Notes on Taiwanese Caraboidea (Coleoptera) IX. Two Little-known Species of the Genus *Mastax* (Brachininae: Brachinini)

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Abstract. Newly collected specimens of *Mastax brittoni* Quentin, 1952 and *M. formosana* Dupuis, 1912 (Brachininae, Brachinini) are recorded from Taiwan and fully illustrated. Two supraorbital setae on each side of the head were observed in both species. The aedeagus without normal parameres was observed in *M. brittoni*. These characters seem to be unusual among the tribe Brachinini. Three different forms with variations in elytral maculation are recognized among the Taiwanese population of *M. brittoni*.

Key words: Brachinini, Caraboidea, *Mastax*, Taiwan, variation.

INTRODUCTION

Members of the genus *Mastax* Fischer von Waldheim, 1828 are small *Brachinus*-like carabid beetles (Coleoptera, Brachininae, Brachinini), widely distributed in Asia and Africa, and also in Eastern Europe. They are usually found beneath stones in such places as riverbeds. Hrdlička (2003) listed 17 as Palearctic species.

This genus can be distinguished from other genera of the tribe Brachinini by the conical apical palpomeres and the mentum with a large concavity below the mentum tooth. Two species of the genus are known from the Taiwanese fauna: *Mastax formosana* Dupuis, 1912, and *M. brittoni* Quentin, 1952, both of which were described from Taiwan, each as a new species. Additional information about those species has not been considered until today. Fortunately, the *Mastax* specimens in our collection include the above two species. The purpose of this paper was to record newly collected specimens of *M. brittoni* and *M. formosana* from Taiwan.

Specimens used in the present study are deposited in the National Museum of Natural Science, Taichung, Taiwan (NMNS) and K. Terada collection, Hiroshima, Japan (KTHJ). Abbreviations used in this paper follow the same convention as our previous papers (Terada *et al*., 2013).

Mastax brittoni Quentin, 1952 (Figs. 1~7)

Mastax brittoni Quentin, 1952: 53. [Type locality: Taiwan, Chiayi County, Chuchi (嘉義縣竹崎)]; Jedlička, 1963: 552; Hrdrička, 2003: 216; Liang and Yu, 2004: 140.

Description.

Measurements. Length 2.9~3.6 mm. Width 1.3~1.6 mm. Antennomeres I: II: III: IV: V: VI: VII: VIII: IX: X: XI, 1: 0.44~0.50: 0.84~0.92: 0.80~0.88: 0.53~0.65: 0.61~0.68: 0.61~0.65: 0.58~0.62: 0.55~0.62: 0.55~0.61: 1.10~1.15. HW/FW, 1.58~1.61. PW/PL, 1.02~1.06. PW/HW, 0.95~0.97. PW/PA, 1.13~1.15. PW/PB, 1.37~1.46. PB/PA, 0.77~0.84. EW/PW, 1.92~2.05. EL/EW, 1.24~1.31.

Color. Head including labrum and clypeus

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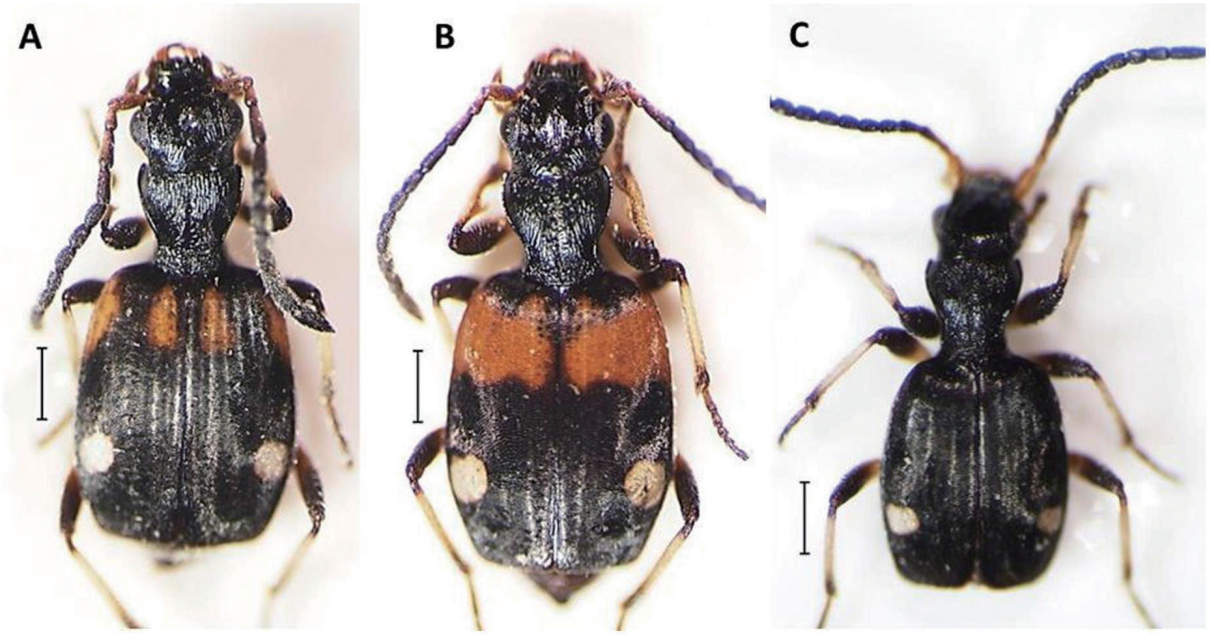

Fig. 1. Habitus of *Mastax brittoni*. A, B. ♀, Suao, Yilan County. C. ♂, Chuchi, Chiayi County. Scale bar = 0.5 mm.

black, shiny; mandibles reddish-yellow-brown, darker apically; palpi dark-brown, paler apically (penultimate segments of labial palpi pale-yellowish-brown) (Fig. 2F); antennae blackish-brown (Fig. 2C), but antennomeres I, II, and sometimes even III yellowish-brown (Fig. 2D). Pronotum black, shiny. Elytra black, with velvety- or silky-luster depending on lighting (Fig. 1A~C); anterior spots dull-orange ("du roux au brun-rouge" by Quentin, 1952), posterior spots white; elytral epipleura blackish-brown, but yellowish-brown near shoulders (Fig. 6B, upper arrow). Thorax and abdomen blackish-brown on ventral side. Legs dark-brown on coxae; trochanters yellowish-brown (Fig. 6B, lower arrow); femora yellowish-brown in basal half, dark-brown in apical half (Fig. 6A, "fe"); tibiae whitish-yellow, but dark-brown at base and apex (Fig. 6A, "ti"); tarsi dark-brown (Fig. 6A, "ta").

Microsculpture. Both head and pronotum with isodiametric mesh laterally and basally; elytra strongly shagreened (Fig. 4D), with 2 kinds of sculpticells: narrowly elongated sculpticells (Fig. 5A) and polygonal sculpticells (Fig. 5B).

