

Notes on the Japanese Species of the Genus *Coelostoma* BRULLÉ (Coleoptera, Hydrophilidae)

Nobutaka WATANABE

Department of Natural History, Faculty of Science, Tokyo Metropolitan
University, Hachioji, Tokyo, 192–03 Japan

Abstract *Coelostoma fallaciosum* d'ORCHYMONT is added to our fauna on the basis of specimens collected from the Ryukyu Islands. The male genitalia and male ninth abdominal segments are morphologically examined and illustrated in detail for the following species: *C. stultum* (WALKER), *C. orbiculare* (FABRICIUS) and *C. fallaciosum*. A key to the Japanese species of this genus is given.

The genus *Coelostoma* BRULLÉ has hitherto been represented in Japan only by *C. (Holocoelostoma) stultum* (WALKER, 1858) and *C. (Coelostoma s. str.) orbiculare* (FABRICIUS, 1775) (SHARP, 1874, 1884; KNISCH, 1924; NAKANE, 1950, 1963; SATÔ, 1960, 1985; and others). The former species is primarily Oriental, very widely distributed, and has been recorded from Honshu to the Ryukyus in Japan; the latter, a Palearctic species of extensive distribution, from Hokkaido to Honshu.

During the examination of material before me, amounting to about 1,200 specimens, it has been found that a third species of the genus occurs in the Ryukyus: *C. (C. s. str.) fallaciosum* d'ORCHYMONT.

In this paper I intend to characterize precisely the male genital organ and male ninth abdominal segment for these interesting species of semi-aquatic habits to provide a base for further phylogenetic analyses as well as to enumerate diagnostic characters.

Genus *Coelostoma* BRULLÉ, 1835

Coelostoma BRULLÉ, 1835, *Hist. nat. Ins.*, (5), 2: 293.

Subgenus *Holocoelostoma* MOUCHAMPS, 1958

Holocoelostoma MOUCHAMPS, 1958, *Bull. Inst. r. Sci. nat. Belg.*, 34: 3.

Coelostoma (Holocoelostoma) stultum (WALKER, 1858)

(Figs. 1–9)

Hydrobius stultus WALKER, 1858, *Ann. Mag. nat. Hist.*, (3), 2: 209.

Cyclonotum simplex SHARP, 1874, *Trans. ent. Soc. Lond.*, 1874: 419 (Japan, China).

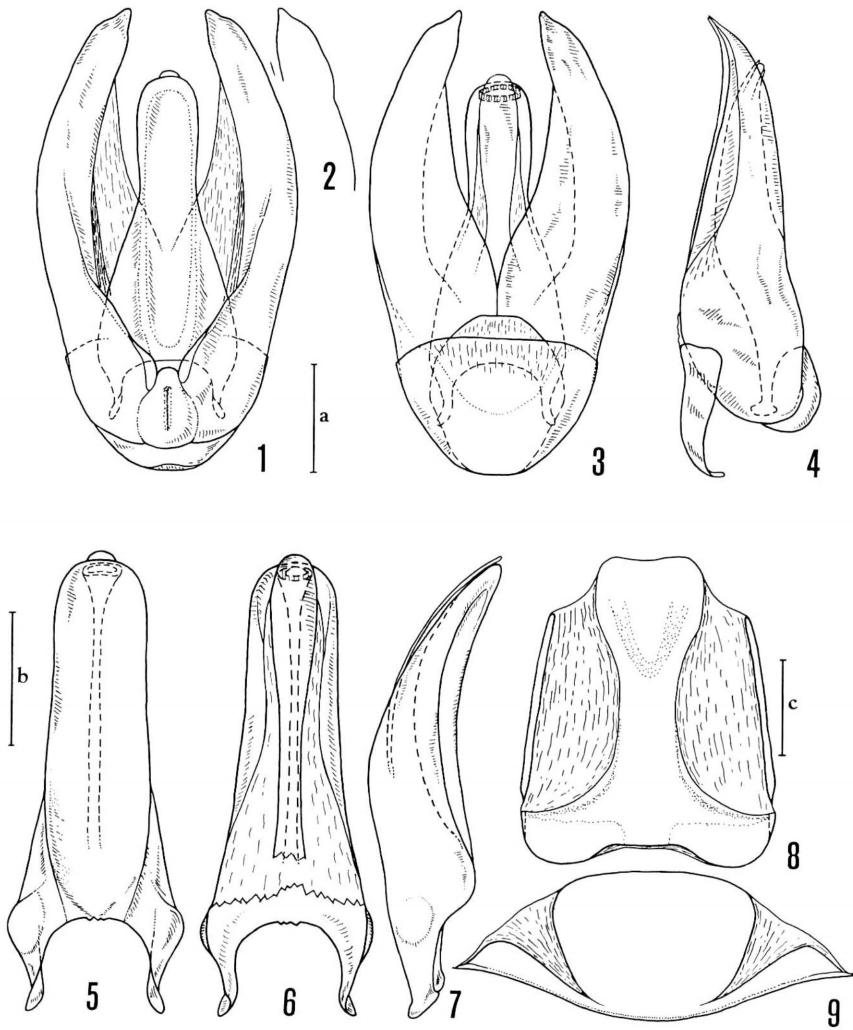
Aedeagus (Figs. 1–4) rather longitudinal. Penis (median lobe) (Figs. 5–7) almost parallel-sided in posterior half, becoming gradually widened toward anterior end,

