ins. Jap. Addit. 2:283 (*Argyramoeba*). Type locality: Bonin Island. Distribution: Japan (Bonin Islands). Japanese name: Ogasawara-hoshi-tsuriabu.

ANTHRAX SP. 1 AND EXACT IDENTIFICATION OF *ANTHRAX* SPECIES

One undetermined species of *Anthrax* is known from Japan, of which a single male specimen is available for study. The wing marking of *A.* sp. 1 (♂) is very similar to that of *A. aygula* (♂, ♀).

The male gentalia of *A.* sp. 1 are conspicuously different from those of *A. aygula* and *A. distigma*. Antennal segment 3 is flattened proximo-distally in *A.* sp. 1 and *A. aygula* but flattened laterally in *A. distigma*. More material is necessary of sp.1 and the examination of type species (or a specimen from the type locality) is needed in *A. aygula* and *A. distigma* for correct specific determination.

MALE GENITALIA OF *ANTHRAX*

Descriptions of the male genitalia are given for 3 known species (not done in *A. jezoensis*) and the undetermined species. The common characters of the male genitalia based on these 4 Japanese species are briefly given below.

Cercus strongly sclerotized, and generally elliptical in shape. Sternum 10 paired and various in shape. Tergum 9 triangular, trapezoidal or semicircular, and with ventral projection at anterolateral corner. Sternum 9 absent. Fused gonocoxites rectangular or oval, with mid-longitudinal ventral furrow or suture, with protruding anterolateral part which represents gonocoxal apodeme, with or without paired posteroventral processes. Gonostylus longer than wide, and widened around middle. Aedeagus comprising the following parts: (1) phallus (dorsal plate+ventral plate); (2) endophallus (endophallic membranous body+paired endophallic sclerites); (3) aedeagal apodeme. Dorsal and ventral plates are not entirely fused but wholly or partly separated from each other. Endophallic sclerites large in *A. aygula* and *A.* sp. 1 and moderate in *A. distigma* and *A.putealis*. Aedeagal apodeme flattened laterally and variable in shape.

KEY TO JAPANESE SPECIES OF *ANTHRAX* BASED ON MALE GENITALIA

(*A. jezoensis* not included)

1. Fused gonocoxites with paired posterior ventral processes; lateral margin of gonocoxite not protruding outward; apical part of dorsal plate with mid-posterior and lateral minute teeth directed dorsally and paired ventral minute teeth 2

— Fused gonocoxites without paired postrior ventral processes; lateral margin of gonocoxite protruding outward; apical part of dorsal plate without minute teeth 3

2(1). Aedeagal apodeme in lateral view larger, rather circular, and vaned from base to near middle of ventral margin ..... *A. aygula*

— Aedeagal apodeme in lateral view smaller, with basal part narrower posteriorly, and vaned from around middle of ventral margin to apical margin ..... A. sp. 1

3(1). Posterolateral ventral sclerite absent alongside apical part of ventral plate; ventral plate pentagonal in posterior part, trapezoidal in anterior part and with spatulate anterolateral part widest at middle; aedeagal apodeme without paired ventral processes..... *A. distigma*

— Posterolateral ventral sclerite present alongside apical part of ventral plate; ventral plate elliptical in anterior part; aedeagal apodeme with paired ventral processes before middle ..... *A.putealis*

MALE GENITALIA IN EACH SPECIES OF *ANTHRAX*

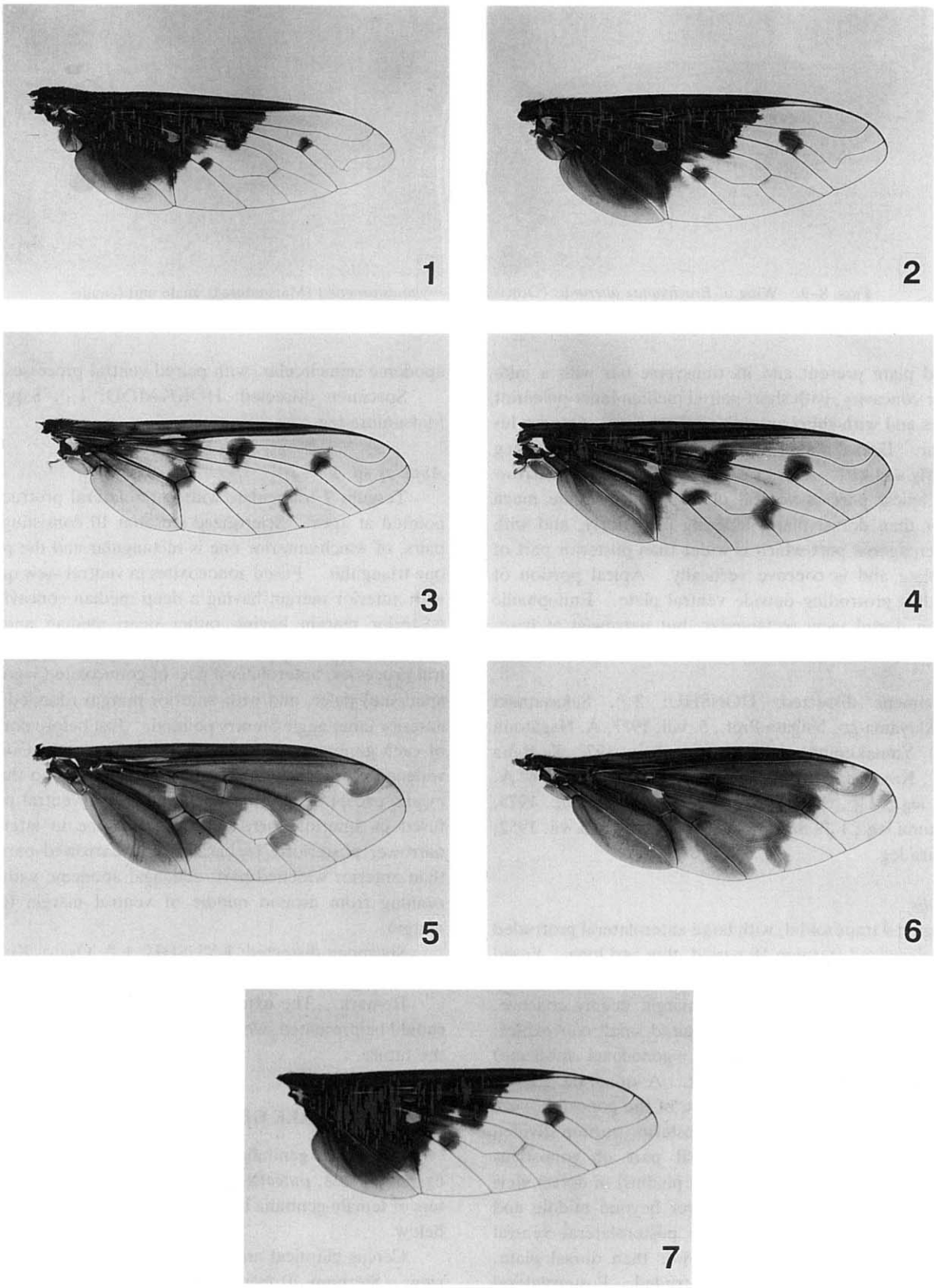
A. aygula

Tergum 9 trapezoidal or triangular, with anterolateral protruded part wider apically. Sclerotized sternum 10 consisting of two pairs, of which anterior one is elliptical and the posterior one rather semicircular or trapezoidal. Fused gonocoxites in ventral view quadrate, with anterior margin having a large concavity, with posterior margin having small median and lateral concavities, and with paired large rectangular posterior ventral processes. Just before dorsal surface of each gonostylus, there is a short rectangular process which is connected with Y-shaped median sclerite. Anterolateral part of gonocoxite (=gonocoxal apodeme) paler, large and rounded at apex. Gonostylus widend around middle. Dorsal plate (in phallus) (except apical part) in dorsal or ventral view somewhat gourd-shaped in outline; apical part of dorsal plate rather pentagonal with mid-anterior and lateral short acute teeth directed dorsally and lateral short tooth directed ventrally. Ventral plate (in phallus) somewhat gourd-shaped in outline, with more sclerotized paired anterolateral projections. Dorsal and ventral plates appear to be fused at anterior part. Endophallic sclerite large and longer than in *A. distigma*. Aedeagal apodeme in lateral view large, with anterior margin rounded, vaned from base to near middle of ventral margin.