Form. Head wide (PW/HW 0.95~0.97), slightly convex at vertex, longitudinally rugose (Fig. 2A), but almost smooth (microscopically punctulate in high-powered image) in middle of frons (Fig. 2A, arrow), almost glabrous, but finely setulose on each side of head (Fig. 2D), where 2 supraorbital setae are also present (Fig. 2D, arrows): anterior seta located near mid-eye level, and posterior seta located away from eye; mandibles thick, strongly curved, acute at apex, dentate in middle (Fig. 2B, 2 inner arrows), with 1 seta on each scrobe (Fig. 2B, 2 outer arrows); palpi pubescent; apical palpomeres subconical (Fig. 2E); labrum 6-setose, strongly emarginate at apex; clypeus with several setae near apex; frontal impressions moderately deep, parallel to each other; antennae long, thick, densely pubescent (Fig. 2F), antennomere I with a long seta near apex (Fig. 2G, arrow); eyes large, moderately convex; temples (oblique part behind eyes seen from dorsal side) short; neck thick; mentum with a small, triangular, acute tooth (Fig. 2C, arrow) and a large concavity below tooth.

Pronotum cordate, strongly convex, almost entirely glabrous, longitudinally rugose (Fig. 3A), deeply and widely furrowed at median line (Fig. 3B) (median line itself is finely impressed), without lateral setae; apex shallowly emarginate, without a border; front angles slightly protruding; anterior transverse impression not obvious; posterior transverse impression obvious; base narrower than apex (PB/PA, 0.77~0.84), without a border; hind angles acute, but not protruding (Fig. 3C, arrow); basal foveae not obvious; lateral margins gently curved before front angles, strongly sinuate before hind angles, finely

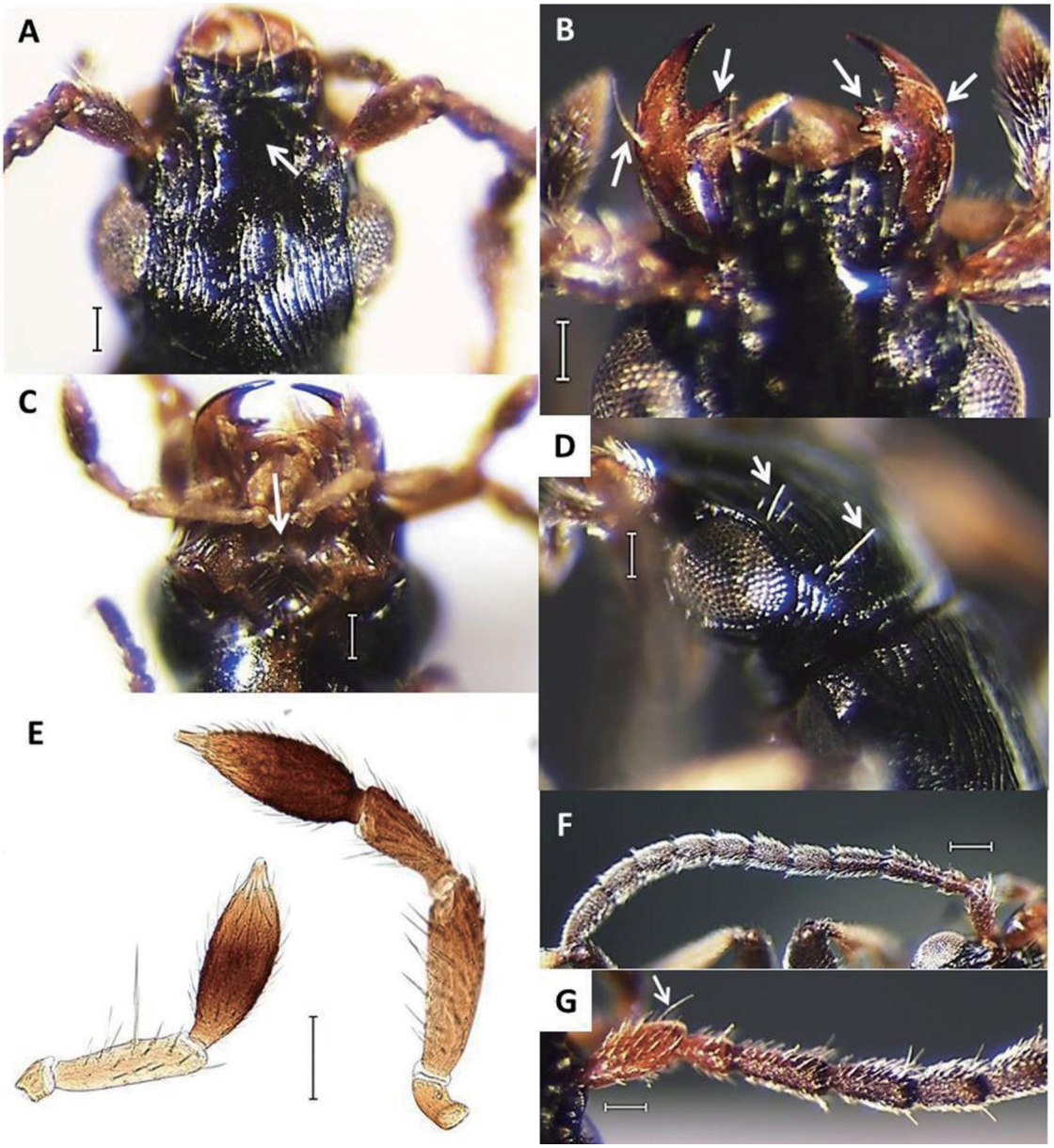

Fig. 2. *Mastax brittoni*. A. Head with distinct wrinkles. Arrow indicates smooth area of frons. B. Anterior part of head, showing mandibles with a bifid tooth (two inner arrows) and a seta from each mandibular scrobe (two outer arrows). C. Head, ventral view, showing a mentum tooth (arrow) and a concavity below the tooth. D. Head, left lateral view, showing two supraorbital setae (arrows) and additional fine setae. E. Maxillary palpus (right) and labial palpus (left). F. Left antenna. G. Right antenna, showing antennomeres with pubescence. Arrow indicates a fixed seta on antennomere I. Scale bar = 0.2 mm (F); 0.1 mm (A~E, G).

bordered; lateral grooves very narrow.