strongly curved with ventral convexity; dorsal surface highly sclerotized, distinctly widely concave at middle; ventral surface widely membranous, medially having a spatulate plate, the posterior end of which covers the apical ostium. Parameres curved with dorsal convexity, becoming gradually thickened toward base, each with the posterior end acutely rounded and internal, external edge sometimes distinctly sinuate near posterior end (Fig. 2); in dorsal aspect, each narrowly sclerotized, sclerotized area strongly curved with external convexity, having almost even width in posterior 2/3, clearly widened near base which is strongly gibbose at middle; ventral surface lightly sclerotized. Basal piece transverse, with a short tip, semicircularly membranous in posterior half.

Male abdominal sternite 9 (Fig. 8) somewhat longitudinal, widely membranous laterally. Male abdominal tergite 9 (Fig. 9) medially with a wide sclerotized area almost ellipsoidal.

Length: ♂, 4.0–5.4 mm; ♀, 3.7–5.5 mm. Width: ♂, 2.6–3.3 mm; ♀, 2.4–3.5 mm.

Specimens examined. JAPAN [Honshu] <Yamagata-ken> 1 ♀, Mt. Gassan, 29–VIII–1963, S. TACHIKAWA leg. <Saitama-ken> 1 ♂, 2 ♀♀, Riv. Ara-kawa, Kuge, Kumagaya-shi, 26–VI–1978, N. WATANABE leg. <Chiba-ken> 1 ♂, 2 ♀♀, Nr. Lake Inba-numa, Hiraka, Inba-mura, Inba-gun, 3–VI–1989, N. WATANABE leg.; 1 ♂, do., 13–VI–1989, N. WATANABE; 4 ♂♂, 8 ♀♀, do., 31–VIII–1989, N. WATANABE leg.; 1 ♂, 3 ♀♀, do., 7–IX–1989, N. WATANABE leg.; 47 ♂♂, 63 ♀♀, do., 13–IX–1989, N. WATANABE leg.; 24 ♂♂, 19 ♀♀, do., 25–IV–1990, N. WATANABE leg.; 4 ♂♂, 4 ♀♀, do., 10–V–1990, N. WATANABE leg.; 1 ♀, Nr. Lake Inba-numa, Kitasuka, Narita-shi, 30–V–1989, N. WATANABE leg.; 24 ♂♂, 18 ♀♀, do., 3–VI–1989, N. WATANABE leg.; 28 ♂♂, 33 ♀♀, do., 13–IX–1989, N. WATANABE leg.; 7 ♂♂, 10 ♀♀, do., 10–V–1990, N. WATANABE leg.; 1 ♂, Riv. Edo-gawa, Sekiyado-machi, Higashikatsushika-gun, 19–IV–1990, N. WATANABE leg.; 1 ♂, Riv. Tone-gawa, Sekiyado-machi, do. <Tokyo> 1 ♂, Irima-chô, Chôfu-shi, 15–IV–1962, S. TSUKAGUCHI leg.; 1 ♀, do., 22–IV–1962, S. TSUKAGUCHI leg. <Kanagawa-ken> 2 ♂♂, 5 ♀♀, Atsugi, 10–VI–1963, N. WATANABE leg.; 3 ♂♂, 2 ♀♀, Sagami-hara, 16–VI–1962, K. MIZUSAWA leg.; 2 ♂♂, 4 ♀♀, Sodegahama, Hiratsuka-shi, 11–X–1961, N. WATANABE leg. <Kyoto> 1 ♀, Ômiya, 5–VIII–1961, H. TAKAIE leg. [Kyushu] <Nagasaki-ken> 12 ♂♂, 17 ♀♀, Reservoir Urakami-suigenchi, Urakami, Nagasaki-shi, 7–VI–1964, N. WATANABE leg. [Tokunoshima Is. <Kagoshima-ken>] 2 ♂♂, Kamezu, 20–IV–1964, K. ARICHI leg. [Amamiôshima Is. <do.