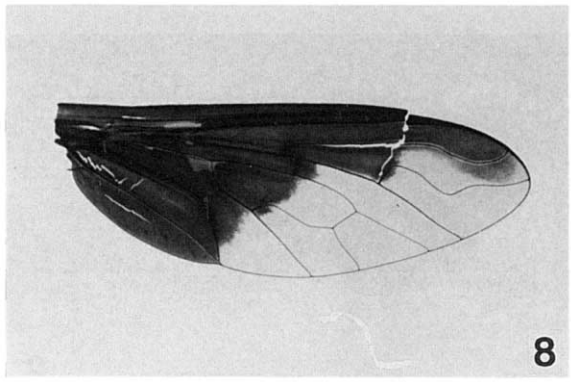
Specimens dissected: HONSHU: 1♂, Kamocho, Okayama, 23. vii. 1954, S. Nakao leg. KYUSHU: 1♂, Iriki, Kagoshima Pref., 29. viii. 1975, A. Nagatomi leg.

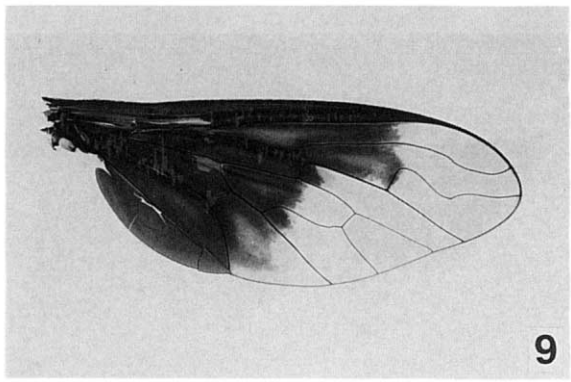
A. distigma

Tergum 9 trapezoidal, with anterolateral part large and pointed at inner apex. Sclerotized sternum 10 not well-marked. Fused gonocoxites in ventral view widest before middle and narrower posteriorly, with a mid-posterior concavity , and with gonocoxal apodeme triangular and bluntly pointed at apex. Just before dorsal surface of gonostyli, a



FIGS. 1–7. Wing of *Anthrax*. 1–2, *aygula*, male and female; 3–4, *distigma*, male and female; 5, *putealis*, male; 6, *jezoensis*, female; 7, sp. 1, male.





FIGS. 8–9. Wing of *Brachyanax atterimus* (Doleschall) [=*yamashiroensis* (Matsumura)], male and female.

T-shaped plate present and its transverse bar with a mid-posterior concavity, with short paired median inner posterior processes and with short anterolateral process. Gonostylus triangular. Dorsal plate (in phallus) in dorsal view tapering posteriorly and with posterior part parallel-sided and narrower than apical part of ventral plate. Ventral plate much narrower than dorsal plate, tapering posteriorly, and with apical pentagonal part which is wider than posterior part of dorsal plate and is concave vertically. Apical portion of endophallus protruding outside ventral plate. Endophallic sclerite in dorsal view rectangular, but narrowed at base. Aedeagal apodeme in lateral view widened and rounded apically.

Specimens dissected: HONSHU: 2♂, Sakasamaki onsen, Akiyama-go, Niigata Pref., 5. viii. 1977, A. Nagatomi leg.; 1♂, Yamakumada, Niigata Pref., 1. ix. 1972, K. Baba leg.; 1♂, Kiso-kaida-mura, Nagano Pref., 16. viii. 1964, A. Tanaka leg.; 1♂, Takayama, Gifu Pref., 25. vii. 1975, A.Nagatomi leg.; 1♂, Sasayama, Hyogo Pref., 16. vii. 1952, K. Nohara leg.

A. putealis

Tergum 9 trapezoidal, with large anterolateral protruded part. Sclerotized sternum 10 paried, thin and long. Fused gonocoxites in ventral view rectangular, with lateral margin somewhat rounded, with anterior margin deeply concave, and with posterior margin having paired small convexities; anterolateral part of gonocoxites (=gonocoxal apodeme) paler, triangular and acute at apex. A quadrate sclerite present just before the dorsal surface of the gonostyli, with anterior margin concave and with posterior portion divided into two rectangular parts. Apical part of gonostylus abruptly narrower. Dorsal plate (in phallus) in dorsal view rectangular at anterior part, narrower beyond middle and with mid-posterior part fused with posterolateral ventral sclerite. Ventral plate much narrower than dorsal plate, elliptical, with mid-posterior part protruded. Posterolateral ventral sclerite present alongside apical portion of ventral plate and their apices directed dorsally. This sclerite may belong to the ventral plate. Endophallic sclerite small, rather elliptical, with apical margin rounded. Aedeagal apodeme semicircular, with paired ventral processes.

Specimen dissected: HOKKAIDO: 1♂, Sapporo, S. Matsumura leg.

Anthrax sp. 1

Tergum 9 triangular, with anterolateral protruded part pointed at apex. Sclerotized sternum 10 consisting of two pairs, of which anterior one is rectangular and the posterior one triangular. Fused gonocoxites in ventral view quadrate, with anterior margin having a deep median concavity, with posterior margin having rather deep median and lateral concavities, and with paired long rectangular posterior ventral processes; anterolateral part of gonocoxite (=gonocoxal apodeme) paler, and with anterior margin rounded or with anterior inner angle bluntry pointed. Just before dorsal base of each gonostylus, a triangular plate present. Gonostylus widened around middle. Aedeagus is similar to that of *A. aygula* except as follows: dorsal plate and ventral plate not fused in anterior part; aedeagal apodeme in lateral view narrower posteriorly (=basally) and narrowed part longer than anterior widened part; aedeagal apodeme with a wing running from around middle of ventral margin to apical margin.

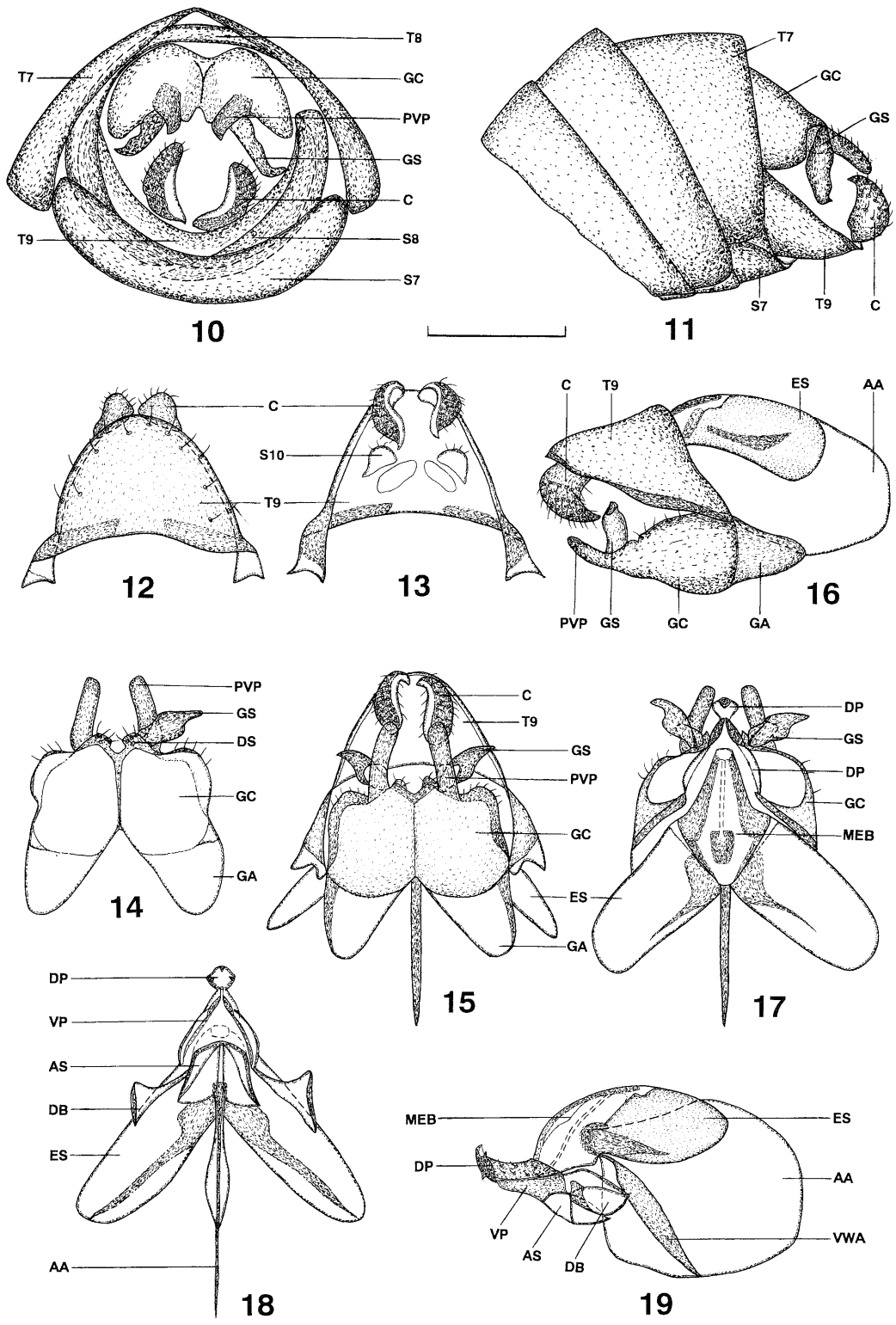
Specimen dissected: KYUSHU: 1♂, Osato, Kuroshima Is., Kagoshima Pref., 1. ix. 1981, Sk. Yamane leg.