Elytra subquadrate (EL/EW 1.24~1.31), moderately convex, sparsely pubescent (Fig. 4B, arrows), pubescence more or less linearly arranged (Fig. 4C, arrows; 5A, arrows; 5B, arrows), each elytron with 2 longitudinal spots anteriorly (Fig. 1A) and 1 circular or slightly transverse spot posteriorly: anterior spots sometimes combined with each other to form a broad transverse fascia (Fig. 1B) or sometimes completely absent (Fig. 1C); base not bordered; shoulders moderately wide and rounded; apex truncate, with membranous margin, along which several setae are present (Fig. 4E, arrows); lateral margins gently curved; lateral grooves very narrow; striae almost obsolete; intervals faintly costate (Fig. 1A; 4A); 2 setiferous pores present on both sides of elytral suture at base (Fig. 4F, arrows; 4G, arrows); marginal setiferous pores 12 or 13 in number; elytral epipleura finely punctate and pubescent. Hindwings developed.

Thorax and abdomen finely punctate and

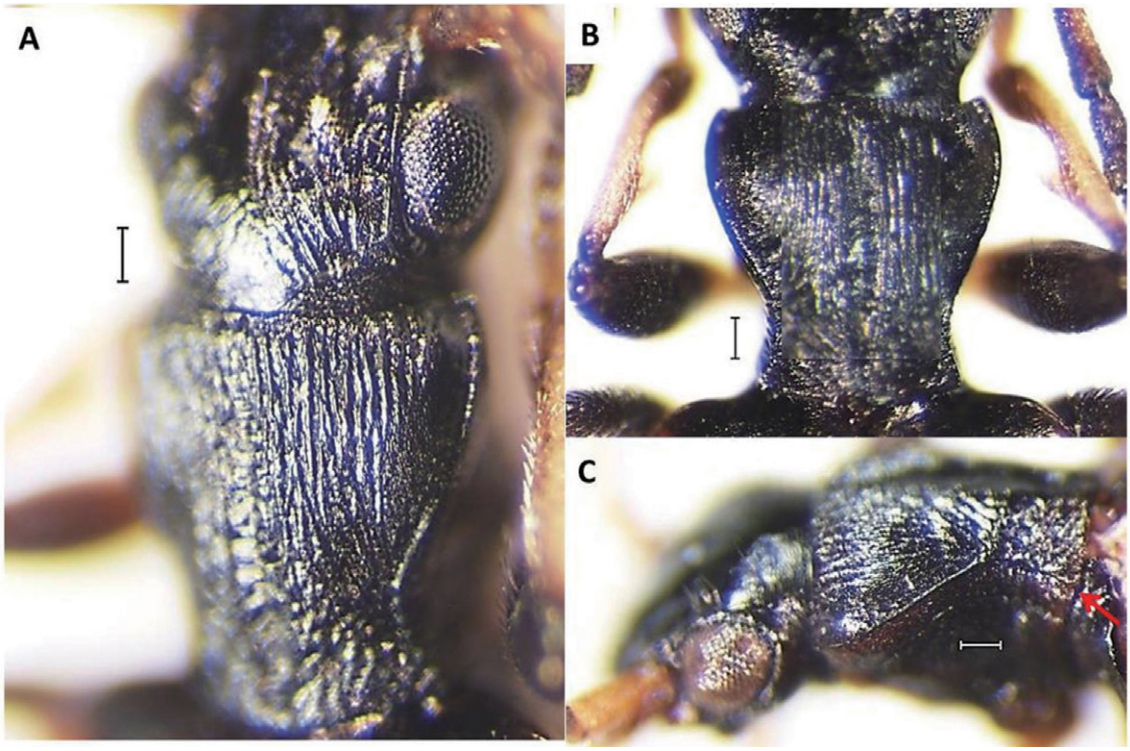

Fig. 3. *Mastax brittoni*. A. Head and pronotum. B. Pronotum with widely furrowed median line. C. Head and pronotum in lateral view. Arrow indicates the pronotal hind angle. Scale bar = 0.1 mm.

pubescent on ventral side; prosternal process not bordered and sparsely setose; metepisterna narrow and long (length/width, ca. 2.4); abdomen with 8 exposed ventrites in ♂ and 7 in ♀; ventrite VII widely emarginate in ♂ (Fig. 6C), or with a median slit in ♀ (Fig. 6D).

Male and female genitalia. Aedeagal median lobe pod-shaped (Fig. 7A, B), gently curved, widely rounded at apex, with a fine split (Fig. 7A, arrow; 7D, arrow; 7F, right arrow) and 2 thickenings close to basal orifice (Fig. 7B, arrows; 7C, arrows; 7D, V-line; 7E, arrows; 7F, left arrow; 7G, upper arrow); basal orifice slightly turned from ventral to right-lateral side (Fig. 7G, lower arrow); endophallus with slightly-dark shades of filaments (Fig. 7B, C); parameres not determined.

Basal segment of each stylus with a long seta at apex (Fig. 7H, upper arrow); apical segment slightly curved, without spines on lateral sides, subapical foramen with fine setae (Fig. 7H, lower arrow).

Specimens examined. New Taipei City, Wulai, Honghegu, Nanshih River (新北市烏來區紅河谷 南勢溪), elev. 100~200 m: 1 ♀, 16-ii-2002, K. Terada leg. (Terada-85). New Taipei City, Gongliao, Fulong (新北市貢寮區福隆), elev. 0~50 m: 1 ♀, 19-iv-2001, K. Terada leg. (Terada-2); 2 ♂♂ 1 ♀, 16-v-2001, K. Terada leg. (Terada-9); 2 ♂♂ 2 ♀♀, 1-x-2001, K. Terada leg. (Terada-53). Yilan County, Suao, Tawan River near Nan-ao Station (宜蘭縣蘇澳鎮大灣溪), elev. 0~50 m: 2 ♂♂ 2 ♀♀, 2-iii-2002, K. Terada leg. (Terada-89); 1 ♂ 1 ♀, 4-iii-2002, K. Terada leg. (Terada-90); 2 ♂♂ 2 ♀♀, 8-iii-2002, K. Terada leg. (Terada-91). Chiayi County, Chuchi, Niuchou River (嘉義縣竹崎鄉 牛稠溪), elev. 100~200 m: 1 ♂, 1-iv-2010 K. Terada leg. (Terada-107). The above specimens were collected beneath stones on more or less dried riverbeds or beneath plant debris washed ashore near the river mouth.

Remarks. We checked the holotype (from a digital image) of *M. brittoni* and the following characters were recognized: 1) the head and pronotum are strongly rugose on the dorsal side; and 2) each elytron has two dull-orange spots anteriorly and one white spot posteriorly. These characters are also agreeable to the Taiwanese specimens presented here. Nevertheless, Quentin (1952) did not refer to rugosity on the head and pronotum in the original description of *M. brittoni*. Further, Jedlička (1963) carelessly described the anterior and posterior spots as "zwei Makeln an den Schultern und zwei vor der Spitze sind weiß", i.e., two anterior and two posterior spots are whitish.