>] 4 ♀♀, Nishinakama, Sumiyô-son, Ôshima-gun, 28~30–VI–1968, K. SAKAI leg.; 1 ♂, 3 ♀♀, do., 9~10–VII–1973, N. WATANABE leg.; 1 ♀, Pass Asato-tôge, 20–VI–1964, M. NISHIKAWA leg.; 1 ♂, do., 23–VI–1964, M. NISHIKAWA leg.; 1 ♀, Hatsu-no, Setouchi-chô, 26–IV–1964, K. ARICHI leg.; 1 ♂, do., 11~12–VII–1973, N. WATANABE leg. [Okinawa Is. <Okinawa-ken>] 1 ♀, Hentona, Kunigami-son, 5–VII–1979, S. SAITO leg.; 26 ♂♂, 19 ♀♀, Okuma, do., 4~6–VII–1973, N. WATANABE leg. [Ishigaki-jima Is. <do.>] 1 ♀, Hirae, Ishigaki-shi, 12–VI–1973, N. WATANABE leg. [Iriomote-jima Is. <do.>] 36 ♂♂, 39 ♀♀, Sonai, Taketomi-chô, Yaeyama-gun, 19~24–VI–1973, N. WATANABE leg.



Figs. 1-9. *Coelostoma stultum* (WALKER). — 1, Aedeagus in dorsal view; 2, paramere, showing a situation near the posterior end; 3, aedeagus in ventral view; 4, same in lateral view; 5, penis (median lobe) in dorsal view; 6, same in ventral view; 7, same in lateral view; 8, male abdominal sternite 9; 9, male abdominal tergite 9. Scales: 0.2 mm (a for Figs. 1-4; b for Figs. 5-7; c for Figs. 8, 9).

TAIWAN 2 ♂♂, 4 ♀♀, Hotso, Jenai-hsiang, Nantou-hsien, 5~6-VIII-1974, N. WATANABE leg.; 2 ♂♂, 1 ♀, Hengchun, Hengchun-hsiang, Pingtung-hsien, 14-VIII-1974, N. WATANABE leg.; 1 ♂, 1 ♀, Hungyeh, Wanjung-hsiang, Hualien-hsien, 21-VIII-1974, N. WATANABE leg.; 1 ♂, Changliang, Changliang-li, Hualien-hsien, 19-VIII-1974, H. NAKAJIMA leg.; 8 ♂♂, 9 ♀♀, Antung, Yuli-hsiang, Hualien-hsien, 19-VIII-1974, N. WATANABE leg.

THAILAND 1 ♂, 2 ♀♀, San Sai, Chiang Mai, 22-IV-1973, Y. YOSHIYASU leg.; 1 ♂, 2 ♀♀, Botanical Garden, Saraburi Prov., 23-III-1982, K. SUGIYAMA leg.; 1 ♂, 1 ♀, Sainoi, Nonthaburi Prov., 19-III-1982, K. SUGIYAMA leg.; 1 ♀, National Park, Saraburi Prov., 23-III-1982, K. SUGIYAMA leg.

MALAYSIA [Borneo] 1 ♂, 1 ♀, Kota Kinabaru, Sabah, 27-III-1981, K. SUGIYAMA leg.; 1 ♂, 2 ♀♀, Sandakan, Sabah, 5-IV-1981, K. SUGIYAMA leg.

