

Notes on the Taiwanese Caraboidea (Coleoptera) I. Eight Species of the Genus *Tachys* Dejean (Carabidae: Bembidiini)

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(Received October 19, 2012; Accepted January 30, 2013; Published online August 30, 2013)

Abstract. Eight species of the genus *Tachys* (Carabidae: Bembidiini), viz. *T. plagiatus sexmaculatus* Andrewes, 1925, *T. fasciatus* (Motschulsky, 1851), *T. fuscicauda* Bates, 1873, *T. exaratus* Bates, 1873, *T. luteus* Andrewes, 1925, *T. fumicatus* Motschulsky, 1851, *T. klugi* (Nietner, 1858), and *T. ovatus* (Motschulsky, 1851), are reported from Taiwan, of which *T. exaratus* and *T. fuscicauda* are new records for Taiwan. The synonymy of *T. fumigatoides* Minowa, 1932 with *T. fumicatus* is proposed. A brief description with illustrations is given for each species.

Key words: Carabidae, Bembidiini, new synonymy, *Tachys*, Taiwan.

INTRODUCTION

The ground beetles (Coleoptera: Caraboidea) of Taiwan have been studied by many authors from Asia and Europe (Terada et al. 2005). Updated information on the Taiwanese fauna of this group of insects is accumulating year by year, but still seems quite insufficient. Thus we have made an attempt to provide further information about the Taiwanese Caraboidea.

As the first report of our contributions, members of the genus *Tachys* Dejean (Carabidae: Bembidiini) are dealt with. They are generally hygrophilous, and often found near streams, around ponds, and under moist litter. Several are halophilous and live in salt marshes or other places like brackish-water areas. Twenty-seven species of *Tachys* in a broad sense have hitherto been recorded in Taiwan (Terada, 2006).

However, many of them need reconfirmation as to their current distribution in Taiwan. We confirmed the occurrence of eight species of *Tachys* in Taiwan, and these are reported here.

MATERIALS AND METHODS

To obtain further information about the Taiwanese Caraboidea, we have continued to collect samples in various places from seashores to high mountains in recent years. The samples are kept in 70% ethanol or in a dry condition and are deposited in the National Museum of Natural Science (NMNS), Taichung, the L.W. Yeh collection (LWY), Taichung, Taiwan, and the K. Terada collection (KTHJ), Hiroshima, Japan. We also examined collections at National Taiwan University (NTU) and the Taiwan Agricultural Research Institute (TARI), where many, old, dried specimens are preserved.

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The genus *Tachys* tends to be split into several genera and subgenera (for Palaearctic species, see Kopecký, 2003), but such classifications have not achieved a consensus. Therefore, only *Tachys* as a broadly represented genus is used in the present paper.

In measurements of insects, the entire length is represented by the length from the front margin of the clypeus to the elytral apex, and the width is the greatest width of the elytra. The following abbreviations are used to indicate several ratios: EL, elytral length from the base to the apex; EW, elytral width at the widest part; HW, head width including the eyes; FW, head width excluding the eyes (= frons width); PL, pronotal length at the median line; PW, pronotal width at the widest part; PA, pronotal width at the apical margin (between the front angles); PB, pronotal width at the basal margin (between the hind angles); I: II: III: IV: V: VI: VII: VIII: IX: X: XI, relative lengths of each antennal segment.

DESCRIPTIONS

Tachys plagiatus sexmaculatus Andrewes, 1925 (Figs. 1, 2)

Tachys plagiatus var. *sexmaculatus* Andrewes 1925: 371. [Thailand]; Miwa, 1931: 8; Jedlička, 1965: 170.

Tachys (Paratachys) plagiatus sexmaculatus, Kopecký, 2003: 276.

Color and microsculpture: Upper surface blackish and iridescent; antennomeres 1~3, legs, margin of elytra including epipleura, and 3 spots on each elytron yellowish. Microsculpture isodiametric on head, forming fine transverse lines on pronotum and elytra.

Head and pronotum: Frontal impressions single, wide, divergent to rear; frontal carinae distinct; eyes prominent; antennae filiform; mentum with 2 pores. Pronotum transverse, convex; sides not or very slightly sinuate before hind angles; hind angles obtuse, minutely dentate at tip, reflexed, without carina; basal transverse impression continuous, weakly crenulate, without pore in middle.