Remark. The external and female gentalic characters should be presented, when more material can be examined in the future.

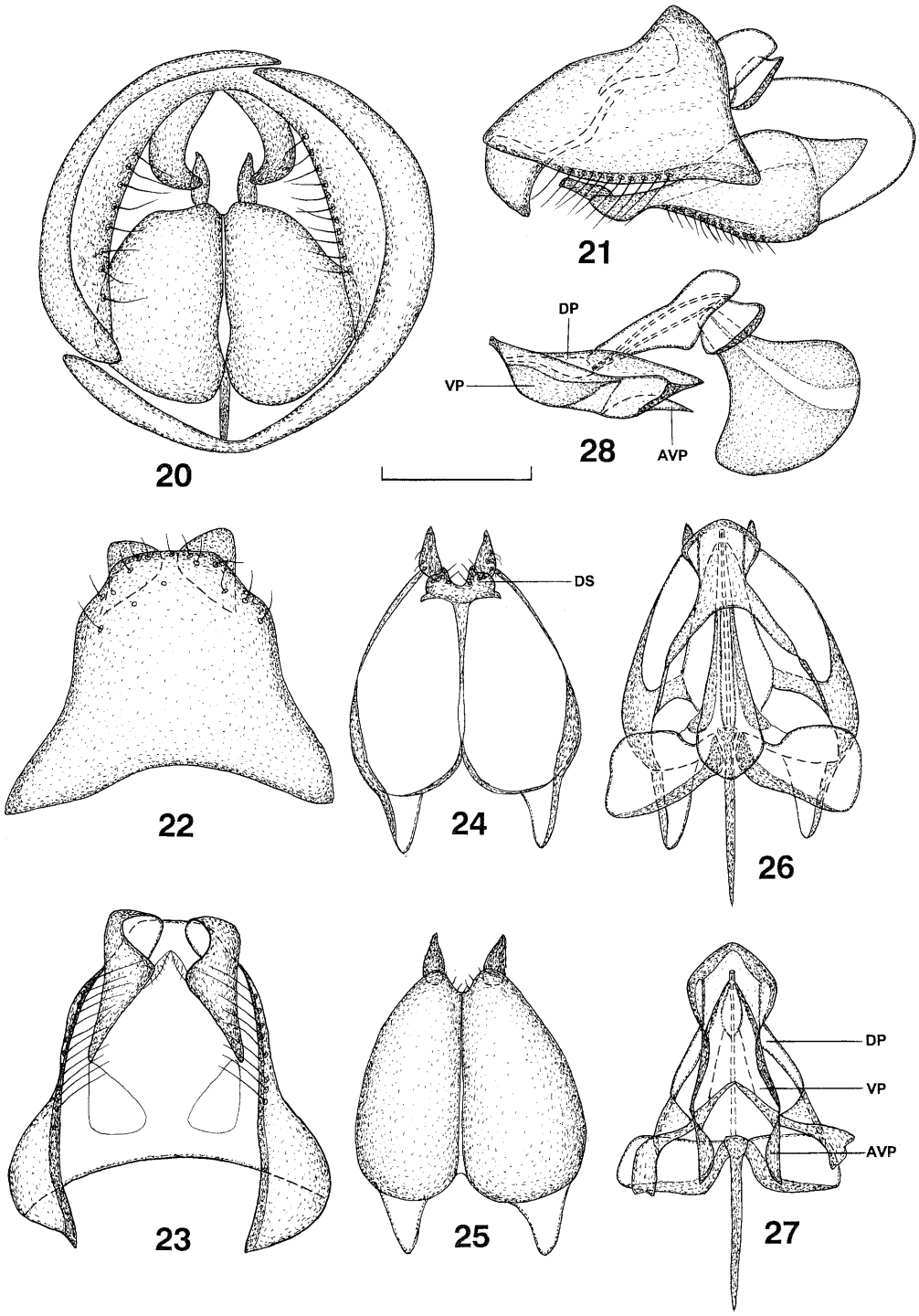
FEMALE GENITALIA OF *ANTHRAX*

The female genitalia are here studied in 3 species but not examined in *A. putealis* and *A.* sp. 1. The common characters of female genitalia based on 3 Japanese species are given below.

Cercus elliptical and much longer than wide in ventral view. Sternum 10 transparent or not marked, but paired sclerites present in *A. distigma*. Tergum 10 (=acanthophorites) cord-like; tergum 10 (except anterior or outer part) with 16–21 stout acanthophorite spines on posterior or inner border. Tergum 9 band-like, thinner laterally and with

