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Studies on the Endophallic Structures of the Japanese Phrissomini (Coleoptera, Cerambycidae)

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Abstract Endophallic structures of all the Japanese species of the cerambycid tribe Phrissomini are described and illustrated. Although the endophallus and crescent sclerites are morphologically similar to each other, the surface of ventral tubercles of the preapical bulb and the hair-like microtrichia on the ventral surface of medial tube can be used as diagnostic characters for species and subspecies. It is inferred that the endophallus of the Phrissomini is so fragile to function as the physical mechanism for the precopulatory isolation.

Introduction

The tribe Phrissomini THOMSON, 1860 is characterized by the vestigial hind wings, the shortened metasternum and the closed cicatrix on scape. Six endemic species belonging to three genera of the tribe are distributed in Japan (HASEGAWA, 2007), *viz.*, *Hayashiechthistatus inexpectus*, *Parechthistatus gibber*, *Mesechthistatus binodosus*, *M. furciferus*, *M. taniguchii* and *M. fujisanus*.

Hayashiechthistatus inexpectus is endemic to Yakushima Island. *Parechthistatus gibber* is distributed in Honshu west of Kantô District, Shikoku, Kyushu, Oki Island and the Tsushima Islands (TAKAKUWA *et al.*, 2004; NAKAMINE & TAKEDA, 2008 a), and currently includes 10 subspecies (MIYAKE, 1980). The genus *Mesechthistatus* includes four species parapatrically distributed in Honshu and Sado Island, *viz.*, *M. binodosus* from eastern Honshu north of Kantô District and Sado Island; *M. furciferus* from eastern Honshu facing the Sea of Japan and running westward to northern Kinki District beyond the Itoigawa-Shizuoka tectonic line; *M. taniguchii* from such central mountains of Honshu as Mt. Ontake, Mts. Kiso, Mts. Akaishi and Mts. Yatsu; *M.*

fujisanus from Mts. Yatsu and Kantô District (TAKAKUWA, 1988; TAKAKUWA *et al.*, 2004; NAKAMINE & TAKEDA, 2008 b).

The tribe Phrissomini has been investigated taxonomically based on external morphology (*e.g.*, MIYAKE, 1980; TAKAKUWA, 1988) and molecular phylogeny (NAKAMINE & TAKEDA, 2008 a, b). The morphology of male genital organ has served for analyzing insect taxonomy, phylogeny and evolution, especially in the endophallic structure (*e.g.*, KUBOTA & SOTA, 1998; DANILEVSKY *et al.*, 2004; DANILEVSKY & KASATKIN, 2006; IMURA, 2007). However, there are a few studies using the endophallus as a diagnostic character in the Cerambycidae (DANILEVSKY *et al.*, 2004; DANILEVSKY & KASATKIN, 2006). It is unique that TOKI & KUBOTA (2007) described the morphology of endophallus in *Mesechthistatus binodosus* and *M. taniguchii* of the Phrissomini. They suggested that the apical phallomere is clearly different in structure between *M. binodosus* and *M. taniguchii*, though that character is very fragile, and sometimes impossible to make comparisons in the case of specimen fixed in ethanol and dried one.

We have recently examined endophallic structure of all the Japanese species including most of their subspecies of the tribe Phrissomini, and will describe and illustrate them with a brief discussion in the present paper.

Materials and Methods

The specimens examined in this study were immediately fixed in 95–99.5% ethanol for molecular phylogenetic analysis or in dried condition killed by ethyl acetate gas. The mesothorax, metathorax and abdomen were heated with water in a vessel floating on boiling water for 10–20 minutes for removing ethanol and softening. Abdominal tergite was slashed with tweezers and exposed the inside. The specimens were placed in enzyme solution consisting of 30 ml saturated aqueous sodium borate ($Na_2B_4O_7 \cdot 10H_2O$), 70 ml distilled water and 1 g trypsin, and incubated at 40℃. After incubated overnight, the muscles were digested and the genital organ was extracted from the abdomen if it could be pulled safely. Besides, the extracted genital organ was placed again in the trypsin solution to digest muscles, and incubation was continued for one to two days at 40℃. Remaining muscles and soft tissues were removed under a binocular microscope, and the median lobe with endophallus was separated from the tegmen. Next, the endophallus was everted carefully with a pair of fine tweezers. Finally, the endophallus was fully everted by filling vaseline.

Terminology of morphological characteristics follows DANILEVSKY *et al.* (2004), DANILEVSKY & KASATKIN (2006), OHBAYASHI (2007), TOKI & KUBOTA (2007), and YAMASAKO & OHBAYASHI (2007) (Fig. 1). The abbreviations used in description are as follows: bt – basal tube, mt – medial tube, ct – central trunk, pb – preapical bulb, vt – ventral tubercles, cs – crescent sclerites.