Striae and pores on each elytron: Striae 1~3 clearly impressed (stria 1 entire, striae 2 and 3 barely reaching both elytral base and apex); striae 4 and 5 faint, striae 6 and 7 barely traceable; stria 8 deeply impressed, but widely interrupted in

middle. Two dorsal pores present, both on third interval adjoining stria 3: front pore located at basal 2/5 of elytron, hind pore at front extremity of apical striole. Apical striole slightly arcuate, hooked at front extremity, with subapical pore near apex, clearly distant from apical pore (Fig. 1G).

Male genitalia: Aedeagus (median lobe) stout, nearly straight in lateral view; ventral side fully chitinized, slightly bent upward at apex (Fig. 2A); dorsal membranous part convex near middle (Fig. 2A, D); apical part rounded and slightly curved at tip (Fig. 2E); endophallus consisting of scaly or reticulate membrane in front (Fig. 2C) and deeply pigmented sclerites near basal orifice (Fig. 2A, B); left paramere subtriangular (except for basal joint part), with 2 long apical setae and a very short subapical seta; length of right paramere 2/3 that of left paramere, with 2 long apical setae and a very short subapical seta.

Measurements and proportions: Length 2.53~2.97 mm. Width 1.05~1.27 mm. Antennal segments I: II: III = 1: 1: 0.84. HW/FW = 1.79~1.86. PW/HW = 1.24~1.30. PW/PL = 1.54~1.60. PW/PA = 1.40~1.44. PW/PB = 1.21~1.25. PA/PB = 0.85~0.89. EW/PW = 1.37~1.44. EL/EW = 1.46~1.55. (Based on 4 specimens.)

Specimens examined: Tainan City: Anping, Yenshui River [台南市 安平 鹽水溪]: 2 ♂♂, 2 ♀♀, 31-iii-2010, K. Terada & L.W. Yeh leg. (Terada-106). Tainan City: near mouth of Tsengwen River [台南市 曾文溪]: 2 ♂♂, 3 ♀♀, 31-iii-2010, K. Terada & L.W. Yeh leg. (Terada-106). Tainan City: Koliao, Jishui River [台南市 蚵寮 急水溪]: 2 ♂♂, 3 ♀♀, 25-vii-2010, K. Terada & L.W. Yeh leg. (Terada-114). Ilan County: Nanao, Nanao River [宜蘭縣 南澳 南澳溪]: 2 ♂♂, 2 ♀♀, 3-iv-2010, Terada & L.W. Yeh leg. (Terada-109). Deposited in NMNS, LWY, and KTHJ.

Remarks: This subspecies is recognized by the blackish elytra with 3 yellowish spots on each side and serratulate shoulders. According to Andrewes (1925), in subsp. *sexmaculatus*, spots on the elytral apex are larger than those of subsp. *plagiatus*, and spots on the elytral shoulders are longer than those of the latter subspecies. The patterns of the elytral spots of our specimens quite agree with his description. Andrewes (1925) also wrote that the apical striole on each elytron is “hardly hooked in front”, but in our specimens, it is slightly hooked (Fig. 1D, F, G). In his key