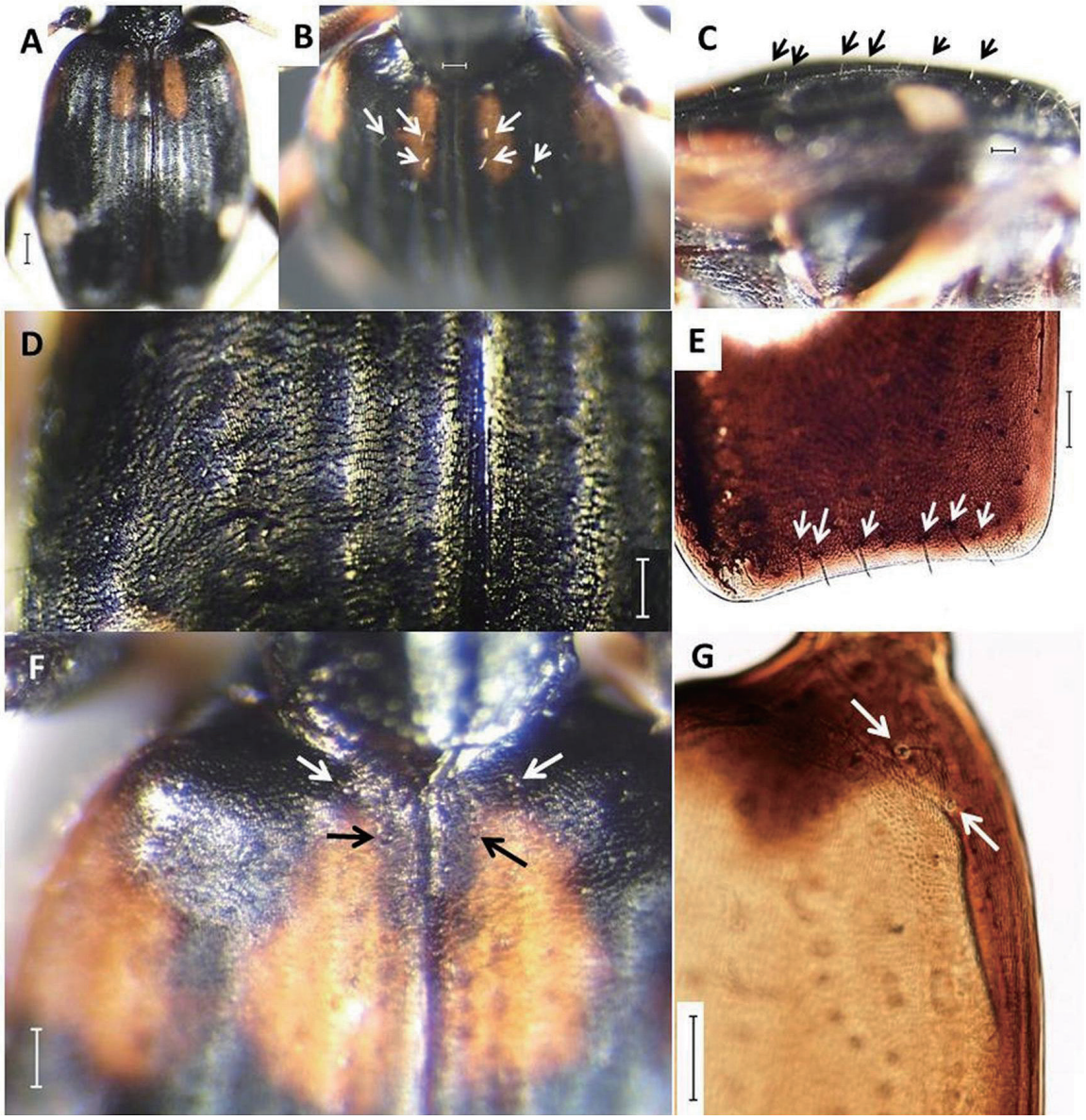

Fig. 4. Elytra of *Mastax brittoni*. A. Elytra with silky-lustered costae. B. Elytra with fine setae (arrows). C. Elytra, lateral view, showing fine setae near elytral suture (arrows). D. Middle portion of elytra, showing shagreened surface. E. Apical portion of left elytron, showing truncate apex with short setae (arrows). F. Basal portion of elytra with two setiferous pores (arrows). G. Basal portion of left elytron with two setiferous pores (arrows). Scale bar = 0.2 mm (A, C); 0.1 mm (B, D~G).

We found three different forms among the Taiwanese population of *M. brittoni*. The first form has two dull-orange anterior spots (Fig. 1A) on each elytron, which is the same as shown by Quentin (1952). In the second form, two anterior spots combine to form a broad band (Fig. 1B). This form strongly resembles *M. latefasciata* Liebke, 1931, from Vietnam. In the third form, the anterior spots are almost completely absent from each elytron (Fig. 1C).

We found two supraorbital setae (Fig. 2D) on each side of the head. We also confirmed the same character in *M. formosana* (Fig. 8G). This seems to be unusual among the tribe Brachinini, because other genera of the same tribe such as *Brachinus*, *Pheropsophus* and *Styphlomerus* have one supraorbital seta on each side of the head.

We found two thickenings at the aedeagal base (close to the basal orifice), but we could not prove that those might be related to normal parameres. No normal parameres were observed in our specimens. This also seems to be unusual among the tribe Brachinini.

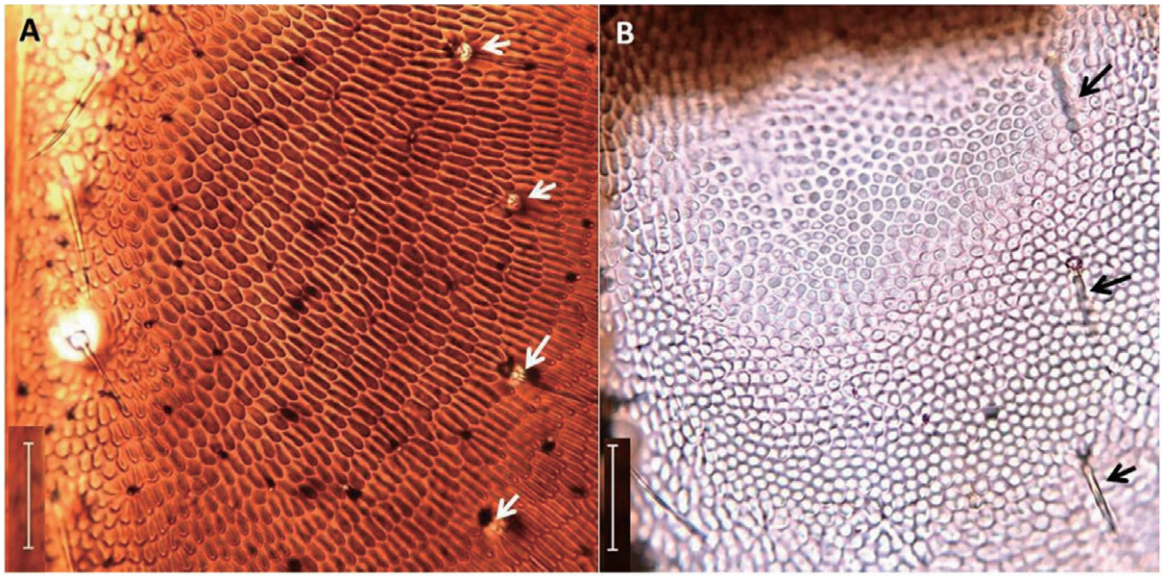

Fig. 5. Microsculpure on elytra of *Mastax brittoni*. A. Narrowly elongated sculpticells on middle portion of elytra. Arrows indicate linearly arranged setiferous pores. B. Polygonal sculpticells on a posterior spot of elytra. Arrows indicate linearly arranged setae. Scale bar = 0.05 mm.