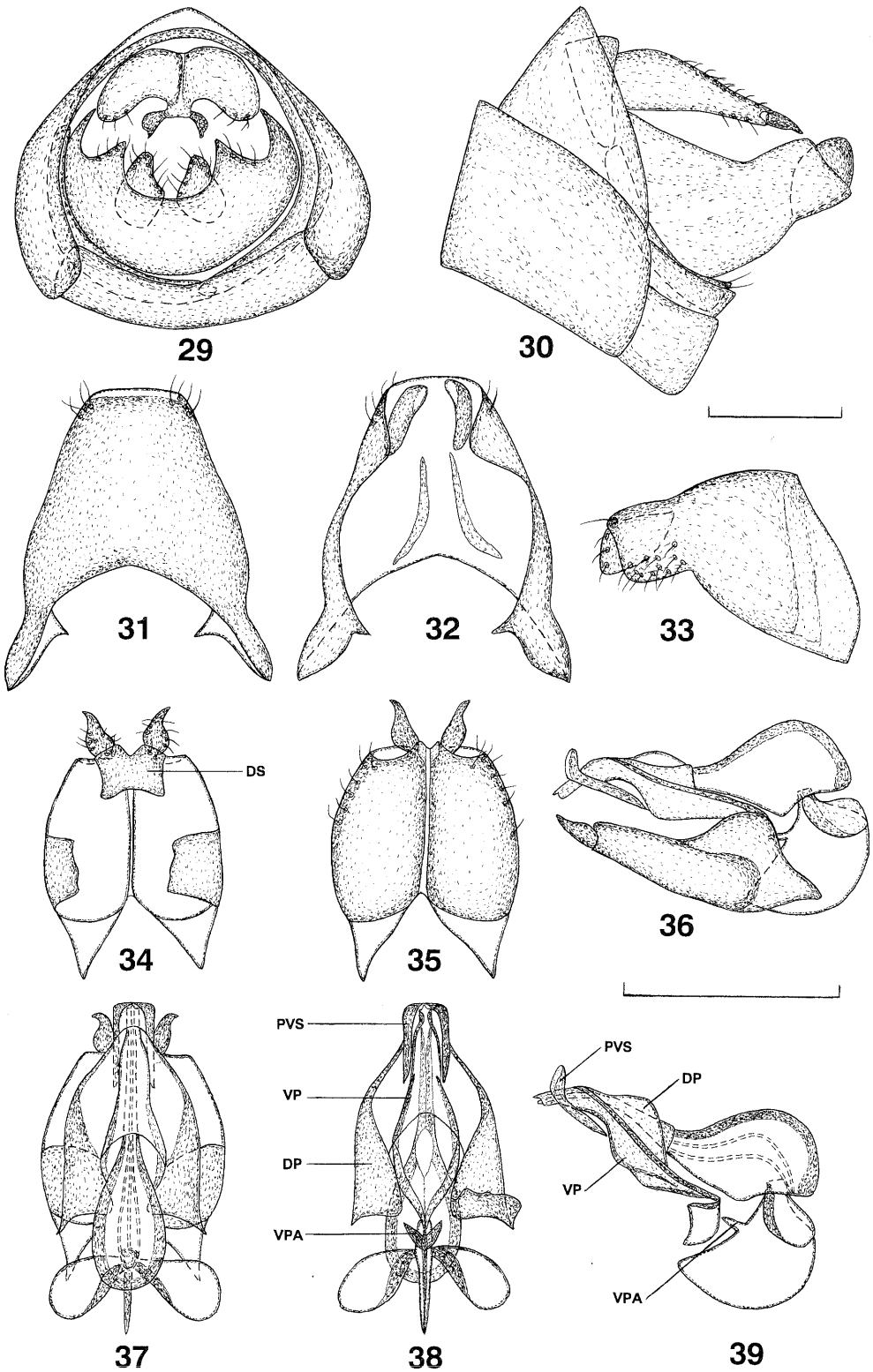


FIGS. 10–19. *Anthrax aygula* Fabricius, male genitalia. 10–11, Posterior part of abdomen, posterior and lateral views; 12–13, tergum 9, cerci and sternum 10, dorsal and ventral views; 14, gonocoxites and gonostylus, dorsal view; 15–16, gonocoxites, gonostyli, tergum 9, cerci, endophallic sclerite and aedeagal apodeme, ventral and lateral views; 17, aedeagus, gonocoxites and gonostyli, dorsal view; 18–19, aedeagus, ventral and lateral views. AA, aedeagal apodeme; AS, anterior sclerite in ventral plate of phallus; C, cercus; DB, dorsal bridge; ES, endophallic sclerite; DP, dorsal plate in phallus; DS, dorsal sclerite in gonocoxite; GA, gonocoxal apodeme; GC, gonocoxite; GS, gonostylus; MEB, membranous endophallic body; PVP, posterior ventral process in gonocoxite; S7-S10, sterna 7–10; T7-T10, terga 7–10; VP, ventral plate in phallus; VWA: ventral paired wings in aedeagal apodeme. Bar=0.75 mm.

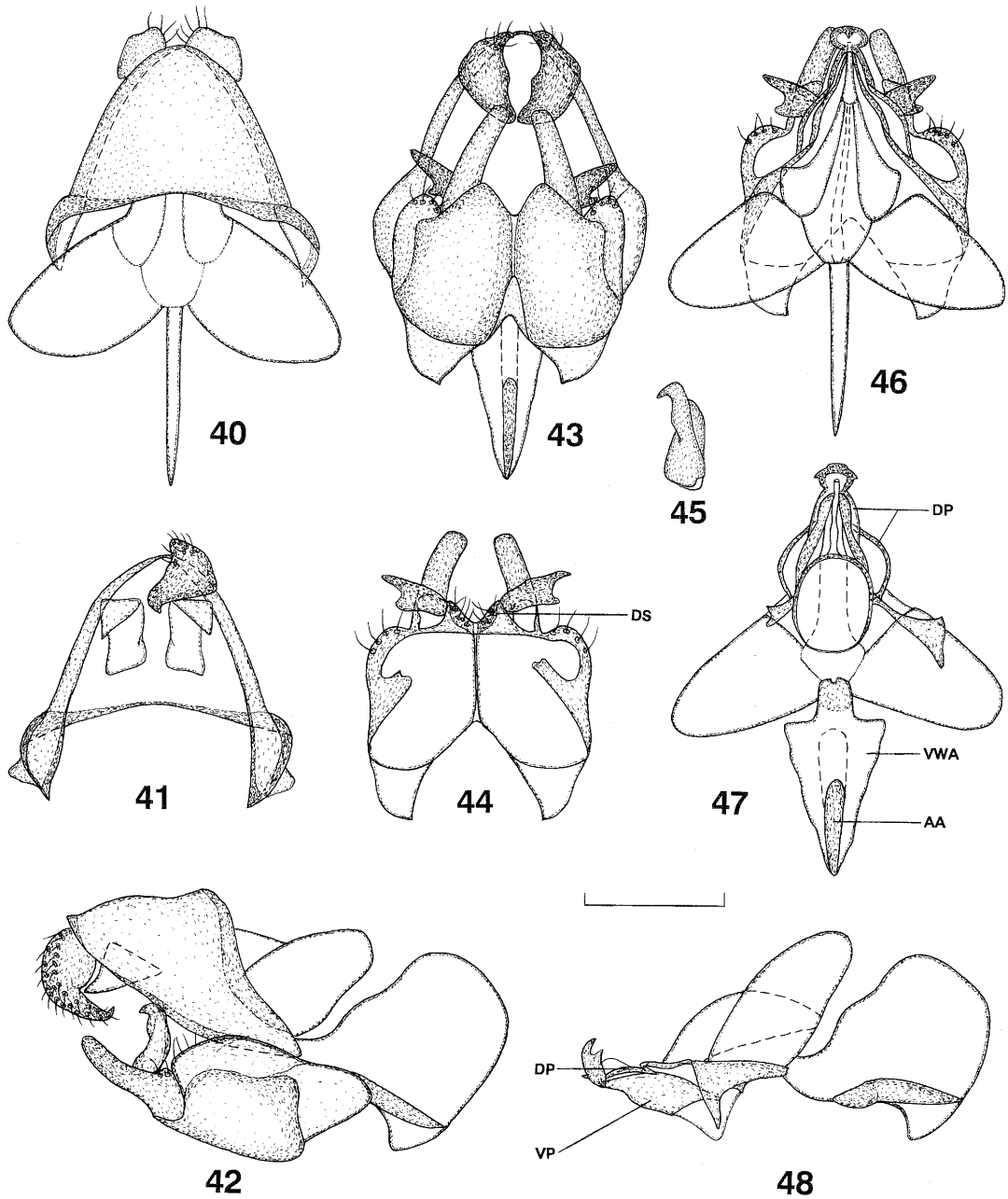


Figs. 20–28. *Anthrax distigma* Wiedemann, male genitalia. 20, Apex of abdomen, posterior view; 21, tergum 9, cercus, gonocoxite, gonostylus and anterior part of aedeagus, lateral view; 22–23, tergum 9, cerci and sternum 10, dorsal and ventral views; 24–25, gonocoxites and gonostyli, dorsal and ventral views; 26, aedeagus, gonocoxites and gonostyli, dorsal view; 27–28, aedeagus, ventral and lateral views. AVP, anterior process in ventral plate; DP, dorsal plate in phallus; DS, dorsal sclerite in gonocoxite; VP, ventral plate in phallus. Bar=0.5 mm.

lateral cord-like process running ventrally and anteriorly. Tergum 8 in dorsal view rectangular or trapezoidal and much wider than long; tergum 8 with mid-anterior process the base of which is widened. Sternum 8 trapezoidal. Genital furca consisting of L-shaped bar and anterior bar which is thickest at middle. Spermathecae three in number, and each consisting of long or short duct and elliptical or circular reservoir; some section of duct with characteristic hairs or armatures.