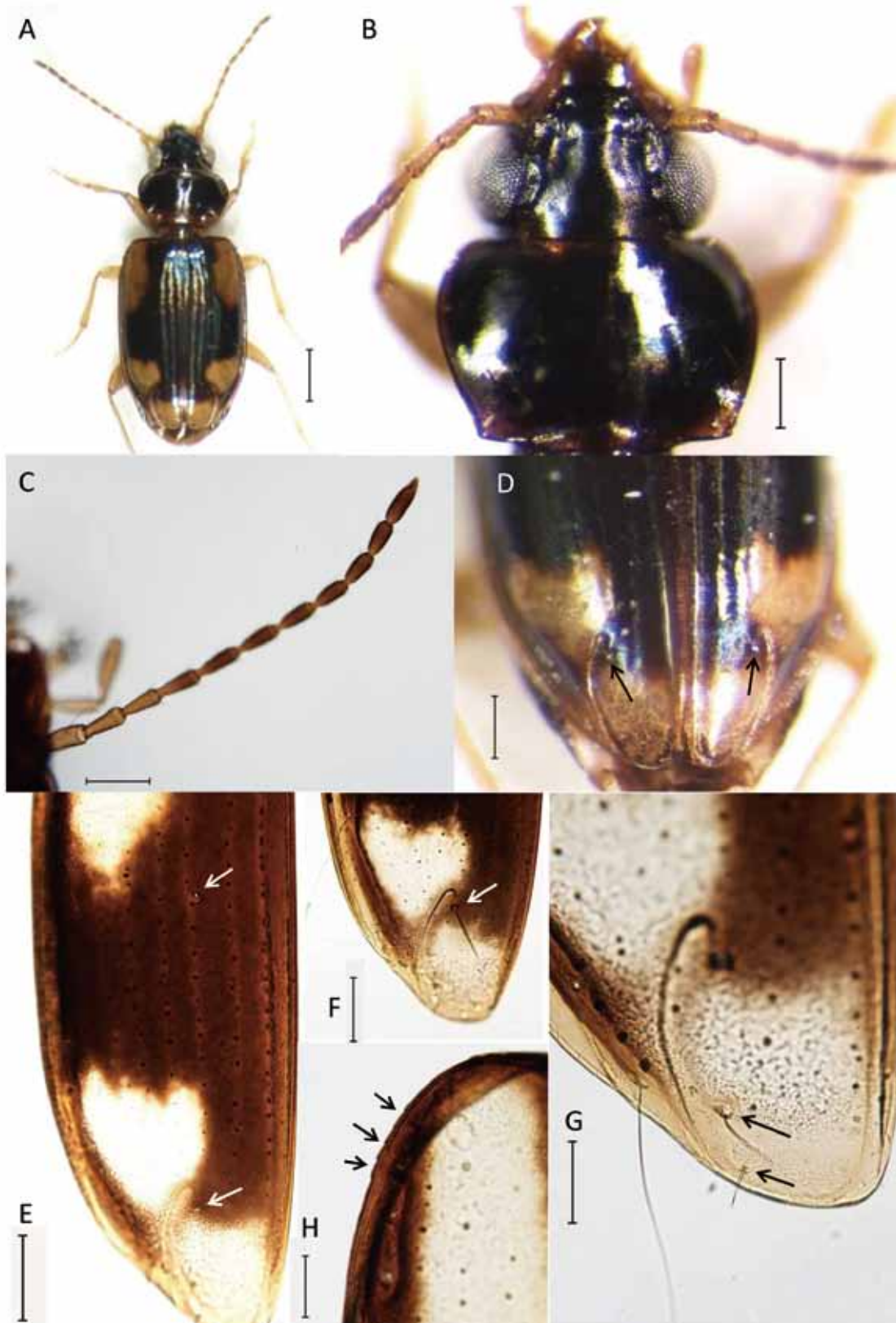


Fig. 1. *Tachys plagiatus sexmaculatus*. A. Male from Koliao, Tainan City. B. Head with obvious microsculpture, and pronotum. C. Right antenna. D. Apical half of elytra, showing an arcuate apical striole on either side. Each arrow indicates a hind dorsal pore beside the hook of the striole. E. Left elytron, showing two dorsal pores (arrows). F. Apical portion of the left elytron, showing the hind dorsal setiferous pore (arrow) beside the hook of the striole. G. Apical portion of the left elytron, showing the arcuate apical striole with a subapical setiferous pore (upper arrow) and apical setiferous pore (lower arrow). H. Humeral portion of the left elytron, showing marginal serration (arrows). Scale bar = 0.5 mm (A), 0.2 mm (B-F), 0.1 mm (G, H).