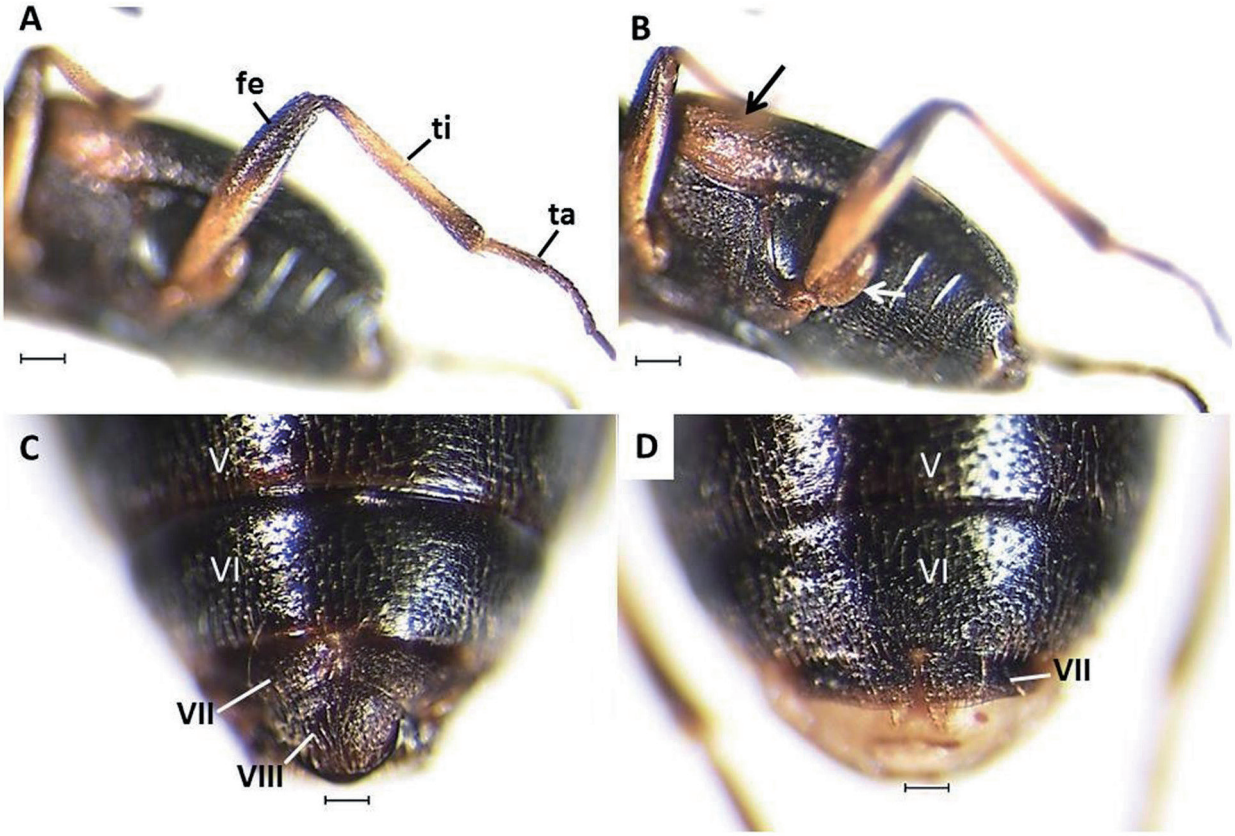

Fig. 6. Abdomen of *Mastax brittoni*. A. Left hind leg, showing femur (fe), tibia (ti), and tarsus (ta). B. Elytral epipleuron (upper arrow) and a hind trochanter (lower arrow). C. Apical portion of abdomen (♂), ventral view, showing ventrites V~VIII. D. Apical portion of abdomen (♀), ventral view, showing ventrites V~VII. Scale bar = 0.2 mm (A, B); 0.1 mm (C, D).