INDONESIA [Sulawesi] 2 ♂♂, 3 ♀♀, Rantepao, S. Sulawesi, 22~24-III-1983, H. YAMAMOTO leg.

Distribution. Japan (Honshu, Shikoku, Kyusyu, Ryukyus); China, Taiwan, SE. Asia, India, Sri Lanka.

Subgenus *Coelostoma* (s. str.) BRULLÉ, 1835

Coelostoma BRULLÉ, 1835, Hist. nat. Ins., 5(2): 293.

Coelostoma (Coelostoma) orbiculare (FABRICIUS, 1775)

(Figs. 10-18)

Hydrophilus orbicularis FABRICIUS, 1775, Syst. ent., p. 229.

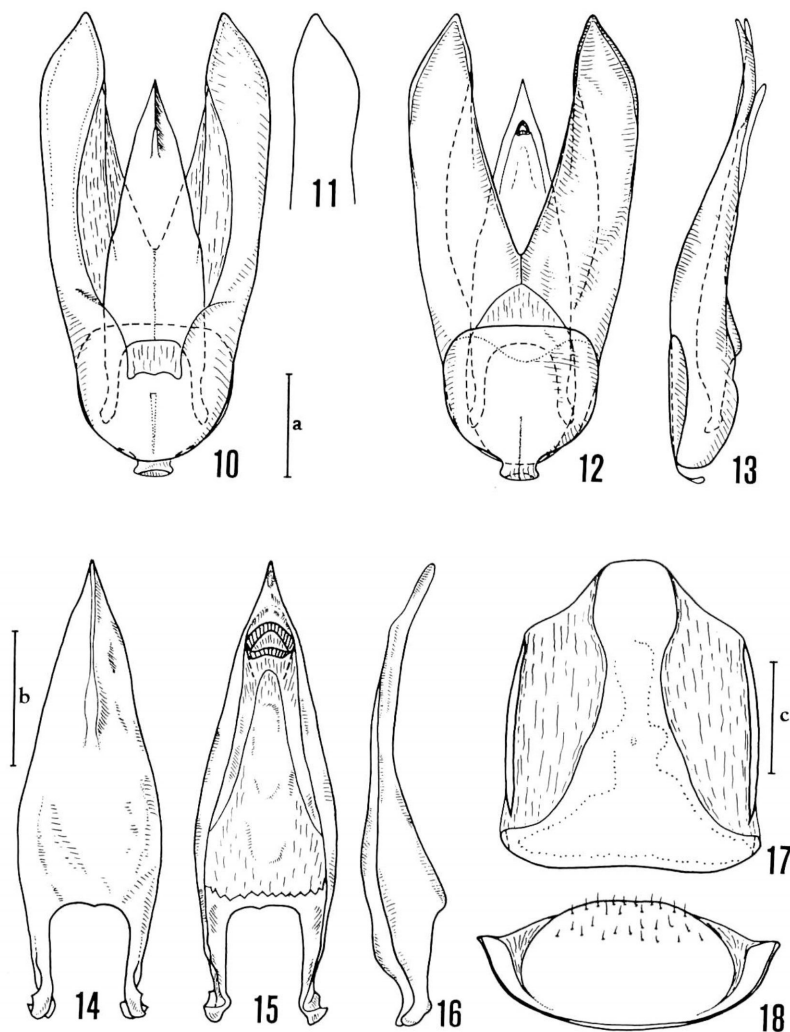
Cyclonotum breve SHARP, 1874, Trans. ent. Soc. Lond., 1874: 419 (Japan).

Aedeagus (Figs. 10-13) rather longitudinal, flattened. Penis (Figs. 14-16) almost triangular, with the posterior end acutely pointed, curved with ventral convexity, having almost even thickness in apical half, then becoming gradually thickened toward base; dorsal surface strongly sclerotized, narrowly ridged longitudinally at middle in posterior half, widely clearly concave at middle in anterior half; ventral surface broadly membranous, with an elongate sclerotized area shortly before subapical ostium. Parameres thin, becoming gradually thickened toward base, clearly curved with dorsal convexity in posterior 1/3, each with the posterior end acutely rounded and somewhat internal; external edge sometimes lightly sinuate near apex (Fig. 11); in dorsal aspect, each narrowly sclerotized, sclerotized area becoming gradually widened toward both ends, lightly reflexed apically, clearly gibbose shortly after base; in ventral aspect, each lightly sclerotized, feebly widely concave at middle. Basal piece almost as long as wide, with a short tip; surface feebly sclerotized.