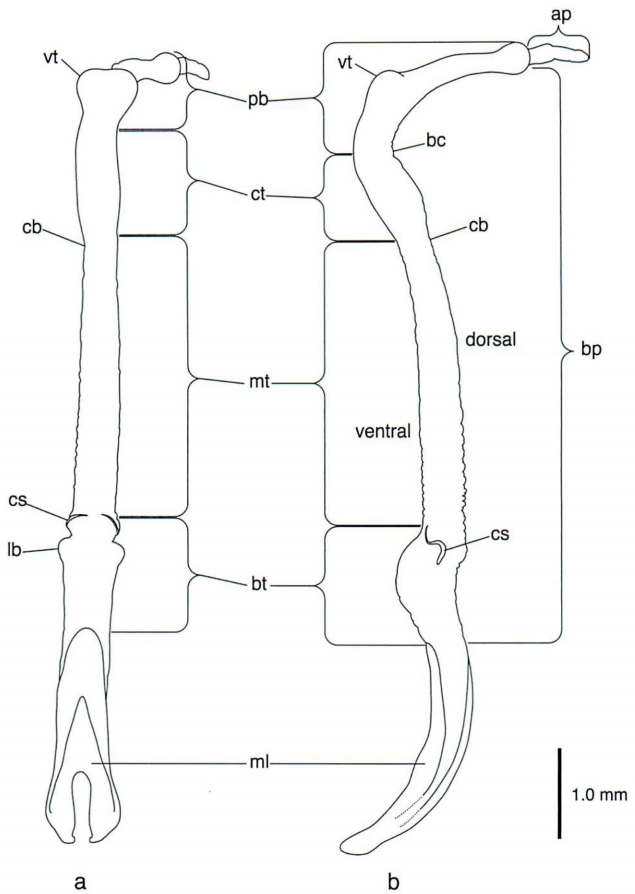

Fig. 1. Schematic view of everted endophallus of *Parechthistatus gibber*; a, ventral aspect of endophallus; b, left lateral aspect of endophallus. Abbreviations: ap, apical phallomere; bc, basal curvature of preapical bulb; bp, basal phallomere; bt, basal tube; cb, central bend; cs, crescent sclerites; ct, central trunk; lb, lateral tubercles of basal tube; ml, medial lobe; mt, medial tube; pb, preapical bulb; vt, ventral tubercles of preapical bulb.

Results

Parechthistatus gibber (BATES, 1873)

(Figs. 2–18, 20–36)

Endophallus 2.3–3.2 times as long as median lobe. Basal tube (bt) moderately swollen in profile, 0.5–0.7 times as long as median lobe. Medial tube (mt) 1.0–1.3 times as long as median lobe; with basal half provided with transverse rugae, apical half with microspicules. Central trunk (ct) 0.3–0.6 times as long as median lobe, swollen at middle and covered with microspicules on dorsal surface. Preapical bulb (pb) 0.7–1.0 times as long as median lobe, swollen near apex, covered with microspicules. Ventral

tubercles (vt) at basal fifth covered with microtrichia. Crescent sclerites (cs) tongue-shaped in ventral half.

Notes. The endophallic structure of *Parechthistatus gibber* is very similar to that of *Mesechthistatus* species, though barely discriminated from the latter by the thin medial tube and somewhat swollen at the middle of central trunk.

The differences of endophallus between the previously known subspecies of *P. gibber* are as follows: Central trunk in *P. g. longicornis* and *P. g. grossus* is longer than those of other subspecies (0.44–0.59 times as long as median lobe in *P. g. longicornis*; 0.57–0.62 times as in *P. g. grossus* and 0.30–0.44 times as in other subspecies); ventral tubercles of preapical bulb projected in *P. g. grossus* (Figs. 18, 19); ventral tubercles covered with a few microtrichia on surface in *P. g. grossus*; median tube without hair-like microtrichia on ventral surface in *P. g. grossus*, though sparsely provided with them in other subspecies. The hair-like microtrichia on the median tube are usually absent in the local population from Mt. Nonobori, Mie of *P. g. shibatai*, that from Mt. Kôdaiji, Osaka of *P. g. gibber*, and that from Mt. Kuruson, Yamaguchi of *P. g. tanakai*. Therefore, this character is variable among several local populations of the subspecies of *P. gibber*, and may not be a structure useful for separating the subspecies.

Parechthistatus gibber shibatai MIYAKE, 1980

Parechthistatus gibber shibatai MIYAKE, 1980, Kita-Kyûshû no Konchû, Kokura, **27**, p. 74, pl. 6, fig. P; type locality: Mt. Iwawaki, Osaka Pref.

Materials examined. 1 ♂, Torigaike, Ôshika-Mura, Nagano Pref., 15–IX–2002, T. KINOSHITA leg.; 1 ♂, Nishiusuzuka, Fujinomiya-shi, Shizuoka Pref., 12–X–2003, H. NAKAMINE leg.; 1 ♂, Mt. Kadoketa, Hamamatsu-shi, Shizuoka Pref., 6–X–2001, K. SHIKATA leg.; 1 ♂, Mt. Nonobori, Kameyama-shi, Mie Pref., 3–VI–2002, K. AKITA leg.; 1 ♂, Mt. Katsuragi, Kishiwada-shi, Osaka Pref., 30–V–2002, R. MATSUMOTO leg.; 1 ♂, Mt. Wasamata, Kamikitayama-mura, Nara Pref., 8–VI–2002, K. FUJIMORI leg.