FIGS. 29–39. *Anthrax putealis* Matsumura, male genitalia. 29–30, Posterior part of abdomen, posterior and lateral views; 31–33, tergum 9, cerci and sternum 10, dorsal, ventral and lateral views; 34–35, gonocoxites and gonostyli, dorsal and ventral views; 36–37, aedeagus, gonocoxites and gonostyli, lateral and dorsal views. 38–39, aedeagus, ventral and lateral views. DP, dorsal plate in phallus; DS, dorsal sclerite in gonocoxite; PVS, posterior ventral sclerite in phallus; VP, ventral plate in phallus; VPA, ventral process in aedeagal apodeme. Bar=0.75 mm for Figs. 29–33; Bar=0.5 mm for Figs. 34–39.



Figs. 40–48. *Anthrax* sp. 1, male genitalia. 40, Tergum 9, cerci and anterior part of aedeagus, dorsal view; 41, tergum 9, cercus and sternum 10, ventral view; 42–43, gonocoxites, gonostyli, tergum 9, cerci, sternum 10 and anterior part of aedeagus, lateral and ventral views; 44, gonocoxites and gonostyli, dorsal view; 45, gonostylus; 46, aedeagus, gonocoxites and gonostyli, dorsal view; 47–48, aedeagus, ventral and lateral views. AA, aedeagal apodeme; DP, dorsal plate in phallus; DS, dorsal sclerite in gonocoxite; VP, ventral plate in phallus; VWA, ventral paired wings in aedeagal apodeme. Bar=0.5 mm.

There is a paired transparent elliptical dorsal membranous body arising near sternum 8 (which is recognized in *A. aygula* and *A. jezoensis* as well as in *Brachyanax aterrimus*). Regettably, the taxonomic importance of this membranous body is unknown but it probably represents an accessory gland.

In *A. distigma*, tergum 8 has a cord-like transparent membrane having apical strong hairs (MT8 in Fig. 57) [this may be a broken piece] and sternum 8 has a large trapezoidal or semicircular membrane having apical strong haris (MS8 in Fig. 59). These two membranes may easily be cut off and may thus be overlooked in other individuals or species.

KEY TO 3 JAPANESE SPECIES OF *ANTHRAX* BASED ON FEMALE GENITALIA

(*A. putealis* and *A.* sp. 1 not included)

1. Spermathecal reservoir elliptical (much longer than

wide); genital furca with lateral bar shorter and thicker, and truncate in posterolateral end..... 2

— Spermathecal reservoir circular but somewhat longer than wide; genital furca with lateral bar longer and thinner, and pointed in posterolateral end ...*A. distigma*

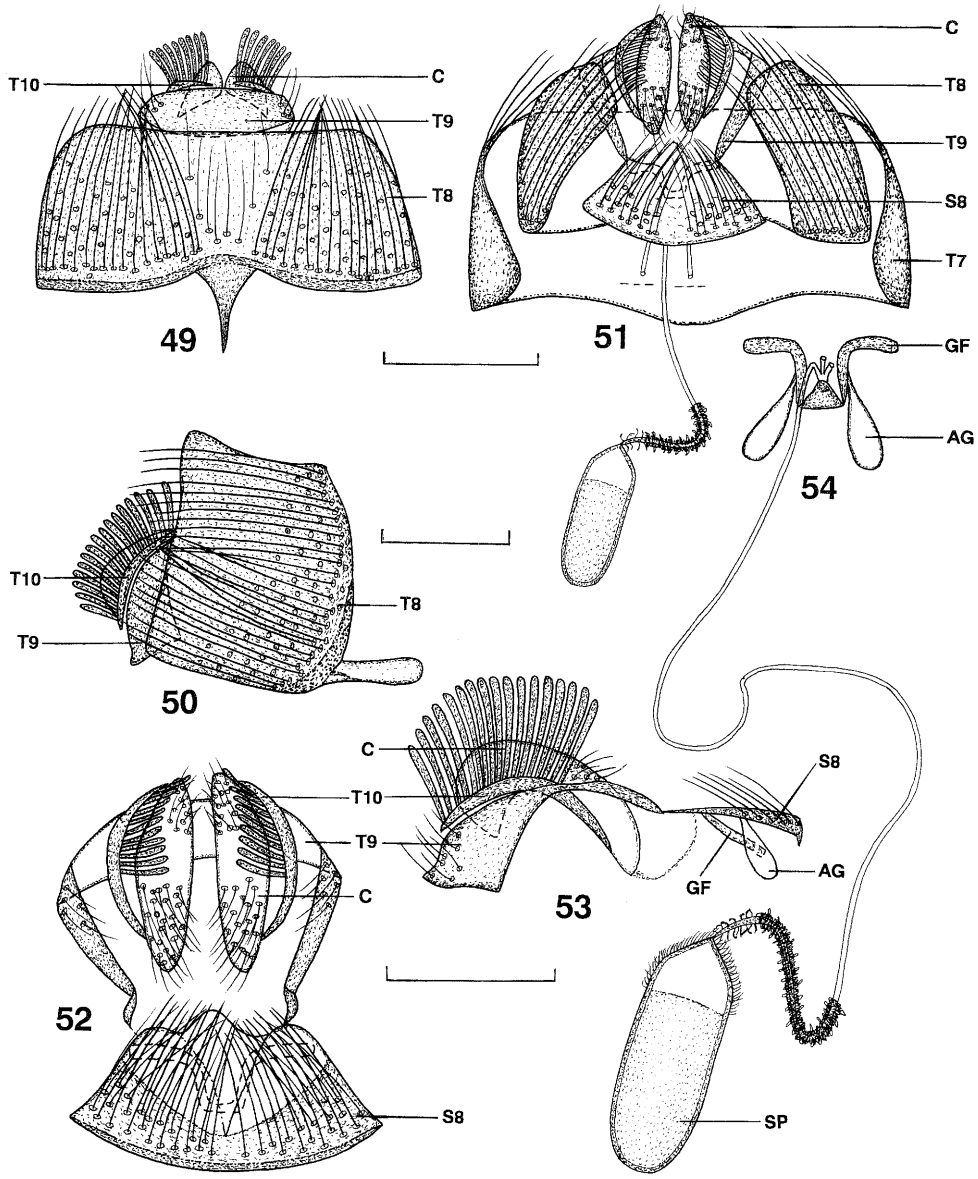
2. Spermathecal duct conspicuously long; tergum 8 not markedly thinner laterally (Fig. 51) and longer than in *A. jezoensis* ..... *A. aygula*

— Spermathecal duct much shorter than in *A. aygula*; tergum 8 thinner laterally (Fig. 62) and shorter than in *A. aygula* ..... *A. jezoensis*

FEMALE GENITALIA IN EACH SPECIES OF *ANTHRAX*

A. aygula

Tergum 10 with 17 or so stout spines. Tergum 8 rather rectangular, not markedly thinner laterally and longer than in *A. distigma* and *A. jezoensis*; middle of tergum 8 paler in color. Sternum 8 with mid-posterior transparent membrane protruded posteriorly. [Near sternum 8, there is a pair of isolated transparent elliptical dorsal membranes]. Genital furca with lateral bar shorter and thicker than in *A. distigma*. Spermathecal duct long, apical portion with minute glandiform hairs near reservoir which is elliptical and wider than in