Male abdominal sternite 9 (Fig. 17) somewhat longitudinal, widely membranous laterally. Male abdominal tergite 9 (Fig. 18) medially with a sclerotized area ellipsoidal.

Length: ♂, 3.2-4.6 mm; ♀, 3.3-4.7 mm. Width: ♂, 2.1-2.7 mm; ♀, 2.2-2.8 mm.

Specimens examined. JAPAN [Hokkaido] 26 ♂♂, 25 ♀♀, Lake Tanji-numa nr. Uenae, Tomakomai-shi, 28-VII-1982, N. WATANABE leg.; 1 ♂, Unnamed lake nr. Yûfutsu, Tomakomai-shi, 16-VII-1982, N. WATANABE leg.; 10 ♂♂, 8 ♀♀, Nr. Satsunai, Toyokoro-chô, Nakagawa-gun, 19-VII-1982, N. WATANABE leg.; 1 ♂, 1 ♀, Tabikorai~Ankotsu, Toyokoro-chô, do., 19-VII-1982, N. WATANABE leg.; 2 ♂♂, Taura, Mukawa-chô, Yûfutsu-gun, 16~17-VII-1982, N. WATANABE leg. [Honshu]



Figs. 10–18. *Coelostoma orbiculare* (FABRICIUS). — 10, Aedeagus in dorsal view; 11, paramere, showing a situation near the posterior end; 12, aedeagus in ventral view; 13, same in lateral view; 14, penis in dorsal view; 15, same in ventral view; 16, same in lateral view; 17, male abdominal sternite 9; 18, male abdominal tergite 9. Scales: 0.2 mm (a for Figs. 10–13; b for Figs. 14–16; c for Figs. 17, 18).

〈Iwate-ken〉 5 ♂♂, 1 ♀, Genbi-kei, Ichinoseki-shi, 21~22-VII-1971, N. WATANABE leg. 〈Fukushima-ken〉 1 ♀, Lake Shigi-numa, Tajima-machi, Minamiaizu-gun, 28-V-1987, N. WATANABE leg. 〈Gunma-ken〉 21 ♂♂, 13 ♀♀, Hanetsuku, Tatebayashi-shi, 4-VI-1987, N. WATANABE leg. 〈Saitama-ken〉 19 ♂♂, 13 ♀♀, Hasuda-shi, 10-V-1987, N. WATANABE leg.; 177 ♂♂, 143 ♀♀, do., 12-V-1987, N. WATANABE leg.; 2 ♂♂, 1 ♀, Iwatsuki, Iwatsuki-shi, 24-V-1987, N. WATANABE leg.; 1 ♀, Riv. Ara-

kawa, Kuge, 17-IX-1981, N. WATANABE leg. <Chiba-ken> 1 ♂, Ichikawa-shi nr. Hongyōtoku-machi, 22-IV-1980, S. SAITO leg.; 1 ♂, 2 ♀♀, do., 16~17-VI-1980, S. SAITO leg.; 1 ♂, Nr. Lake Inba-numa, Hiraka, Inba-mura, 7-IX-1989, N. WATANABE leg.; 2 ♂♂, do., 25-IV-1990, N. WATANABE leg.; 1 ♀, do., 10-V-1990, N. WATANABE leg.; 3 ♂♂, 1 ♀, Nr. Lake Inba-numa, Kitasuka, Narita-shi, 3-VI-1989, N. WATANABE leg.; 7 ♂♂, 7 ♀♀, do., 13-IX-1989, N. WATANABE leg.; 1 ♂, 6 ♀♀, do., 10-V-1990, N. WATANABE leg.; 1 ♀, Riv. Tone-gawa, Sekiyado-machi, 19-IV-1990, N. WATANABE leg.

Distribution. Japan (Hokkaido, Honshu); most parts of the Palearctic Region.