Parechthistatus gibber gibber (BATES, 1873)

Echthistatus gibber BATES, 1873, Ann. Mag. nat. Hist., (4), **12**, p. 308; type locality: Maiyasan and Kawatchi.

Materials examined. 1 ♂, Mt. Kôdaiji, Toyono-chô, Osaka Pref., 3–VI–2004, H. NAKAMINE leg.; 1 ♂, Mt. Maya, Kôbe-shi, Hyôgo Pref., 17–VI–2002, H. NAKAMINE leg.; 1 ♂, Mt. Yuzuruha, Minamiawaji-shi, Hyôgo Pref., 23–IX–2003, Y. NAMEDA & N. ÔTSUKA leg.; 1 ♂, Shôdoshima Is., Shôdoshima-chô, Kagawa Pref., 7–VI–2003, Y. NAMEDA leg.

Parechthistatus gibber daisen MIYAKE et TSUJI, 1980

Parechthistatus gibber daisen MIYAKE et TSUJI, 1980, Kita-Kyûshû no Konchû, Kokura, **27**, p. 76; type locality: Hoki Daisen.

Materials examined. 1 ♂, Akazai-keikoku, Shisô-shi, Hyôgo Pref., 26–IX–2004 (emerged out), Y. NAMEDA leg.; 1 ♂, Ôzuku, Okinoshima-chô, Shimane Pref., 6–IX–2004, T. SHIMADA leg.

Parechthistatus gibber tanakai MIYAKE, 1980

Parechthistatus gibber tanakai MIYAKE, 1980, Kita-Kyûshû no Konchû, Kokura, **27**, p. 77, pl. 6, figs. j, k, l; type locality: Tokusa-ue [sic] = Tokusakami, Abu-gun, Yamaguchi Pref., Japan.

Materials examined. 1 ♂, Kidanikyô, Iwakuni-shi, Yamaguchi Pref., 27–V–2002, Y. MATSUMOTO leg.; 1 ♂, Mt. Kuruson, Shimonoseki-shi, Yamaguchi Pref., 12–X–2002, T. MIKAGE leg.

Parechthistatus gibber nankiensis YOKOYAMA, 1969

Parechthistatus nankiensis YOKOYAMA, 1969, Ent. Rev. Japan, Osaka, **21**, p. 59, pl. 7, figs. 3, 4; type locality: Hirai, Kii Kozagawa, Wakayama Pref., Japan.

Material examined. No material examined.

Parechthistatus gibber nakanei MIYAKE, 1980

Parechthistatus gibber nakanei MIYAKE, 1980, Kita-Kyûshû no Konchû, Kokura, **27**, p. 76, pl. 6, fig. O; type locality: Yufuori, Shionoemura, Kagawa Pref.

Materials examined. 1 ♂, Mt. Unpenji, Miyoshi-shi, Tokushima Pref., 13–VI–2004, N. ÔTSUKA leg.; 1 ♂, Mt. Nyotai, Awa-shi, Tokushima Pref., 18–V–2003, Y. NAMEDA leg.

Parechthistatus gibber pseudogrossus MIYAKE, 1980

Parechthistatus gibber pseudogrossus MIYAKE, 1980, Kita-Kyûshû, no Konchû, Kokura, **27**, p. 78, pl. 6, fig. r; type locality: Mt. Tsurugi, Tokushima Pref.

Materials examined. 1 ♂, Mt. Takanawa, Matsuyama-shi, Ehime Pref., 30–IX–1999, T. KONISHI leg.; 1 ♂, Mt. Ishizuchi, Kumakôgen-chô, Ehime Pref., 29–VIII–1998, T. KONISHI leg.; 1 ♂, Mt. Yatsura, Uwajima-shi, Ehime Pref., 29–V–2004, N. ÔTSUKA leg.; 1 ♂, Mt. None, Tôyô-chô, Kôchi Pref., 24–V–2003, Y. NAMEDA & N. ÔTSUKA leg.

Parechthistatus gibber tsushimanus OHBAYASHI, 1961

Parechthistatus gibber tsushimanus OHBAYASHI, 1961, Ent. Rev. Japan, Osaka, **12**, p. 49; type locality: Mt. Ariake, Is. Tsushima.

Material examined. No material examined.

Parechthistatus gibber longicornis Hayashi, 1951

Parechthistatus gibber longicornis HAYASHI, 1951, Ent. Rev. Japan, Osaka, **5**, p. 80; type locality: Mt. Fukuchi, Kokura City, Northern Kyushu, Japan.

Materials examined. 1 ♂, Mt. Sefuri, Kanzaki-shi, Saga Pref., 13–VIII–2002, R. NODA leg.; 1 ♂, Otoko-Ike, Yufu-shi, Ôita Pref., 21–IX–2002, T. MIKAGE leg.; 1 ♂, Kakushimizu, Yufu-shi, Ôita Pref., 29–IX–2002, K. ARAMAKI leg.