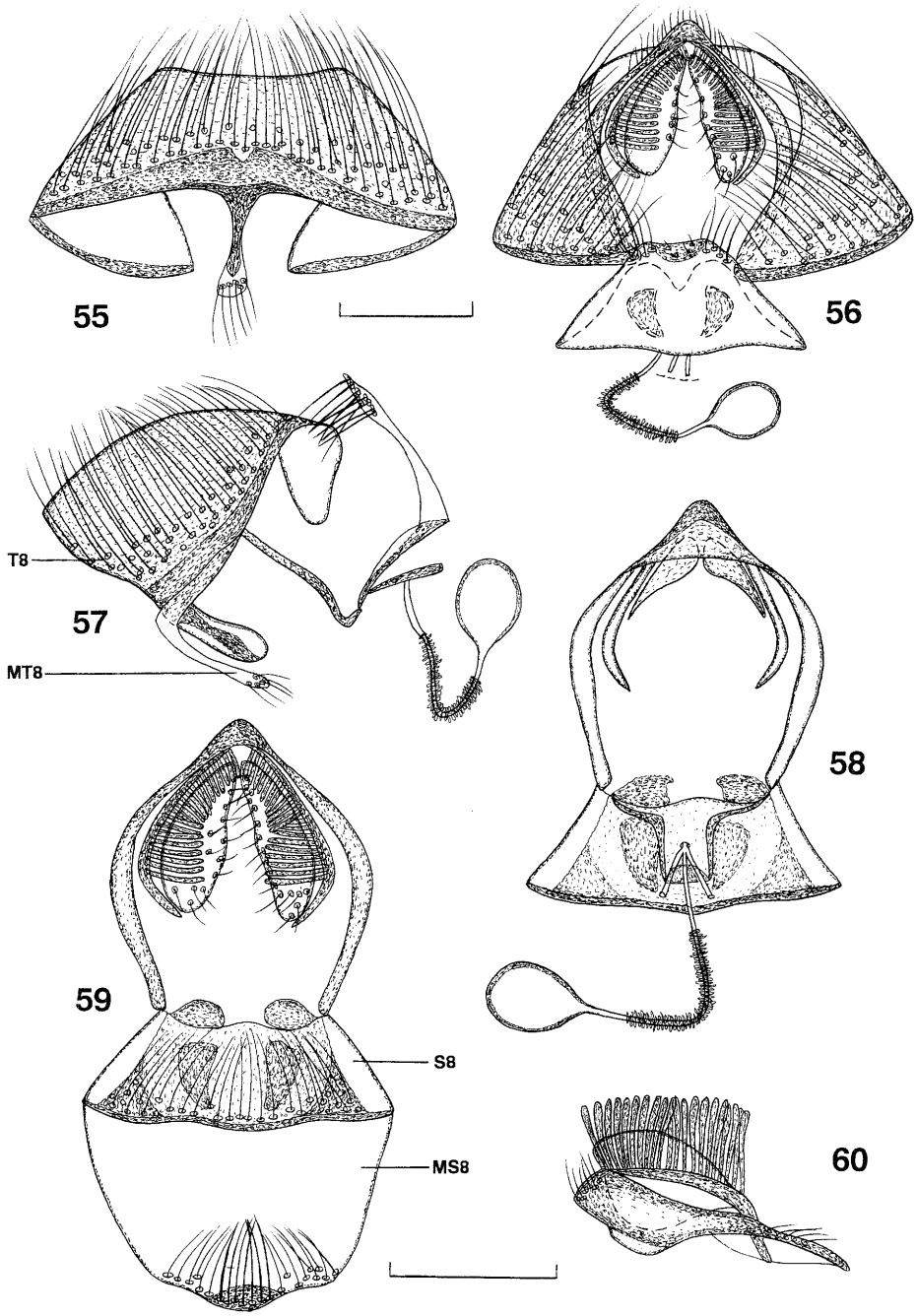
FIGS. 49–54. *Anthrax aygula* Fabricius, female genitalia. 49–50, terga 8–10 and cerci, dorsal and lateral views; 51, terga 7–10, cerci, sternum 8 and spermatheca, ventral view; 52–53, terga 9–10, cerci,sternum 8 and genital furca, ventral and lateral views; 54, genital furca, spermatheca and accesory gland, dorsal view. AG, accessory gland; C, cercus; GF, genital furca; SP, spermatheca; S8, sternum 8, T7-T10, terga 7–10. Bar=0.75 mm for Figs. 49, 51. Bar=0.5 mm for Figs. 50; Bar=0.5 mm for Figs. 52–54.

A. jezoensis.

Specimens dissected: HONSHU: 1♀, Senami, Niigata Pref., 18. x. 1982, K. Baba leg. KYUSHU: 1♀, Hamada, Kanoya, Kagoshima Pref., 4. viii. 1968, K. Kanmiya leg. YAEYAMA I.: 1♀, Omotodake, Ishigaki-jima, 19. viii. 1961, S. Ueda leg. TAIWAN: 1♀, Liukuei, SW Taiwan, 30. iv. 1971, N. Fukuhara leg.

A. distigma

Tergum 10 with 21 or so stout spines. Sternum 10 with paired sclerites present at posterolateral corners. Tergum 8 trapezoidal, thinner laterally, and with paler triangular middle part. [Tergum 8 with a cord-like transparent membrane having apical strong hairs over mid-posterior process]. Sternum 8 with more sclerotized paired patches at middle.



Figs. 55–60. *Anthrax distigma* Wiedemann, female genitalia. 55, tergum 8, dorsal view; 56, terga 8–10, cerci, sternum 8 and spermatheca, ventral view; 57; tergum 8, sternum 8, genital furca and spermatheca, lateral view; 58, terga 9–10, cerci, sternum 8, genital furca and spermatheca, dorsal view; 59–60, terga 9–10, cerci and sternum 8, ventral and lateral views. MS8, membrane having apical strong hairs in sternum 8; MT8, membrane having apical strong hairs in tergum 8; S8, sternum 8; T8, tergum 8. Bar=0.5 mm for Figs. 55–56; Bar=0.5 mm for Figs. 57–60.

[Sternum 8 with a large trapezoidal or semicircular transparent anterior membrane whose mid-apical part possesses strong hairs]. Genital furca with lateral bar longer and thinner than in *A. aygula* and *A. jezoensis*. Spermathecal duct consisting of shorter bare basal part, ejection apparatus and short bare apical part; spermathecal reservoir nearly spherical, and somewhat longer than wide.

Specimens dissected: HONSHU: 1♀, Miomote, Niigata Pref., 26. iv. 1982, K. Baba leg; 1♀, Minomo, Osaka Pref., 19. viii. 1955, T. Kimura leg. KYUSHU: 1♀, Mt. Hiko, Fukuoka Pref., 15. viii. 1954, S. Nakao leg.

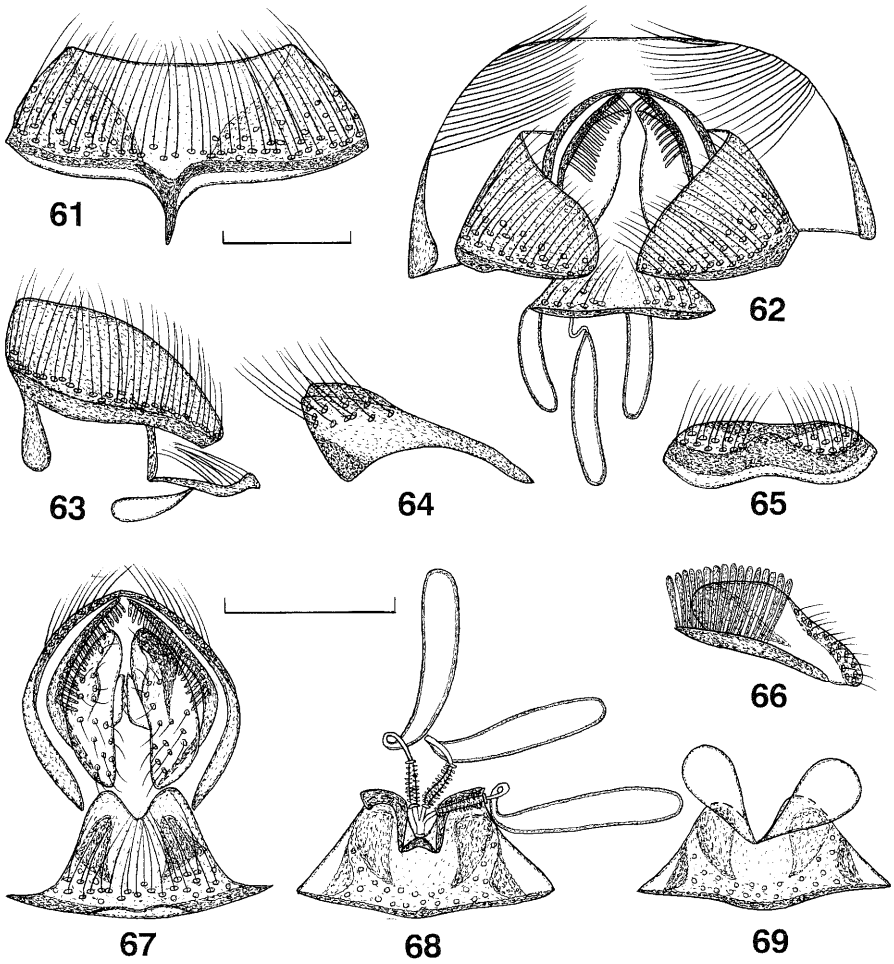
A. jezoensis

Tergum 10 with 16 or so stout spines. Tergum 8 trapezoidal, thinner laterally, and with paler triangular middle part which is larger than in *A. distigma*. Sternum 8 with a mid-posterior concavity and with more sclerotized paired patches around middle. [Near sternum 8, there are isolated transparent elliptical paired dorsal membranes]. Genital furca with lateral bar shorter and thicker than in *A. distigma*. Spermathecal duct much shorter than in the other 2 species; ejection apparatus with small valves; spermathecal reservoir elliptical, much longer than wide and narrower than in other 2 species.