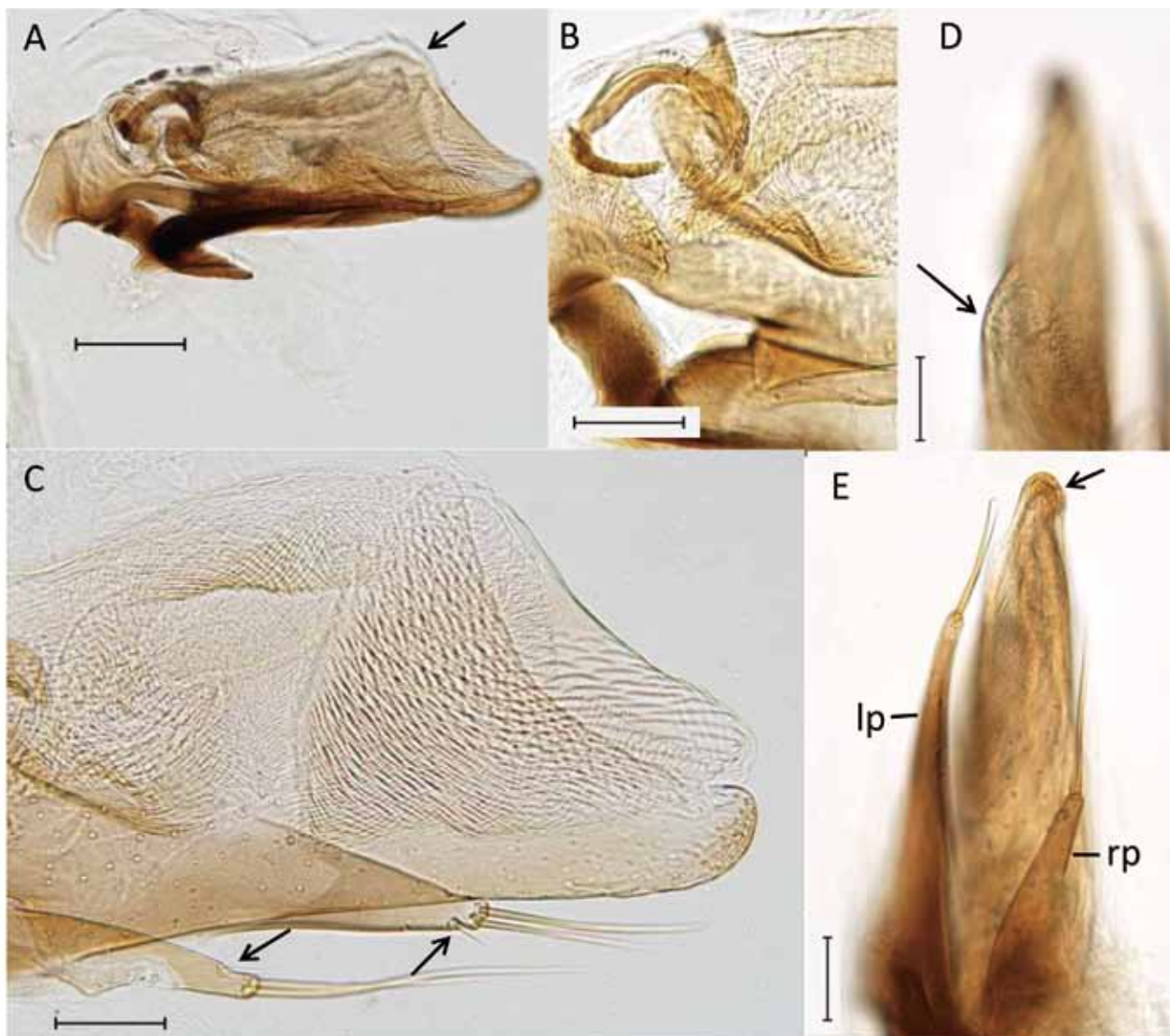


Fig. 2. Male genitalia of *Tachys plagiatus sexmaculatus*. A. Aedeagus, left lateral view. The arrow indicates dorsal swelling of the membranous part. B. Somewhat deeply pigmented endophallic components inside the aedeagus, left lateral view. C. Apical portion of the aedeagus, left lateral view, showing a thin reticulate or scaly membrane. Arrows indicate a short subapical seta of each paramere. D. Blunt swelling (arrow) of membranous part of the aedeagus, left dorsal view. E. Aedeagus with a longer left paramere (lp) and a shorter right paramere (rp), ventral view. The arrow indicates the curved tip of the apical lobe of the aedeagus. Scale bar = 0.1 mm (A) and 0.05 mm (B-E).

to the subspecies of *T. plagiatus*, Tanaka (1956) wrote “elytra shorter, not more than a half longer than wide” for both subsp. *plagiatus* and subsp. *sexmaculatus*. In our specimens, however, the elytral proportion (EL/EW) ranges 1.46~1.55.