Parechthistatus gibber grossus (BATES, 1884)

Echthistatus grossus BATES, 1884, J. Linn. Soc. London, (Zool.), **18**, p. 237; type locality: Yuyama, Japan.

Materials examined. 2 ♂♂, Mt. Shiraga, Asagiri-chô, Kumamoto Pref., 26–X–2001, K. MORI leg.; 1 ♂, Ôjibaru, Takaharu-chô, Miyazaki Pref., 24–X–2001, K. MORI leg.

Hayashiechthistatus inexpectus (HAYASHI, 1959)

(Figs. 19 & 37)

Parechthistatus inexpectus HAYASHI, 1959, Ent. Rev. Japan, Osaka, **10**, p. 56; Kosugidani (alt. 700 m), Yakushima, Japan.

Endophallus about 2.9 times as long as median lobe. Bt moderately swollen in profile, about 0.7 times as long as median lobe. Mt about 1.2 times as long as median lobe, with basal half provided with transverse rugae, apical half with microspicules. Ct about 0.6 times as long as median lobe, swollen at middle, covered with microspicules on dorsal surface. Pb about 0.9 times as long as median lobe, swollen near apex, covered with microspicules. Vt at basal fifth feeble, covered with microtrichia. Cs tongue-shaped in ventral half.

Material examined. 1 ♂, Yakushima Is., Yakushima-chô, Kagoshima Pref., 14–IX–2002, N. OHBAYASHI leg.

Notes. The endophallic structure of *Hayashiechthistatus inexpectus* is almost identical with that of *Parechthistatus gibber grossus*, and is difficult to discriminate in

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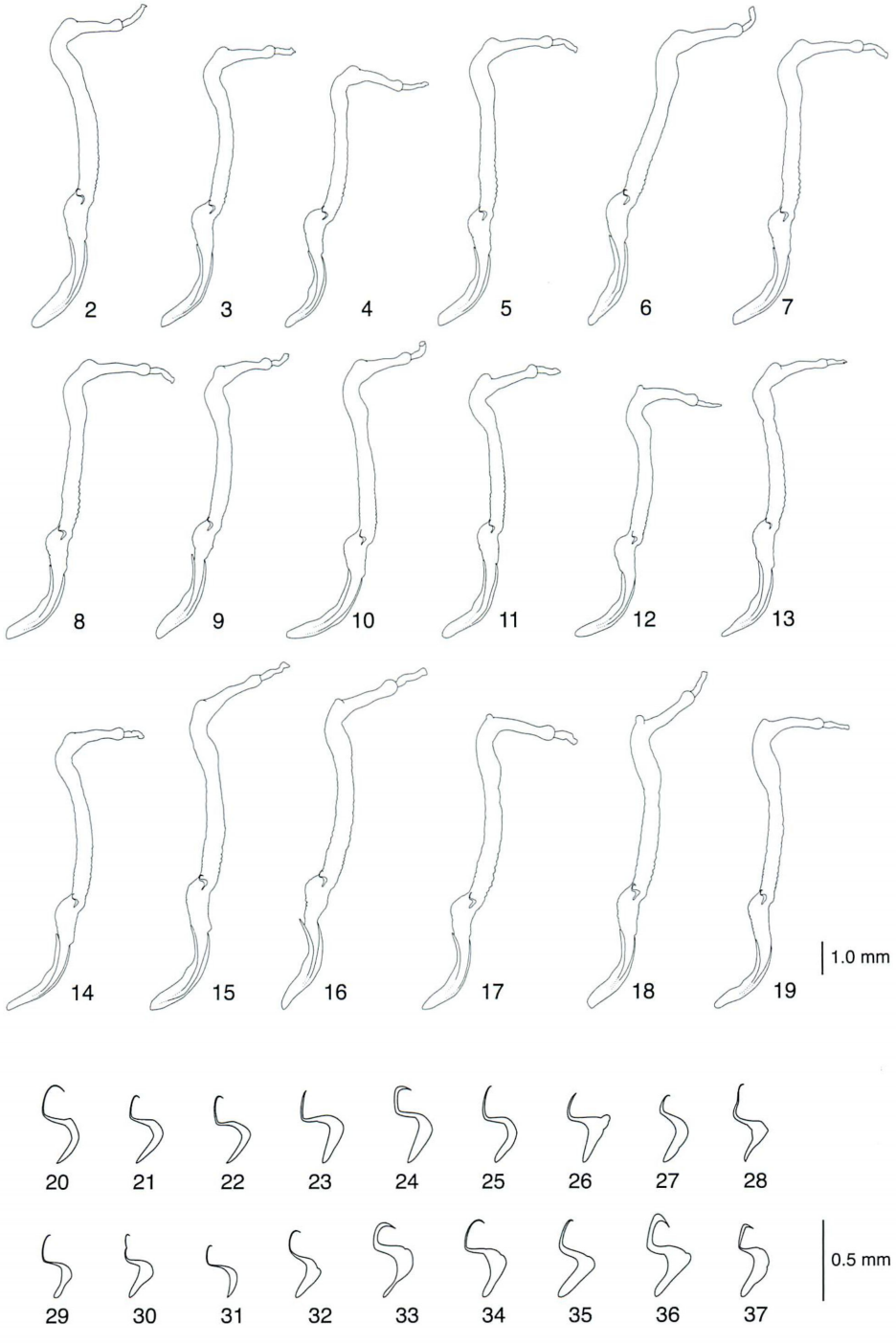
Figs. 2–37. Left lateral aspect of endophallus (2–19) and crescent sclerites (20–37) of *Parechthistatus gibber* and *Hayashiechthistatus inexpectus*. —— 2, 20, *P. g. shibatai* from Mt. Fuji, Shizuoka; 3, 21, *P. g. shibatai* from Mt. Kadoketa, Shizuoka; 4, 22, *P. g. shibatai* from Mt. Nonobori, Mie; 5, 23, *P. g. shibatai* from Mt. Wasamata, Nara; 6, 24, *P. g. shibatai* from Mt. Katsuragi, Osaka; 7, 25, *P. g. gibber* from Mt. Kôdaiji, Osaka; 8, 28, *P. g. gibber* from Awajishima Is., Hyôgo; 9, 27, *P. g. gibber* from Shôdoshima Is., Kagawa; 10, 28, *P. g. daisen* from Akazai, Hyôgo; 11, 29, *P. g. daisen* from Okinoshima Is., Shimane; 12, 30, *P. g. tanakai* from Mt. Kuruson, Yamaguchi; 13, 31, *P. g. nakanei* from Mt. Nyotai, Kagawa; 14, 32, *P. g. pseudogrossus* from Mt. Ishizuchi, Ehime; 15, 33, *P. g. pseudogrossus* from Mt. None, Kôchi; 16, 34, *P. g. longicornis* from Mt. Sefuri, Saga; 17, 35, *P. g. grossus* from Mt. Shiraga, Kumamoto; 18, 36, *P. g. grossus* from Ôjibaru, Miyazaki; 19, 37, *H. inexpectus* from Yakushima Is., Kagoshima.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their morphology.