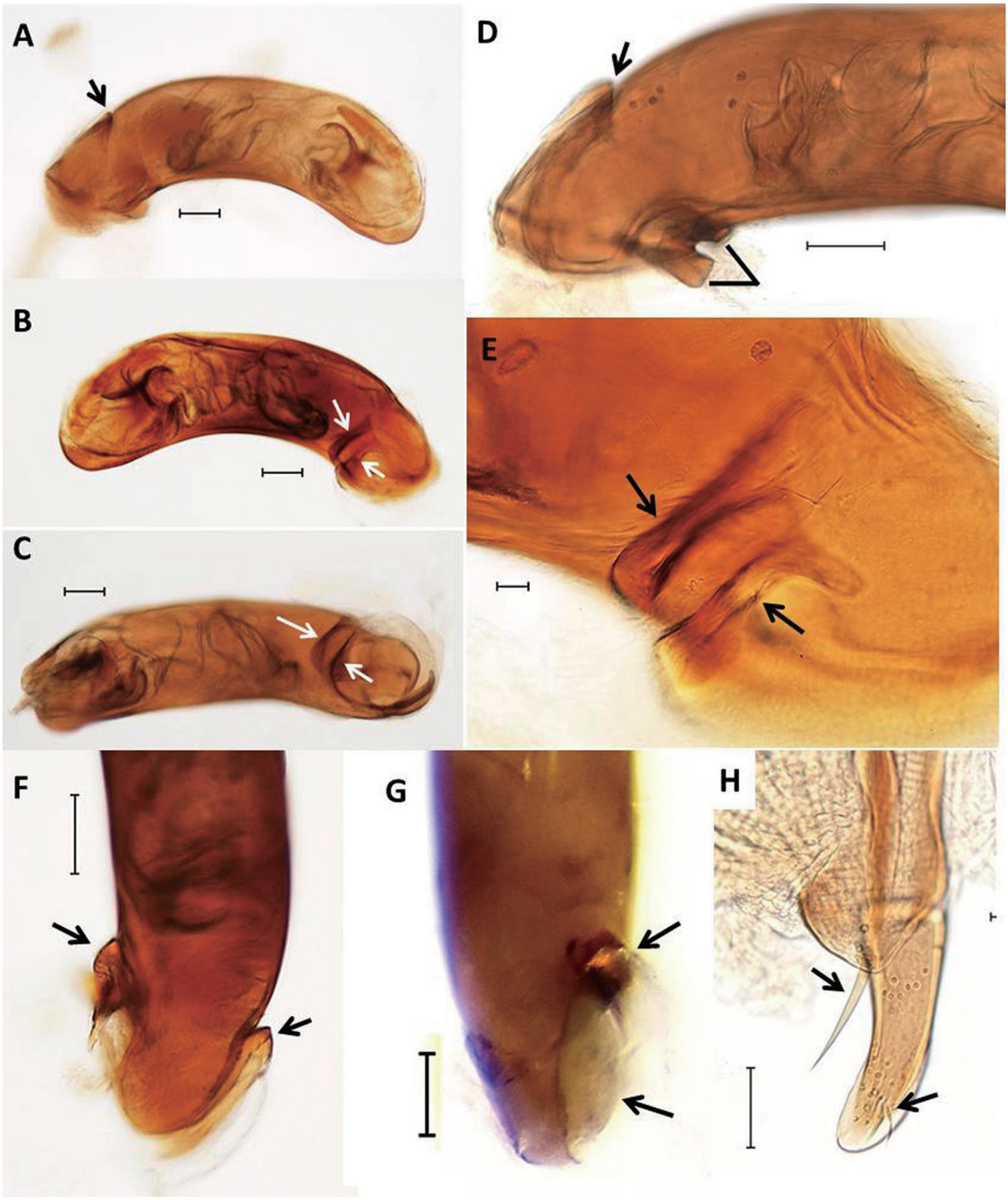

Fig. 7. Male and female genitalia of *Mastax brittoni*. A~G. Aedeagus. A. Median lobe in left-lateral view. Arrow indicates a split. B. Median lobe in right lateral view. Two arrows indicate thickenings close to the basal orifice. C. Median lobe in ventral view. Two arrows indicate thickenings close to the basal orifice. D. Basal half of median lobe, left-lateral view (seen from slightly-ventral side), showing thickenings (V-line) and a split (arrow). E. Base of median lobe in right lateral view (closer than in 7B). Arrows indicate thickenings. F. Basal half of aedeagus, dorsal view, showing thickenings (left arrow) and a split (right arrow). G. Basal half of median lobe, ventral view, showing thickenings (upper arrow) close to the basal orifice (lower arrow). H. Right stylus in ventral view. Upper arrow indicates a long seta of basal segment. Lower arrow indicates fine setae from subapical foramen of apical segment. Scale bar = 0.1 mm (A~D, F, G); 0.05 mm (H); 0.02 mm (E).

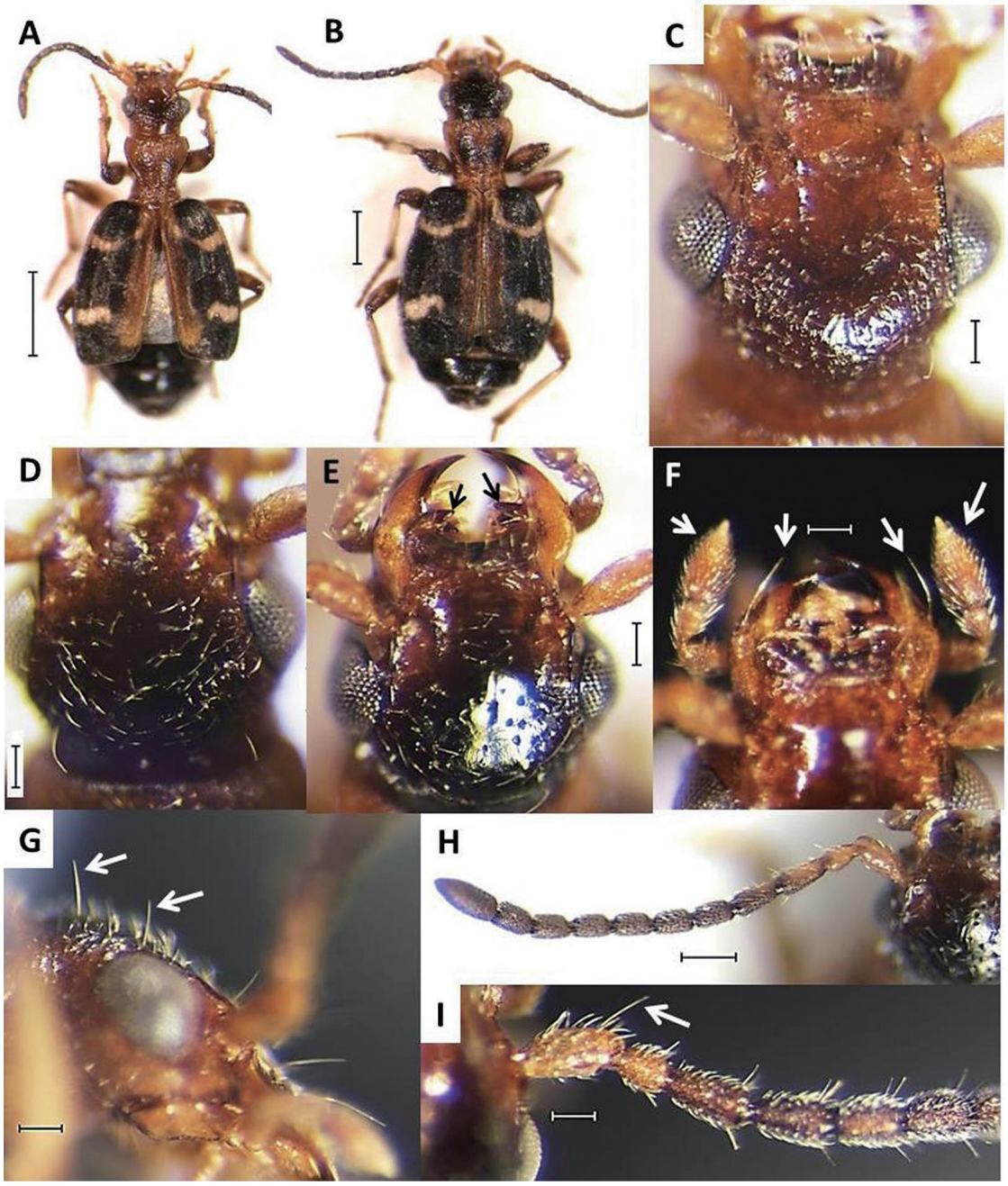

Fig. 8. *Mastax formosana*. A, B. Habitus, ♂, Fulong, New Taipei City. C. Upper surface of head. Punctures can clearly be seen. D. Upper surface of head. Pubescence can clearly be seen. E. Head, showing a bifid tooth of each mandible (arrows). F. Head, showing a seta on each mandibular scrobe (two inner arrows) and maxillary palpi (two outer arrows). G. Head, right lateral view, showing two supraorbital setae (arrows) and fine pubescence. H. Left antenna. I. Right antenna, showing pubescence on antennomeres. Arrow indicates a fixed seta on antennomere I. Scale bar = 1 mm (A); 0.5 mm (B); 0.2 mm (H); 0.1 mm (C~G, I).