The first record of this subspecies from Taiwan was reported by Andrewes (1925) who identified several specimens collected by H. Sauter at Anping, Tainan City. Our collections were also made in several places of Tainan City including Anping. This species lives in saline habitats.

***Tachys fasciatus* (Motschulsky, 1851)**

(Figs. 3, 4)

Trechus fasciatus Motschulsky, 1851: 506. [Ind. or.].

Tachys triangularis, Andrewes, 1925: 350; Miwa, 1931: 7.

Tachys fasciatus, Andrewes, 1935: 217.

Eotachys fasciatus, Uéno, 1953a: 41.

Tachys fasciatus fasciatus, Jedlička, 1965: 168.

Tachys (Paratachys) fasciatus fasciatus, Kopecký, 2003: 275.



Fig. 3. *Tachys fasciatus*. A. Male from Yuchmei, Taoyuan County. B. Head with obvious microsculpture, and pronotum. C. Left antenna. D. Apical half of elytra, showing the weakly arcuate apical striole on either side. Each arrow indicates the position of a hind dorsal pore beside the hook of the striole. E. Apical portion of the left elytron, showing the apical and subapical pores very close to each other (arrows). F. Right elytron, showing two dorsal pores (arrows) on the fourth interval. Scale bar = 0.5 mm (A), 0.2 mm (B-D, F) and 0.1 mm (E).

Color and microsculpture: Upper surface yellowish-brown, iridescent; head except clypeus and labrum, and transverse band across middle of elytra blackish-brown to almost black; elytral apex becoming dark-brown; antennae dark-yellowish-brown (basal and apical antennomeres paler); clypeus, labrum, palpi, and legs yellowish-brown. Microsculpture isodiametric on head, forming fine transverse lines on elytra and pronotum.

Head and pronotum: Frontal impressions single, wide, divergent to rear; frontal carinae indistinct; eyes prominent; antennae long, filiform; mentum with 2 pores. Pronotum transverse or subcordate; sides weakly sinuate behind; hind angles obtuse, reflexed, without carina; basal transverse impression crenulate, with large pore in middle.

Striae and pores on each elytron: Striae 1~5 clearly impressed and punctate (stria 1 entire, striae 2~5 barely reaching both elytral base and apex); stria 6 very weakly impressed; stria 7 barely traceable; stria 8 impressed, but broadly

interrupted in middle. Two dorsal pores present, both on fourth interval: front pore located between basal 1/3 and 2/5 of elytron; hind pore at front extremity of apical striole. Apical striole slightly arcuate, hooked at front extremity, with subapical pore near apex, close to apical pore (Fig. 3E).

Male genitalia: Aedeagus (median lobe) elongate and gently arcuate in lateral view; ventral part fully chitinized, with fold on left side before apex in dorsal view (Fig. 4D); apical part rounded and slightly bent at tip (Fig. 4C, D); endophallus with distinctly scaled membrane at mid-dorsal side, and several, somewhat deeply pigmented components proximally (Fig. 4B); left paramere long and broad, with 3 setae at apex; right paramere much smaller than left one (1/5 of left paramere in length), with 3 setae at apex.

Measurements and proportions: Length 2.38~2.48 mm. Width 1.00~1.05 mm. Antennal segments I: II: III = 1: 1.17: 1. HW/FW = 1.68~1.78. PW/HW = 1.28~1.30. PW/PL = 1.63~1.66. PW/PA = 1.37~1.42. PW/PB =