Mesechthistatus binodosus (WATERHOUSE, 1881)

(Figs. 38–41, 52–55)

Endophallus 2.3–2.8 times as long as median lobe. Bt moderately swollen in profile, about 0.5 times as long as median lobe. Mt 1.0–1.2 times as long as median lobe, with basal half provided with transverse rugae, apical half with microspicules and also with sparse hair-like microtrichia on ventral surface. Ct 0.4–0.5 times as long as median lobe, swollen at middle, covered with microspicules on dorsal surface. Pb 0.6–0.8 times as long as median lobe, swollen near apex, covered with microspicules. Vt at basal fifth covered with microtrichia. Cs tongue-shaped in ventral half.

Notes. The endophallic structure of *Mesechthistatus binodosus* is almost identical with that of *M. furciferus meridionalis*, and difficult to discriminate in their morphology. Besides, there is no difference in the endophallic structure between two subspecies from eastern Honshu and Sado Island.

Mesechthistatus binodosus binodosus (WATERHOUSE, 1881)

Echthistatus binodosus WATERHOUSE, 1881, Trans. ent. Soc. London, **1881**, p. 431; type locality: Tokei [sic] =Tokyo?, Japan.

Materials examined. 1 ♂, Anmon-no-taki, Nishimeya-mura, Aomori Pref., 21–IX–2003, M. TÔYAMA leg.; 1 ♂, Toranosawa-rindô, Nishimeya-mura, Aomori Pref., 21–IX–2003, M. TÔYAMA leg.; 1 ♂, Mt. Shinzan, Oga-shi, Akita Pref., 21–IX–2003, M. TÔYAMA leg.; 1 ♂, Mt. Tahô, Niigata-shi, Niigata Pref., 26–X–2001, H. NAKABAYASHI leg.; 1 ♂, Shiori-tôge, Uonuma-shi, Niigata Pref., 9–VI–2003, H. KONYA leg.; 1 ♂, Mt. Narô, Suzaka-Shi, Nagano Pref., 22–IX–2002, H. NAKAMINE leg.; 1 ♂, Sano, Hakuba-mura, Nagano Pref., 10–X–2000, H. NAKAMINE leg.

Mesechthistatus binodosus insularis HAYASHI, 1955

Mesechthistatus binodulus insularis HAYASHI, 1955, Col. Ill. Ins. Japan, **1**, p. 55, foot-note, No. 19; type locality: Sado Is.

Material examined. 1 ♂, Mt. Donden, Sado-shi, Niigata Pref., 28–IX–1999, H. NAKAMINE leg.

Mesechthistatus furciferus (BATES, 1884)

(Figs. 42–47, 56–62)

Endophallus 1.8–2.8 times as long as median lobe. Bt moderately swollen in profile, 0.4–0.6 times as long as median lobe. Mt 0.8–1.2 times as long as median lobe, with

basal half provided with transverse rugae, apical half with microspicules and also with sparse hair-like microtrichia on ventral surface. Ct 0.3–0.5 times as long as median lobe, swollen at middle, covered with microspicules on dorsal surface. Pb 0.6–0.8 times as long as median lobe, swollen near apex, covered with microspicules. Vt at basal fifth covered with microtrichia. Cs tongue-shaped in ventral half.