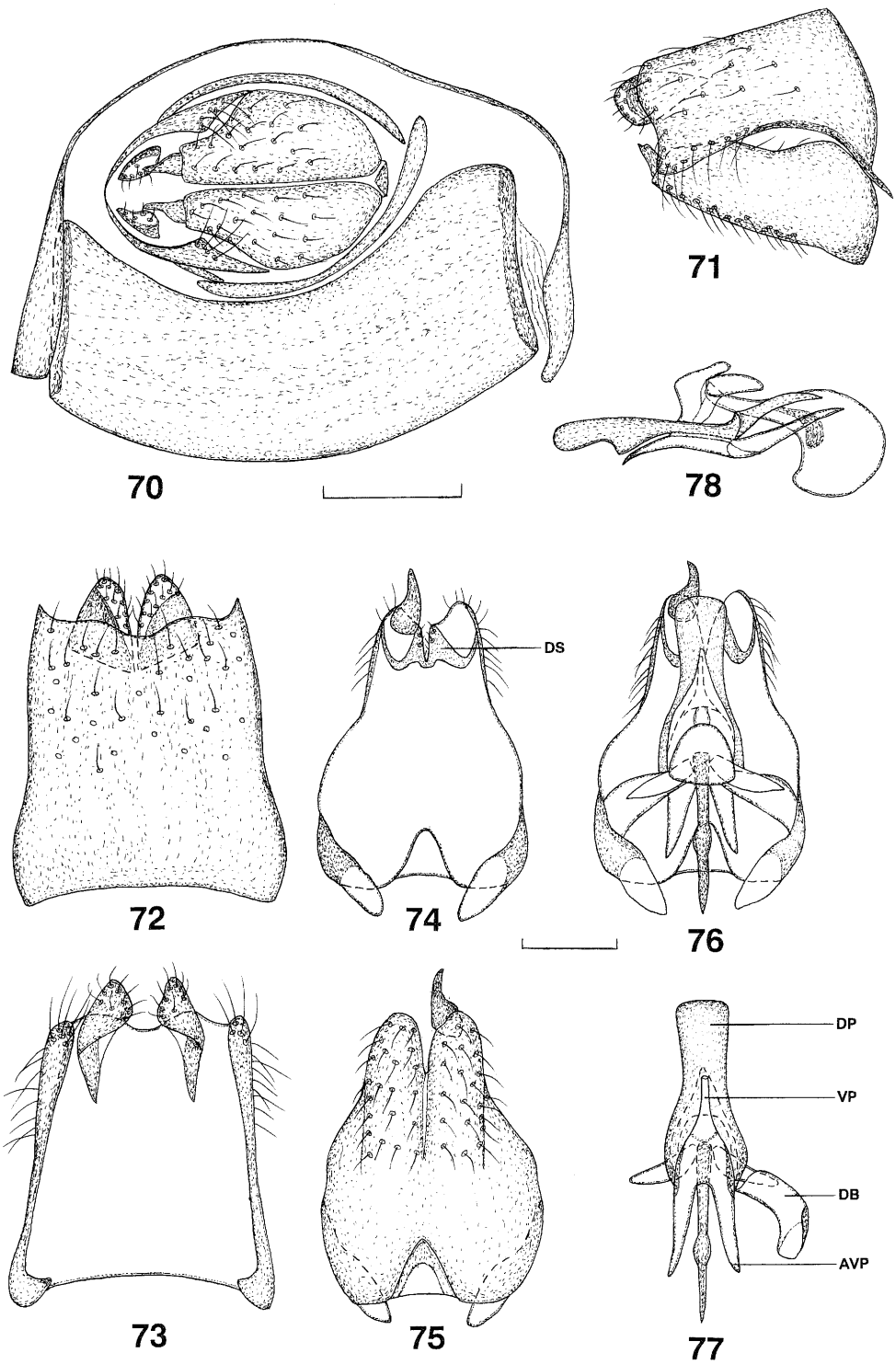
Specimen dissected: HONSHU: 1♀, Shimashimadani, Nagano Pref., 29. viii. 1961, H. Hasegawa leg.

GENITALIA OF *BRACHYANAX ATERRIMUS* (=*YAMASHIROENSIS*)

Only one species of *Brachyanax* is examined and definite generic diagnosis of this genus cannot be offered based on the genitalia. However, the male and female genitalia of *Brachyanax aterrimus* differ very much from those of *Anthrax* species examined in this paper in having the following characters. Male: Fused gonocoxites without mid-longitudinal ventral furrow or suture at anterior part and with ventral posterior part divided into paired protruded parts rounded at apex; gonostylus widened at base; ventral plate (in phallus) with a mid-posterior thinner process and paired anterolateral