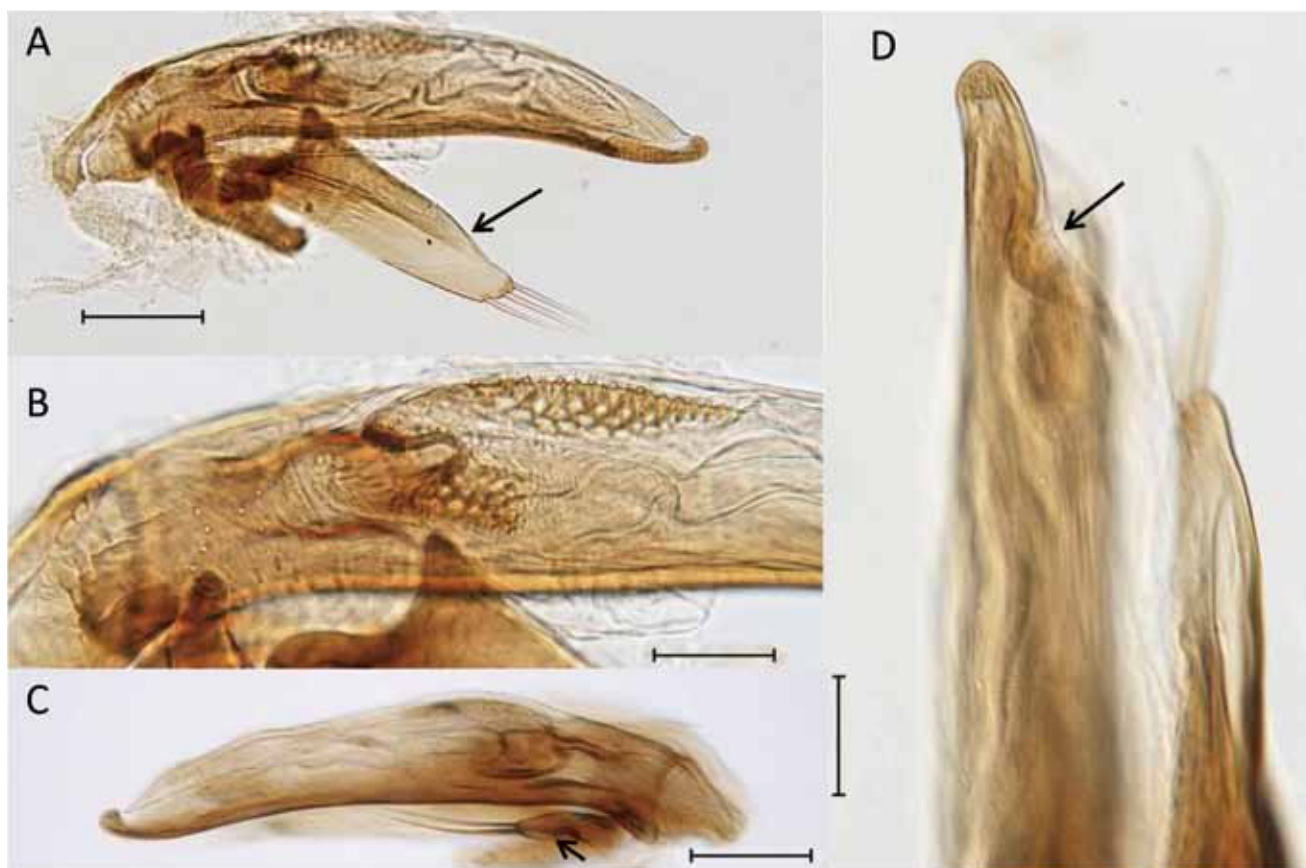


Fig. 4. Male genitalia of *Tachys fasciatus*. A. Aedeagus, left lateral view. The arrow indicates the left paramere. B. Middle portion of the aedeagus, left lateral view, showing the scaly membrane and sclerites. C. Aedeagus, right lateral view. The arrow indicates the right paramere. D. Apical portion of the aedeagus, showing a fold (arrow) before the apex. Left dorsal view. Scale bar = 0.1 mm (A, C) and 0.05 mm (B, D).

1.26~1.31. PA/PB = 0.90~0.94. EW/PW = 1.30~1.36. EL/EW = 1.44~1.54. (Based on 4 specimens.)

Specimens examined: Taoyuan County: Yangmei [桃園縣 楊梅]: 1 ♂, 20-viii-2001, K. Terada & M.H. Hsu leg. (Terada-41); 2 ♂♂, 2 ♀♀, 22-viii-2001, K. Terada & M.H. Hsu leg. (Terada-42); 1 ♂, 1 ♀ 18-vi-2002, M.H. Hsu leg. (Terada-103). Taoyuan County: Tahsi, Yuehmei [桃園縣 大溪 月眉]: 1 ♂, 10-iii-2002, K. Terada & M.H. Hsu leg. (Terada-92). Deposited in NMNS and KTHJ.