Notes. The endophallic structure of *Mesechthistatus furciferus* is similar to that of *M. binodosus*.

Vt are projected in *M. furciferus furciferus* (Figs. 42, 43, 44) instead of conical in *M. f. meridionalis* (Figs. 45, 46, 47).

Mesechthistatus furciferus furciferus (BATES, 1884)

Echthistatus furciferus BATES, 1884, J. Linn. Soc. London, (Zool.), **18**, p. 237; type locality: Maigasan [sic] = Mayasan, Hiogo, Japan.

Materials examined. 1 ♂, Mt. Oike, Inabe-shi, Mie Pref., 16–IX–2001, K. AKITA leg.; 1 ♂, Ashû, Nantan-shi, Kyoto Pref., X–2000, M. TÔYAMA leg.; 1 ♂, Mt. Hachigamine, Nantan-shi, Kyoto Pref., 15–X–2006, H. NAKAMINE leg.; 1 ♂, Mt. Ôe, Fukuchiyama-shi, Kyoto Pref., 14–X–2001, H. NAKAMINE leg.; 1 ♂, Nasa, Toyooka-shi, Hyôgo Pref., 13–X–2001, H. NAKAMINE leg.; 1 ♂, Tokose, Toyooka-shi, Hyôgo Pref., 15–V–2002, M. MATSUNAGA leg.; 1 ♂, Itoi-keikoku, Asago-shi, Hyôgo Pref., 5–X–2002, H. NAKAMINE leg.

Mesechthistatus furciferus meridionalis (HAYASHI, 1951)

Echthistatus? binodosus subsp. *meridionalis* HAYASHI, 1951, Ent. Rev. Japan, Osaka, **5**, p. 79; type locality: Mt. Ohmine, Nara Pref., Honshu, Japan.

Materials examined. 1 ♂, Mt. Shiratori, Itoigawa-shi, Niigata Pref., 28–X–2001, H. NAKABAYASHI leg.; 1 ♂, Mt. Hôryû, Wajima-shi, Ishikawa Pref., 29–IX–2002, H. NAKAMINE leg.; 1 ♂, Mt. Hôonji, Katsuyama-shi, Fukui Pref., 10–X–2004, H. NAKABAYASHI leg.; 2 ♂♂, Mt. Daibutsuji, Eiheiji-chô, Fukui Pref., 4–X–2004, H. NAKAMINE leg.; 1 ♂, Mt. Jôzan, Echizen-chô, Fukui Pref., 11–X–2004, H. NAKABAYASHI leg.; 1 ♂, Ômigawa, Otari-mura, Nagano Pref., 9–X–2000, H. NAKAMINE leg.; 1 ♂, Nanakura, Ômachi-shi, Nagano Pref., 20–X–2001, S. TSUYUKI leg.; 1 ♂, Sakai-tôge, Matsumoto-shi, Nagano Pref., 22–IX–2007, H. NAKAMINE leg.; 1 ♂, Hiwada-kôgen, Takayama-shi, Gifu Pref., 23–IX–2007, H. NAKAMINE leg.

Mesechthistatus taniguchii (SEKI, 1944)

(Figs. 48, 49, 62 & 63)

Echthistatus taniguchii SEKI, 1944, Ins. Wld. Gifu, **48**, p. 168, fig.: type locality: Mt. Kiso-koma, Nagano Pref., Japan.

Endophallus 1.7–2.4 times as long as median lobe. Bt moderately swollen in profile, 0.4–0.5 times as long as median lobe. Mt 0.8–0.9 times as long as median lobe, with basal half provided with deep transverse rugae, apical half with microspicules and also with sparse hair-like microtrichia on ventral surface. Ct 0.4–0.5 times as long as median lobe, swollen at middle, and covered with microspicules. Pb 0.6–0.8 times as long as median lobe, swollen near apex, covered with microspicules. Vt at basal fifth covered with microtrichia. Cs triangular in ventral half.

Materials examined. 1 ♂, Maruyama-rindô, Masuho-chô, Yamanashi Pref., 8–X–2001, T. KOBAYASHI leg.; 1 ♂, Yadehara-rindô, Kawakami-mura, Nagano Pref., 4–IX–2004, T. KOBAYASHI leg.; 1 ♂, Fudôshimizu, Fujimi-machi, Nagano Pref., 24–IX–2005, H. NAKAMINE leg.; 1 ♂, Ôdaira-tôge, Iida-shi, Nagano Pref., 18–IX–2004, H. NAKAMINE leg., 2 ♂♂, Kisokoma-kôgen, Kisofukshima-machi, Nagano Pref., 19–IX–2004, H. NAKAMINE leg.; 1 ♂, Nigorigo-tôge, Takayama-shi, Gifu Pref., 19–IX–2004, H. NAKAMINE leg.; 1 ♂, Mt. Kadoketa, Hamamatsu-shi, Shizuoka Pref., 6–X–2001, H. NAKAMINE leg.