Coelostoma (Coelostoma) fallaciosum d'ORCHYMONT, 1936

[Japanese name: Nise-semaru-gamushi]

(Figs. 19-26)

Coelostoma Fabriciusi: d'ORCHYMONT, 1925, Bull. Anns. Soc. ent. Belg., **65**: 270 (cf. *Coelostoma* sp.

B: d'ORCHYMONT, 1919, Ibid., **59**: 73) (ex p.).

Coelostoma (s. str.) *fallaciosum* d'ORCHYMONT, 1936, Mém. Mus. r. Hist. nat. Belg., (2), **7**: 19.

Aedeagus (Figs. 19-21) fairly longitudinal. Penis (Figs. 22-24) almost triangular, with the posterior end obtusely rounded; dorsal surface strongly sclerotized, lightly convex except for antero-lateral areas hollowed; ventral surface entirely membranous without sclerotized area, with an ostium subapical. Parameres curved with dorsal convexity in posterior half, becoming gradually thickened toward base, with the posterior end acutely rounded and internal; dorsal surface narrowly sclerotized, sclerotized area becoming gradually widened toward both ends, base very wide; ventral surface weakly sclerotized, underside internally with rows of hairs. Basal piece somewhat transverse, with a short tip.

Male abdominal sternite 9 (Fig. 25) as long as wide, broadly membranous laterally. Male abdominal tergite 9 (Fig. 26) with a wide sclerotized area ellipsoidal.

Length: ♂, 4.6-5.4 mm; ♀, 4.5-5.7 mm. Width: ♂, 2.9-3.3 mm; ♀, 3.0-3.3 mm.

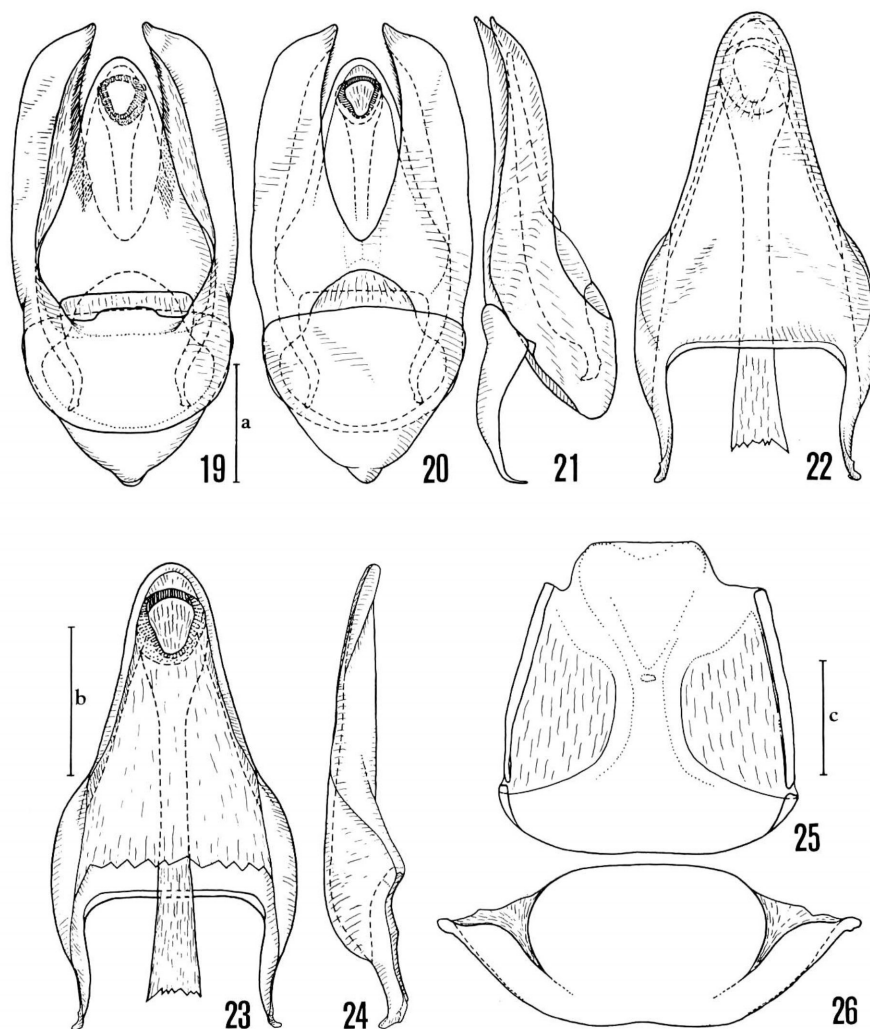
Specimens examined. JAPAN [Ishigaki-jima Is.] 22 ♂♂, 17 ♀♀, Yonehara, 14~15-VI-1973, N. WATANABE leg.; 2 ♂♂, 5 ♀♀, Hirae, 12-VI-1973, N. WATANABE leg. [Iriomote-jima Is.] 9 ♂♂, 8 ♀♀, Sonai, 19~23-VI-1973, N. WATANABE leg.