Remarks: This species is recognized by the blackish head, yellowish-brown pronotum, and elytra with a blackish band near middle. The first record of this species in Taiwan was by Miwa (1931) as *T. triangularis* Nietner, although no further information was given except the locality (Taipei). Our specimens were collected by light traps in paddy fields and near ponds scattered among agricultural land.

***Tachys fuscicauda* Bates, 1873**

(Figs. 5, 6)

Tachys fuscicauda Bates, 1873: 298. [Nagasaki, Japan]; Andrewes, 1925: 438.

Tachyura (Tachyura) fuscicauda, Kopecký, 2003: 279.

Color and microsculpture: Upper surface light- to dark-reddish-brown; antennomeres 1 and 2, legs, and 2 vague spots on each elytron yellowish-brown. Microsculpture absent from head, pronotum, and elytra.

Head and pronotum: Frontal impressions short, duplicate; eyes not prominent but slightly convex; frontal carinae distinct; antennae submoniliform; mentum without pores. Pronotum a little transverse, moderately convex; sides slightly sinuate to rear; hind angles right, each with distinct carina; basal transverse impression strongly crenulate, with pore in middle.

Striae and pores on each elytron: Striae 1~3 clearly impressed and punctate (stria 1 entire, striae 2 and 3 barely reaching both elytral base and apex); stria 4 weakly impressed; striae 5~7 barely traceable; stria 8 entire, deeply impressed. Two dorsal pores present, both on third interval adjoining stria 3: front pore located at basal 1/3 of elytron; hind pore located between apical 1/3 and 2/5 of elytron. Apical striole slightly arcuate, but not hooked in front, with subapical pore located near middle and clearly distant from apical pore

(Fig. 5F).

Male genitalia: Aedeagus (median lobe) relatively small, slightly curved in lateral view (Fig. 6A); ventral side fully chitinized and lamellate, extending beyond tip of dorsal membranous part, slightly curled at tip (Fig. 6D-F); endophallus without conspicuous copulatory pieces; left paramere large, subtriangular (except for basal joint part), abruptly narrowed at apex, with 2 apical setae and a very short subapical seta; right paramere much smaller than left one (1/4 of left paramere in length), with 2 apical setae and very short subapical seta.

Measurements and proportions: Length 2.11~2.37 mm. Width 0.90~1.07 mm. Antennal segments I: II: III = 1: 0.88: 0.88. HW/FW = 1.57~1.66. PW/HW = 1.12~1.15. PW/PL = 1.47~1.50. PW/PA = 1.56~1.57. PW/PB = 1.18~1.21. PA/PB = 0.75~0.77. EW/PW = 1.40~1.50. EL/EW = 1.41~1.50. (Based on 3 specimens.)

Specimens examined: New Taipei City: Fulung [新北市 福隆]: 2 ♂♂, 2 ♀♀, 13-vi-2001, K. Terada leg. (Terada-18). New Taipei City: Kungliao, Shuanghsi River [新北市 貢寮 雙溪]: 1 ♀, 14-iii-2002, K. Terada leg. (Terada-94). Hualien County: Taroko, Shakatang River: [花蓮縣 太魯閣 砂卡礑溪]: 1 ♂, 15-ii-2009, L.W. Yeh leg. Deposited in NMNS, LWY, and KTHJ.

Remarks: This species is recognized by the small, convex, reddish-brown body and the elytra with 2 vague paler spots on the humeral and hind parts; sometimes the humeral spots are difficult to recognize. A hairy patch is present above the middle part of the aedeagus as indicated by the arrow in Fig. 6A, but it is not considered an endophallic component of the aedeagus.

No records of this species were previously published from Taiwan, although it is relatively common here. Our specimens were obtained under gravel near streams.

***Tachys exaratus* Bates, 1873**

(Figs. 7, 8)

Tachys exaratus Bates 1873: 296. [Hiogo, Japan]; Andrewes, 1925: 392.

Tachyura (Amaurotachys) exarata, Kopecký, 2003: 277.