Notes. Mesechthistatus taniguchii is a unique species that is clearly different in the endophallic structure from the other species of the Japanese Phrissomini. The basal half of medial tube is provided with deep transverse rugae, central trunk is covered with microspicules on both dorsal and ventral surfaces, and the crescent sclerite is triangular in the ventral half.

Mesechthistatus fujisanus HAYASHI, 1957

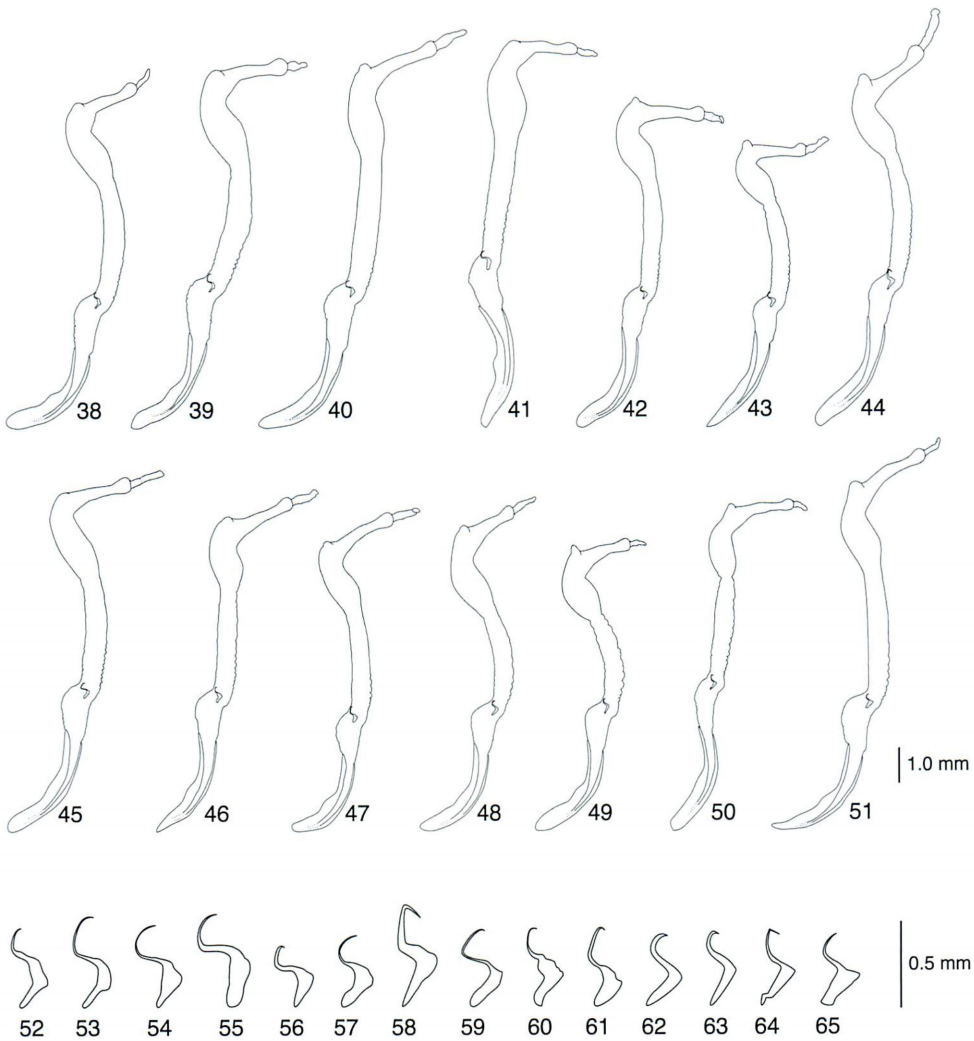
(Figs. 50, 51, 64 & 65)

Mesechthistatus fujisanus HAYASHI, 1957, Ent. Rev. Japan, Osaka, **8**, p. 46, fig. 2; Mt. Fuji (3-gôme), Shizuoka Pref.

Endophallus 2.0–2.8 times as long as median lobe. Bt moderately swollen in profile, 0.4–0.6 times as long as median lobe. Mt 0.9–1.0 times as long as median lobe, with basal half provided with transverse rugae, apical half with microspicules and also with sparse hair-like microtrichia on ventral surface. Ct 0.4–0.5 times as long as median lobe, swollen at middle, and covered with microspicules on dorsal surface and on a small area of ventral surface. Pb 0.7–0.8 times as long as median lobe, swollen near apex, covered with microspicules. Vt at basal fifth covered with microtrichia. Cs tongue-shaped in ventral half.

Materials examined. 1 ♂, Hikawa-rindô, Enzan-shi, Yamanashi Pref., 23–X–2004, S. SAITÔ leg.; 1 ♂, Mt. Tenjin, Narusawa-mura, Yamanashi Pref., T. KOBAYASHI leg.; 2 ♂♂, Takinoirisawa, Ueda-shi, Nagano Pref., 22–IX–2002, H. NAKAMINE leg.; 1 ♂, Sanjiro, Matsumoto-shi, Nagano Pref., 21–IX–2002, S. SAITÔ leg.; 1 ♂, Kowashimizu, Suwa-shi, Nagano Pref., 25–IX–2005, H. NAKAMINE leg.