Mastax formosana Dupuis, 1912 (Figs. 8~10)

Mastax formosanus Dupuis, 1912: 282. [Type locality: Taiwan, Tainan City, Anping (台南市安平)]; Jedlička, 1963: 550.
Mastax formosana, Hrdrička, 2003: 217; Liang and Yu, 2004: 140.

Description.

Measurements. Length 2.9~3.5 mm. Width 1.4~1.6 mm. Antennomeres I: II: III: IV: V: VI: VII: VIII: IX: X: XI, 1: 0.48~0.54: 0.77~0.90: 0.66~0.74: 0.55~0.63: 0.55~0.63: 0.55~0.63: 0.55~0.63: 0.55~0.63: 0.55~0.68: 1.18~1.27. HW/FW, 1.47~1.51. PW/PL, 0.94~1.00.

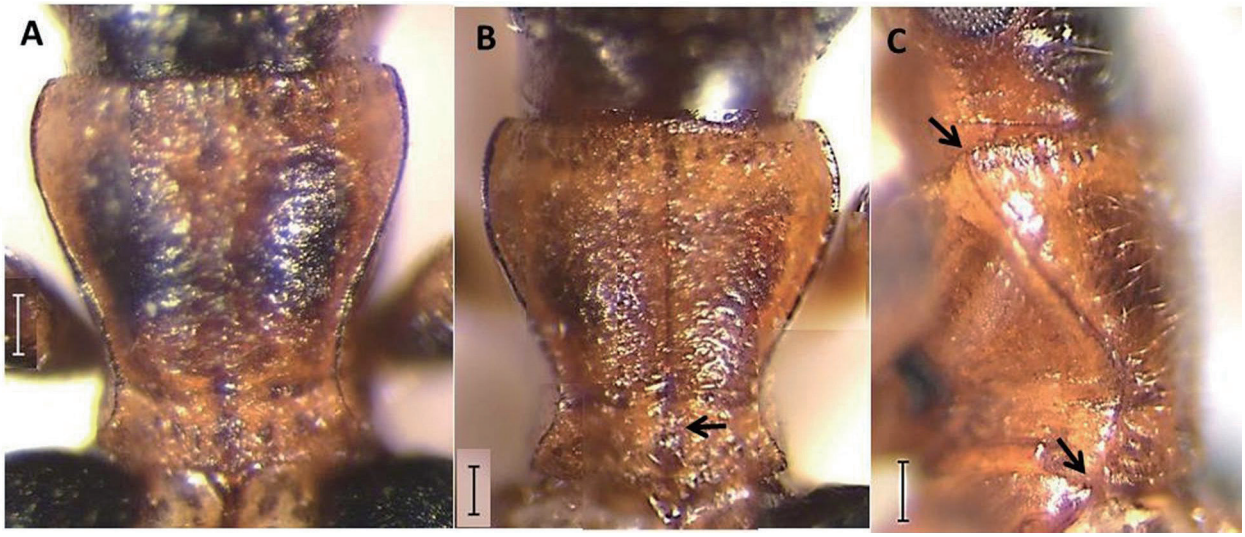

Fig. 9. Pronotum of *Mastax formosana*. A. Pronotum with obviously dark area on disc. B. Pronotum with faintly dark area on disc. C. Prothorax, left lateral view, showing pubescence on pronotum surface. Upper arrow indicates pronotal front angle. Lower arrow indicates pronotal hind angle. Scale bar = 0.1 mm.

PW/HW, 0.92~0.95. PW/PA, 1.10~1.20. PW/PB, 1.37~1.40. PB/PA, 0.80~0.85. EW/PW, 2.05~2.18. EL/EW, 1.10~1.17.

Color. Head yellowish-brown to blackish-brown, shiny, labrum darker than clypeus; mandibles yellowish-brown, darker apically; palpi yellowish-brown, paler apically; antennae dark-brown (Fig. 8H), but antennomeres I, II, and sometimes even III yellowish-brown (Fig. 8I). Pronotum yellowish-brown, usually with dark-brown area on either side of disc (Fig. 9A). Elytra blackish-brown, with velvety- or silky-luster depending on lighting; sutural stripes dull-orange (Fig. 10A, "ss"); humeral arcs (Fig. 10A, "aa") and posterior fasciae (Fig. 10A, "pf") white (more or less dirty); elytral epipleura brown or dark-brown, but with a small paler area near shoulders. Thorax yellowish-brown on ventral side. Abdomen blackish-brown on ventral side. Legs yellowish-brown on coxae and trochanters; femora yellowish-brown, becoming dark-brown toward apex; tibiae whitish-yellow, but dark-brown at base and apex (entire inner area of protibiae sometimes becoming dark); tarsi yellowish-brown or dark-brown.

Microsculpture. Both head and pronotum with faint microsculpture of isodiametric or slightly transverse mesh; elytra with 2 kinds of sculpticells: narrowly elongated scupticells and polygonal sculpticells.

Form. Head more or less wide (PW/HW, 0.92~0.95), slightly convex at vertex, slightly rugose, coarsely punctate (Fig. 8C), pubescent (Figs. 8D, E); 2 supraorbital setae present on either side of head (Fig. 8G arrows): anterior seta located slightly behind mid-eye level, posterior seta located away from eye; mandibles thick, strongly curved, acute at apex, dentate in middle (Fig. 8E, arrows), with 1 seta on each scrobe (Fig. 8F, 2 inner arrows); palpi pubescent, apical palpomeres subconical (Fig. 8F, 2 outer arrows); labrum 6-setose, strongly emarginate at apex; clypeus with several setae near apex; frontal impressions moderately deep, parallel to each other; antennae long, thick, densely pubescent (Fig. 8H), antennomere I with a long seta near apex (Fig. 8I, arrow); eyes moderately convex, slightly smaller than those of *M. brittoni*; temples short; neck thick; mentum with a small triangular acute tooth and a large concavity below tooth.

Pronotum (Fig. 9A, B) cordate, strongly convex, pubescent, slightly rugose, deeply and widely furrowed at base of median line (Fig. 9B, arrow) (median line itself is finely impressed), without lateral setae; apex shallowly emarginate, without a border; front angles less protruding (Fig. 9C, upper arrow); anterior transverse impression not obvious: posterior transverse impression obvious; base narrower than apex (PB/PA, 0.80~0.85), without a border; hind angles acute, but not protruding (Fig. 9C, lower arrow); basal foveae not obvious; lateral margins gently curved before front angles, strongly sinuate before hind angles, finely bordered; lateral grooves very narrow.