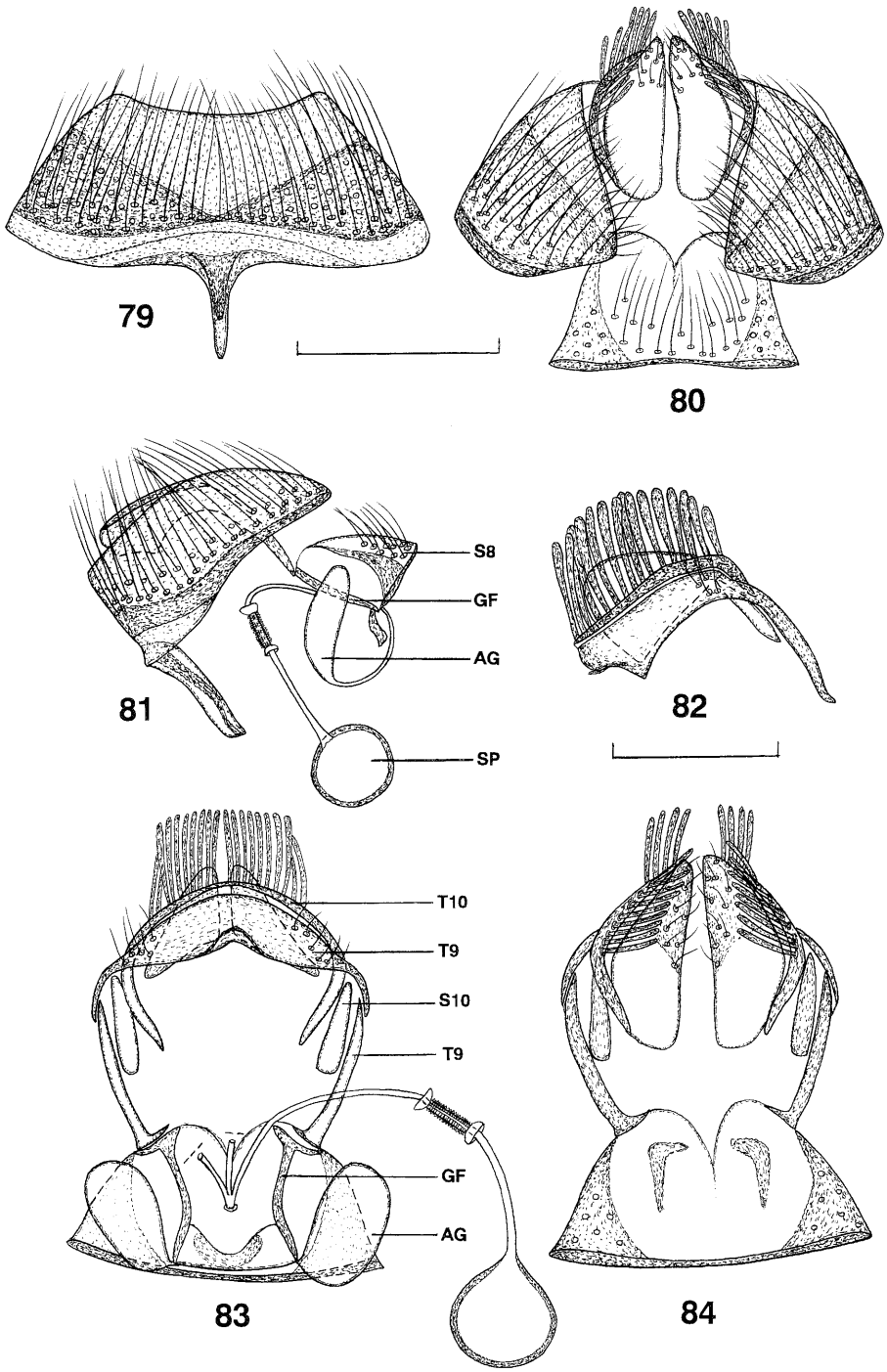


FIGS. 61–69. *Anthrax jezoensis* Matsumura, female genitalia. 61, tergum 8, dorsal view; 62, terga 7–10, cerci, sternum 8 and spermatheca, ventral view; 63, tergum 8, genital furca and accessory gland, lateral view; 64–65, tergum 9, lateral and anterior views; 66, tergum 10 and cercus, lateral view; 67, terga 9–10, cerci and sternaum 8, ventral view; 68, sternum 8, genital furca and spermatheca, dorsal view. 69, sternum 8 and accsessory gland, dorsal view. Bar=0.5 mm for Figs. 61–63; Bar=0.5 mm for Figs. 64–69.



Figs. 70–78. *Brachyanax aterrimus* (Doleschall) [=*yamashiroensis* (Matsumura)], male genitalia. 70, Apex of abdomen, posterior view; 71, tergum 9, cercus, gonocoxite and gonostylus, lateral view; 72–73, tergum 9 and cerci, dorsal and ventral views; 74–75, gonocoxites and gonostylus, dorsal and ventral views; 76, aedeagus, gonocoxites and gonostylus, dorsal view; 77–78, aedeagus, ventral and lateral views. AVP, anterior ventral process; DB, dorsal bridge; DP, dorsal plate in phallus; DS, dorsal sclerite in gonocoxite; VP, ventral plate in phallus. Bar=0.5 mm for Figs. 70–71. Bar=0.25 mm for Figs. 72–78.

long processes; endophallic sclerite small in relation to *Anthrax* species examined in this paper; sclerotized sternum 10 not well-marked. Female: Lateral part of tergum 9 two-segmented; sternum 10 (which is thin and elongate) present as distinct paired sclerites between tergum 10 and lateral part of tergum 9; genital furca with lateral bar T-



FIGS. 79–84. *Brachyanax aterrimus* (Doleschall) [=*yamashiroensis* (Matsumura)], female genitalia. 79, tergum 8, dorsal view; 80, terga 8–10, cerci and sternum 8, ventral view; 81, terga 8–9, sternum 8, genital furca, spermatheca and accessory gland, lateral view; 82, terga 9–10 and cercus, lateral view; 83, terga 9–10, cerci, sternum 8, sternum 10, genital fruca and spermatheca, dorsal view; 84, terga 9–10, cerci, sternum 8 and sternum 10, ventral view. AG, accessory gland; GF, genital furca; SP, spermatheca; S8, sternum 8; S10, sternum 10; T9-T10, terga 9–10. Bar=0.75 mm for Figs. 79–81. Bar=0.5 mm for Figs. 82–84.

shaped rather than L-shaped, and with anterior bar concave at posterior margin.

Male genitalia

Tergum 9 rectangular, with anterolateral protruded part small and directed ventrally (or inwards). Sclerotized sternum 10 not well-marked. Fused gonocoxites in ventral view widest before middle and narrower behind middle, and with posterior part divided into paired protruded parts rounded at apex; gonocoxal apodeme short and elliptical. Just before dorsal surface of each gonostylus, a triangular inner plate and a thin outer plate present, which are connected to each other.

Gonostylus widened at base. Dorsal plate (in phallus) in dorsal view with posterior part rectangular and narrower than the anterior part whose lateral margins are somewhat convex outward. Ventral plate with a mid-posterior thinner process and paired anterolateral long processes. Endophallic sclerite small , rather elliptical and with apex pointed. Aedeagal apodeme in lateral view circular, except posterior part which is tapering posteriorly (=basally).

Specimen dissected: HONSHU: 1♂, Tokyo Pref., 18. vi. 1967, J. Minamikawa leg.

Female genitalia

Tergum 10 with 16 or so stout spines. Lateral part of tergum 9 running ventrally and anteriorly anteriorly, 2-segmented. An elongate thin ventral sclerite is present between tergum 9 (running ventrally) and tergum 10 and it probablly represents sternum 10. Tergum 8 rectangular and thinner laterally, and with mid-posterior paler part which is wider than in *A. jezoensis*. Sternum 8 with lateral parts and paired L-shaped median patches which are more sclerotized. [There is an isolated transparent elliptical pair of dorsal membranes the base of which is cord-like and arising near posterior border of sternum 8]. Gential furca with lateral bar T-shaped rather than L-shaped, and with anterior bar concave at posterior margin. Spermathecal duct long, bare; ejection apparatus with large valves; spermathecal reservoir spherical.

Specimen dissected: HONSHU: 1♀, Kurokawa, Niigata Pref., 2. viii. 1956, K. Baba leg.

DISCUSSION

Male genitalia

Hull [10] and Theodor [16] illustrated the male genitalia of many genera and species of Bombyliidae. Marston [11, 12] revised the genus *Anthrax* of the New World, and included an analysis of male genitalic characters.

It has been found in this study that a dorsal sclerite just before the gonostyli varies markedly with species in *Anthrax*. Fused gonocoxites, aedeagal apodeme, and phallus (dorsal and ventral plates) also vary in shape with species. A study based on more species would be worthwhile.

Female genitalia

Theodor [16] wrote, "The female genitalia were completely disregarded by the earlier authors." He illustrated the spermatheca and genital furca for a number of genera and species of Bombyliidae. Besides spermatheca and furca, which are peculiar to each species, various segments of the female genitalia (e. g., tergum 8, sternum 8, etc.) vary considerably between species and it is desirable to study them for a full understanding of the taxonomy of *Anthrax* species.

Anthrax aygula *complex and* A. distigma

We have recognized the *Anthrax aygula* complex, which is at least composed of *A. aygula* and *A.* sp. 1. It has been shown in this paper that the study of genitalia is essential for the identification of species within the *Anthrax aygula* complex.

Brunetti [2] wrote, "This species [=*A. distigma*] shows considerable variation, mainly in the extent of the small white scales on the abdomen and in the wing markings, the three isolated spots being often much reduced in size, or one or more may be absent ; in one specimen, taken on board ship 10 miles off the Madras coast, all three are absent. The variety *tripunctata*, Wulp, has these three spots reduced exceedingly, and the dark band fills the whole of the anal and axillary cells." If the *A. distigma* complex is present, to clarify genitalic characters would be essential to the taxonomy of this species complex.

Genera of Anthracini

The genera *Anthrax* and *Brachyanax* belong to the tribe Anthracini. Evenhuis [5] discussed the status of the genera of Anthracini and prepared a key to 7 genera. Of the Anthracini other than *Anthrax*, the genitalia of only one species of *Brachyanax* have been studied in detail. Detailed comparison of the genitalia throughout the genera and species of Anthracini would be interesting for the future workers.

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