Notes. The endophallic structure of *Mesechthistatus fujisanus* is barely discriminated from the other species of the Japanese Phrissomini by the presence of microspic-



Figs. 38–65. Left lateral aspect of endophallus (38–51) and crescent sclerites of *Mesechthistatus* spp. —— 38, 52, *M. binodosus binodosus* from Mt. Shirakami, Aomori; 39, 53, *M. b. binodosus* from Oga Penin., Akita; 40, 54, *M. b. binodosus* from Shiori-tôge, Niigata; 41, 55, *M. b. insularis* from Mt. Donden, Sado Is., Niigata; 42, 56, *M. furciferus furciferus* from Mt. Oike, Mie; 43, 57, *M. f. furciferus* from Mt. Hachigamine, Kyoto; 44, 58, *M. f. furciferus* from Tokose, Hyôgo; 45, 59, *M. f. meridionalis* from Ômigawa, Nagano; 46, 60, *M. f. meridionalis* from Sakai-tôge, Nagano; 47, 61, *M. f. meridionalis* from Hiwada-kôgen, Gifu; 48, 62, *M. taniguchii* from Maruyama-rindô, Yamanashi; 49, 63, *M. taniguchii* from Kisokoma-kôgen, Nagano; 50, 64, *M. fujisanus* from Mt. Tenjin, Yamanashi; 51, 65, *M. fujisanus* from Takinoirisawa, Nagano.

ules on the dorsal surface and in a small area of the ventral surface of the central trunk.

Discussion

Although morphologically similar in the endophallus and crescent sclerites among *Mesechthistatus* species, several diagnostic characters are recognized especially in those of *M. taniguchii* (Figs. 48, 49, 62, 63) (see TOKI & KUBOTA, 2007); vt are developed, mt is strongly rugged on the surface, cs is triangular in the ventral half, ct are covered with microspicules on the whole surface, though covered with only on the dorsal surface in other *Mesechthistatus* species. Only the species is *Mesechthistatus fujisanus* that has microspicules in a small area of ventral surface of ct. Although TOKI and KUBOTA (2007) reported the absence of hair-like microtrichia on the ventral surface of mt in *M. taniguchii*, we found that structure on mt of the same species.

The endophallic structures mentioned above are no doubt similar to all the Japanese species of the Phrissomini. It is suggested that the structure of endophallus does not function as physical mechanism in precopulatory isolation between the six Japanese species belonging to three genera. Factually, the intergeneric and interspecific hybrids have been usually discovered in their distributional boundary (see TAKAKUWA *et al.*, 2004), and the mitochondrial introgression supports their hybridization (NAKAMINE & TAKEDA, 2008 a, b). However, the three genera and six species of Japanese Phrissomini are clearly classified by external morphology. It is necessary to make research on the ecological traits and more detailed examination of external and genitalic morphology in order to solve the speciation of those species.

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要　　約

中峰　空・竹田真木生：日本産コブヤハズカミキリ族の雄交尾器内袋構造. —— 日本に分布するコブヤハズカミキリ族3属6種の反転・膨隆させた♂交尾器内袋の構造について，詳細に記

載し，図示した．日本産3属6種については，種間のみならず，属間においても形態的な差異は軽微であることから，交尾器の内袋構造が交尾前隔離の物理的機構として作用していない可能性が示唆された．

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Notes on Phylogenetic Relationships of the Tribe Phrissomini (Coleoptera, Cerambycidae) Inferred from Mitochondrial COI Gene Sequences

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The tribe Phrissomini THOMSON, 1860 consists of flightless longicorn beetles with atrophied hindwings. Three genera, including the following six species of this tribe are distributed in and endemic to Japan, *Hayashiechthistatus inexpectus* (HAYASHI), *Parechthistatus gibber* (BATES), *Mesechthistatus binodosus* (WATERHOUSE), *M. furciferus* (BATES), *M. taniguchii* (SEKI) and *M. fujisanus* HAYASHI. Molecular phylogenetic approach is a method of utility to investigate the phylogenetic relationships at inter-taxon level and chronological distance of divergence. We have already reported molecular analyses on phylogeny, both intergeneric one [for *Parechthistatus gibber* and *Hayashiechthistatus inexpectus* (NAKAMINE & TAKEDA, 2008 a)] and intrageneric one [for four *Mesechthistatus* species (NAKAMINE & TAKEDA, 2008 b)]. However, we have not published our results of molecular phylogenetic analysis at intra-tribe level. Here we provide the phylogenetic relationships by the analysis that was carried out based on partial sequences from the mitochondrial cytochrome oxidase subunit I (COI) gene from six different species of tribe Phrissomini.

Materials and Methods. The analytical methods are the same as already described by NAKAMINE & TAKEDA (2008 a, 2008 b). Two lamiine species, *Plectrura metallica yoshihiroi* TAKAKUWA and *Dolichoprosopus yokoyamai* (GRESSITT) were used as outgroup.

Results and discussion. Figure 1 shows the maximum likelihood tree of the mitochondrial