Distribution. Japan (Ryukyus); China, Indo-China, Sumatra, Borneo.

I identify the specimens with this species at present, because the structure of the aedeagus agrees closely with the figure of the organ given by d'ORCHYMONT (1936). This species was originally described from China, Indo-China, Sumatra and Borneo, appearing not to have previously been recorded from our territory.

Morphological Notes

The presence of the spatulate plate on the penis in *stultum* is noteworthy: it is considered to be a result of adaptation for water pressure, because a similar structure



Figs. 19–26. *Coelostoma fallaciosum* d'ORCHYMONT. — 19, Aedeagus in dorsal view; 20, same in ventral view; 21, same in lateral view; 22, penis in dorsal view; 23, same in ventral view; 24, same in lateral view; 25, male abdominal sternite 9; 26, male abdominal tergite 9. Scales: 0.2 mm (a for Figs. 19–21; b for Figs. 22–24; c for Figs. 25, 26).

is found in some dryopoids (“Ventralleiste des Membransackes”) (STEFFAN, 1961) as well as in some truly aquatic hydrophilids (e.g., *Enochrus*, *Hydrocassis*). Also in *orbiculare* a sclerotized area is discerned on the ventral surface of the peins, but the posterior end of the area never extends over the ostium.

The male abdominal sternite 9 and the aedeagus of *Coelostoma* are dissimilar to those of *Sphaeridium* belonging to the same tribe in the traditional classification, in which they are more reduced as in the Ceryonini and Megasternini.

Furthermore, an apomorphic character found in *Sphaeridium* (at least in *scarabaeoides* (LINNAEUS), *dimidiatum* GORY and *quinquemaculatum* FABRICIUS) or the sucker-shaped plate on the ventral surface of the male maxillae is shared with *Cercyon*, *Megasternum*, *Cryptopleurum*, *Pachysternum*, etc. HANSEN (1990) has enumerated *Sphaeridium* as one of some genera more closely related to Cercyonini – Megasternini (and perhaps also Omicrini) in his discussion on the phylogeny of the Sphaeridiinae.

Key to Japanese Species of *Coelostoma*

1. Posterior margin of last visible abdominal sternite medially with a semicircular notch which is fringed with reddish brown bristles (Subgenus *Holocoelostoma* MOUCHAMPS). (Maxillary palpi uniformly yellowish brown; mentum with a transverse ridge higher than in *orbiculare* along anterior margin, intervals of punctures highly polished; metafemur strongly widened near the middle, underside sparingly pubescent); aedeagus with penis parallel-sided in posterior half. *C. stultum* (WALKER).
 — Last sternite without any notch, posterior margin being fringed with fine hairs (Subgenus *Coelostoma* s. str.). Aedeagus with penis triangular. 2.
2. Body size smaller, form less rounded; scutellum narrower; mentum with a transverse ridge lower and narrower along anterior margin, intervals of punctures highly polished; maxillary palpi blackish brown, partially paler; metafemur gradually widened near the middle, underside sparingly pubescent; penis with the apex acutely pointed. *C. orbiculare* (FABRICIUS).
 — Body size larger, form more rounded; scutellum nearly as long as wide; mentum with a ridge higher and wider, intervals somewhat opaque; maxillary palpi yellowish brown; metafemur more strongly widened near the middle, underside more sparingly pubescent; penis with the apex obtusely rounded.
 *C. fallaciosum* d'ORCHY-MONT.