Elytra subquadrate (EL/EW, 1.10~1.17), moderately convex, pubescent (pubescence is rather denser than in *M. brittoni* and more or less linearly arranged) (Fig. 10C, D), each elytron with 3 different markings: 1) a sutural stripe (Fig. 10A, "ss") extending close to sutural apex, 2) a humeral arc (Fig. 10A, "aa") with faint interruption in middle (Fig. 10B, arrows) and 3) a posterior fascia (Fig. 10A, "pf") not touching sutural stripe; base without border; shoulders moderately wide and rounded; apex truncate, with membranous margin, along which several setae are present; lateral margins gently arcuate; lateral grooves very narrow; striae almost obsolete; intervals faintly costate; 2 setiferous pores present on both sides of elytral suture at base (Fig. 10E, arrows); marginal setiferous pores 12 or 13 in number; elytral epipleura finely punctate and pubescent. Hindwings developed.

Thorax and abdomen finely punctate and pubescent on ventral side; prosternal process not bordered and sparsely setose; metepisterna narrow and long (length/width, ca. 2.2); abdomen with 8 exposed ventrites in ♂ and 7 in ♀; ventrite VII widely emarginate in ♂, or with a median slit in ♀.

Male and female genitalia. Not examined.

Specimens examined. New Taipei City, Gongliao, Fulong (新北市貢寮區福隆), elev. 0~50 m: 1 ♂, 13-vi-2001, K. Terada leg. (Terada-18); 1 ♂, 2-x-2001, K. Terada leg. (Terada-53). Taoyuan City, Tahshi, Yuemei (桃園市大溪區月眉), elev. 50~100 m: 1 ♂, 6-xi-2001, K. Terada leg. (Terada-64). Taoyuan City, Luchu, Kengtsu (桃園市蘆竹區坑子), elev. 0~50 m: 1 ♀, 5-iv-2002, M.-H. Hsu leg. (Terada-99).

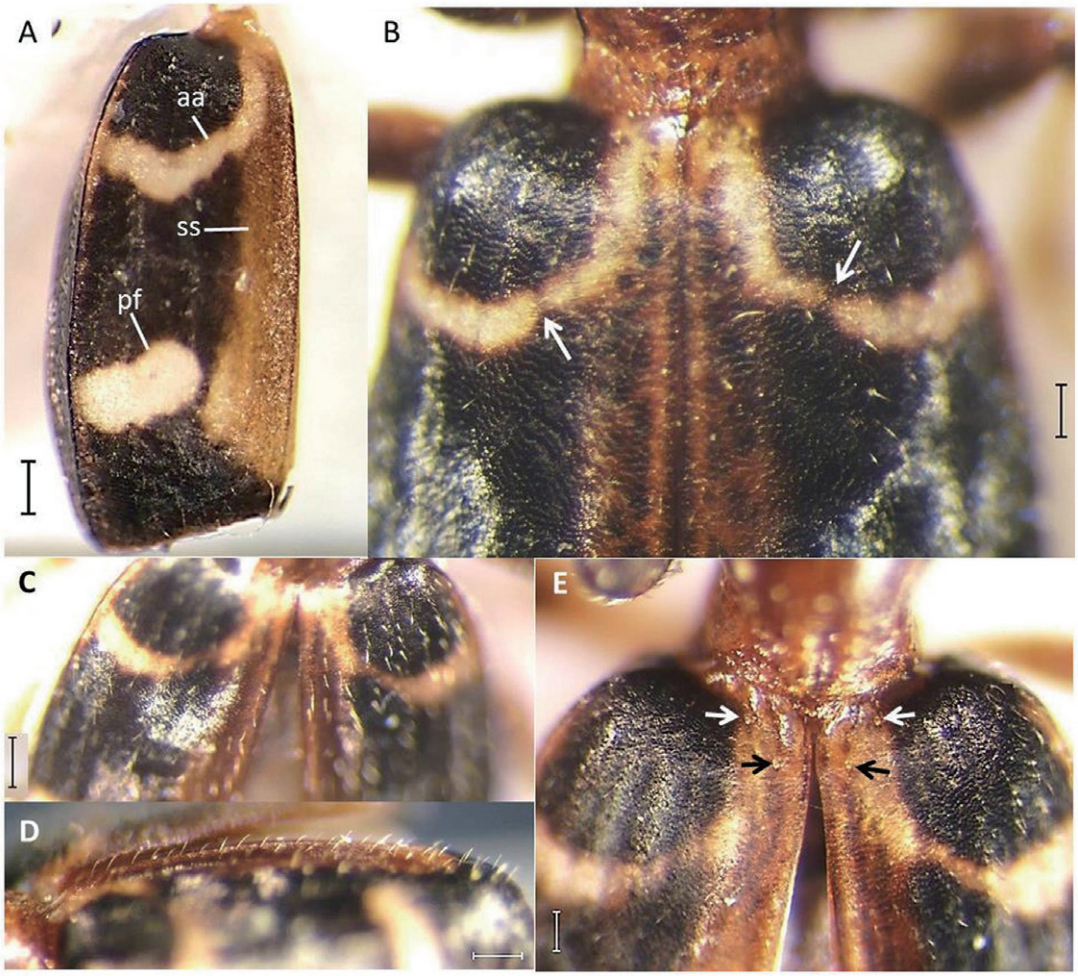

Fig. 10. Elytra of *Mastax formosana*. A. Left elytron with three markings: an anterior arc (aa), a sutural stripe (ss), and a posterior fascia (pf). B. Basal half of elytra, showing anterior arcs, each with a faint interruption in middle (arrows). C. Basal half of elytra with linearly arranged pubescence. D. Left elytron, lateral view, showing pubescence on sutural stripe. E. Basal half of elytra, showing two setiferous pores (arrows) on each elytron base. Scale bar = 0.2 mm (A, C, D); 0.1 mm (B, E).

Remarks. This species is well recognized by the color and elytral maculation (Fig. 8A, B). Similar elytral maculation can be also seen in *M. poecila* Schaum, 1863, from Hong Kong, from which *M. formosana* is distinguished by the arcuate humeral spots and posterior fasciae separated from the sutural stripes.

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臺灣產步行蟲總科 (鞘翅目) 之註記 (IX)—二種罕知的 *Mastax* 屬種類 (Brachininae: Brachinini)

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本文依據在臺灣新的採集標本記錄 *Mastax brittoni* Quentin, 1952 and *M. formosana* Dupuis, 1912，並附圖。這二種在頭部兩側各具二根眼上剛毛，而 *M. brittoni* 的陽莖沒有正常的陽基側突，此爲Brachinini族種類少見的特徵。*M. brittoni* 的臺灣族群的翅鞘斑紋變異可區分爲三種型式。

關鍵詞：Brachinini，步行蟲總科，*Mastax*，臺灣，變異。