Acknowledgments

I wish to express my hearty thanks to Prof. Emeritus Toyohi OKADA of Tokyo Metropolitan University for his constant encouragement. My thanks are also due to Mr. K. ARICHI, Dr. K. KUROSA, Mr. K. MIZUSAWA, Mr. H. NAKAJIMA, Dr. M. NISHIKAWA, Dr. S. SAITO, Mr. K. SAKAI, Dr. S. TACHIKAWA, Dr. O. TADAUCHI, Dr. H. TAKAIE and Dr. S. TSUKAGUCHI, for providing me with material.

要 約

渡辺信敬：セマルガムシ属の日本産種。—— 手元にあるセマルガムシ属 (*Coelostoma*) の標本を検討した結果、従来から記録のある2種、セマルガムシ (*C. stultum*)、ヒメセマルガムシ (*C. orbiculare*) に加え、琉球にはニセセマルガムシ (*C. fallaciosum*) の分布することがわかった。これは、d'ORCHY-

MONT (1936) によって、中国、インドシナ半島、スマトラ、ボルネオより記載された種であり、いままで日本産種としては記録されてこなかったように思われる。前2種とは、雄交尾器官の中央片が幅の広い三角形状になっていることにより、よく識別できる。

雄交尾器官および雄第9腹節を形態学的に詳細に調べた結果、とくに、セマルガムシの雄交尾器官の中央片腹面に位置するスプーン状節片は注目に値することがわかった。これに類似する節片は、ドロムシ類、真性の水生ガムシ類にも見られ、水圧に対する適応の一つとみなせる。セマルガムシ属の雄交尾器官と雄第9腹節の構造は、同族のハバビロガムシ属 (*Sphaeridium*) のものには似ず、別族のケンガムシ族 (Cercyonini)、マグソガムシ族 (Megasternini) のそれに似る。

References

- HANSEN, M., 1990. Australian Sphaeridiinae (Coleoptera: Hydrophilidae): a taxonomic outline with descriptions of new genera and species. *Invertebr. Taxon.*, **4**: 317–395.
- KNISCH, A., 1924. *Coelostoma* BRULLÉ. In: JUNK, W., & S. SCHENKLING (eds.), *Coleopterorum Catalogus*, pars 79 (pp. 109–113), W. Junk, Berlin.
- MOUCHAMPS, R., 1958. Notes sur quelques *Coelostoma* (BRULLÉ) (Coléoptères Hydrophilidae) principalement africains (12^{me} note). *Bull. Inst. r. Sci. nat. Belg.*, **34**: 1–36.
- NAKANE, T., 1950. Hydrophilidae. In: ESAKI, T., et al. (eds.), *Iconographia Insectorum Japonicorum*, p. 1041. Hokuryukan, Tokyo. (In Japanese.)
- 1963. Hydrophilidae. In: NAKANE, T., et al. (eds.), *Iconographia Insectorum Japonicorum Colore naturali edita*, **2**: 63, pl. 32. Hokuryukan, Tokyo. (In Japanese.)
- d'ORCHYMONT, A., 1925. Contribution à l'étude des Hydrophilides. III. *Bull. Annl. Soc. ent. Belg.*, **65**: 261–295.
- 1936. Revision des «*Coelostoma*» (s. str.) non américains. *Mém. Mus. r. Hist. nat. Belg.*, (2), **7**: 1–38.
- SATÔ, M., 1960. Notes on the tribe Sphaeridiinae of Japan (Coleoptera: Hydrophilidae). *Ageha, Matsuyama*, (8): 20–21. (In Japanese.)
- 1985. Hydrophilidae. In: UÉNO, S.-I., et al. (eds.), *The Coleoptera of Japan in Color*, **2**: 209–216 [incl. pls. 38–39]. Hoikusha, Osaka. (In Japanese.)
- SHARP, D., 1874. Some additions to the coleopterous fauna of Japan. *Trans. ent. Soc. Lond.*, **1874**: 417–422.
- 1884. The water-beetles of Japan. *Ibid.*, **1884**: 439–464.
- STEFFAN, A. W., 1961. Vergleichend-mikromorphologische Genitaluntersuchungen zur Klärung der phylogenetischen Verwandtschaftsverhältnisse der mitteleuropäischen Dryopoidea (Coleoptera). *Zool. Jahrb.*, **88**: 255–354.