Color and microsculpture: Upper surface brown to blackish-brown (elytra sometimes lighter than head and pronotum); antennomeres

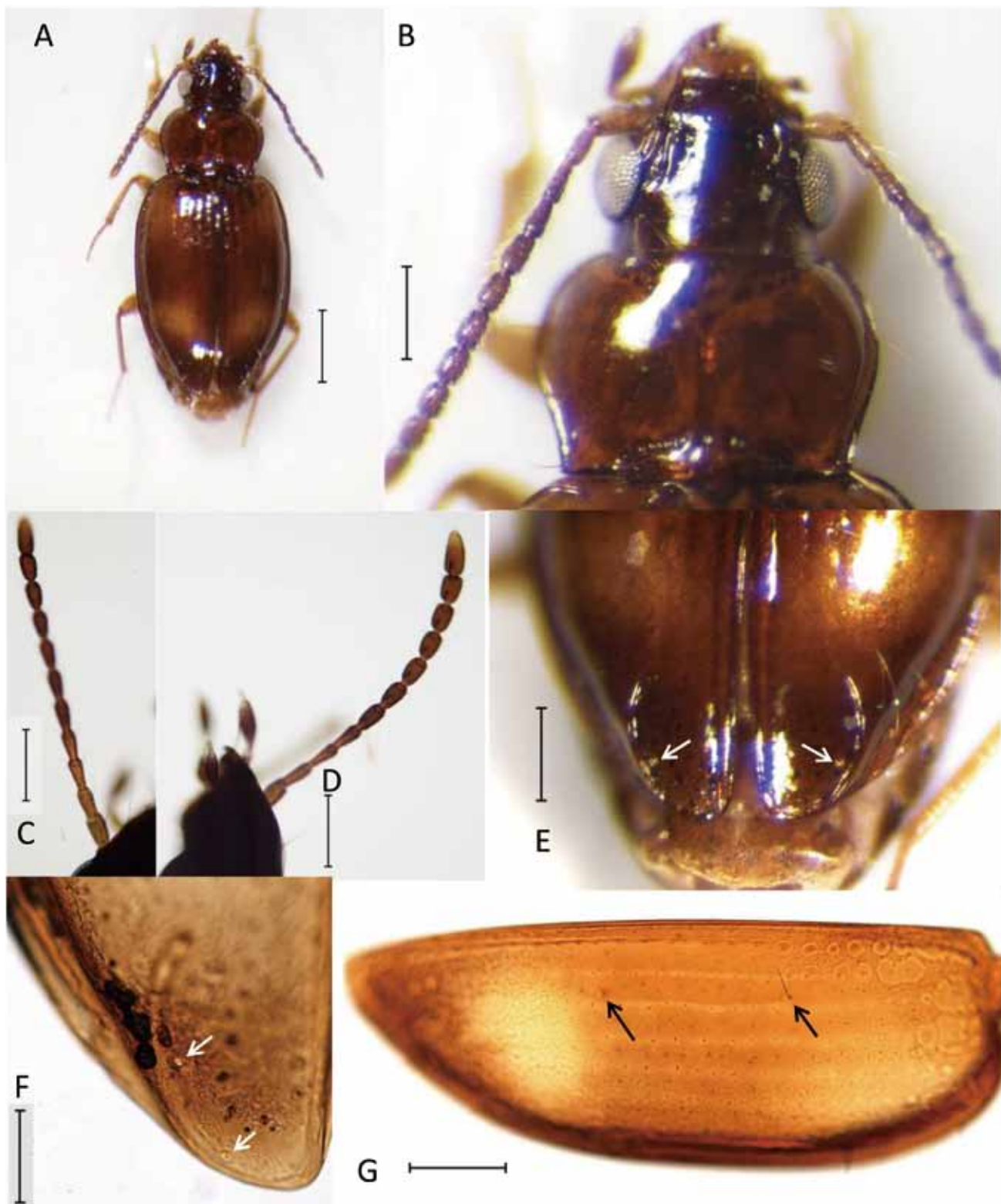


Fig. 5. *Tachys fuscicauda*. A. Male from Fulung, New Taipei City. B. Head and pronotum. C. Left antenna, dorsal view. D. Left antenna, lateral view. E. Apical portion of the elytra, showing an arcuate apical striole on either side. Each arrow indicates a subapical pore. F. Apical portion of the left elytron, showing an apical pore (lower arrow) and a subapical pore (upper arrow). G. Right elytron, showing two dorsal pores (arrows) adjoining stria 3. Scale bar = 0.5 mm (A), 0.2 mm (B-E, G) and 0.1 mm (F).

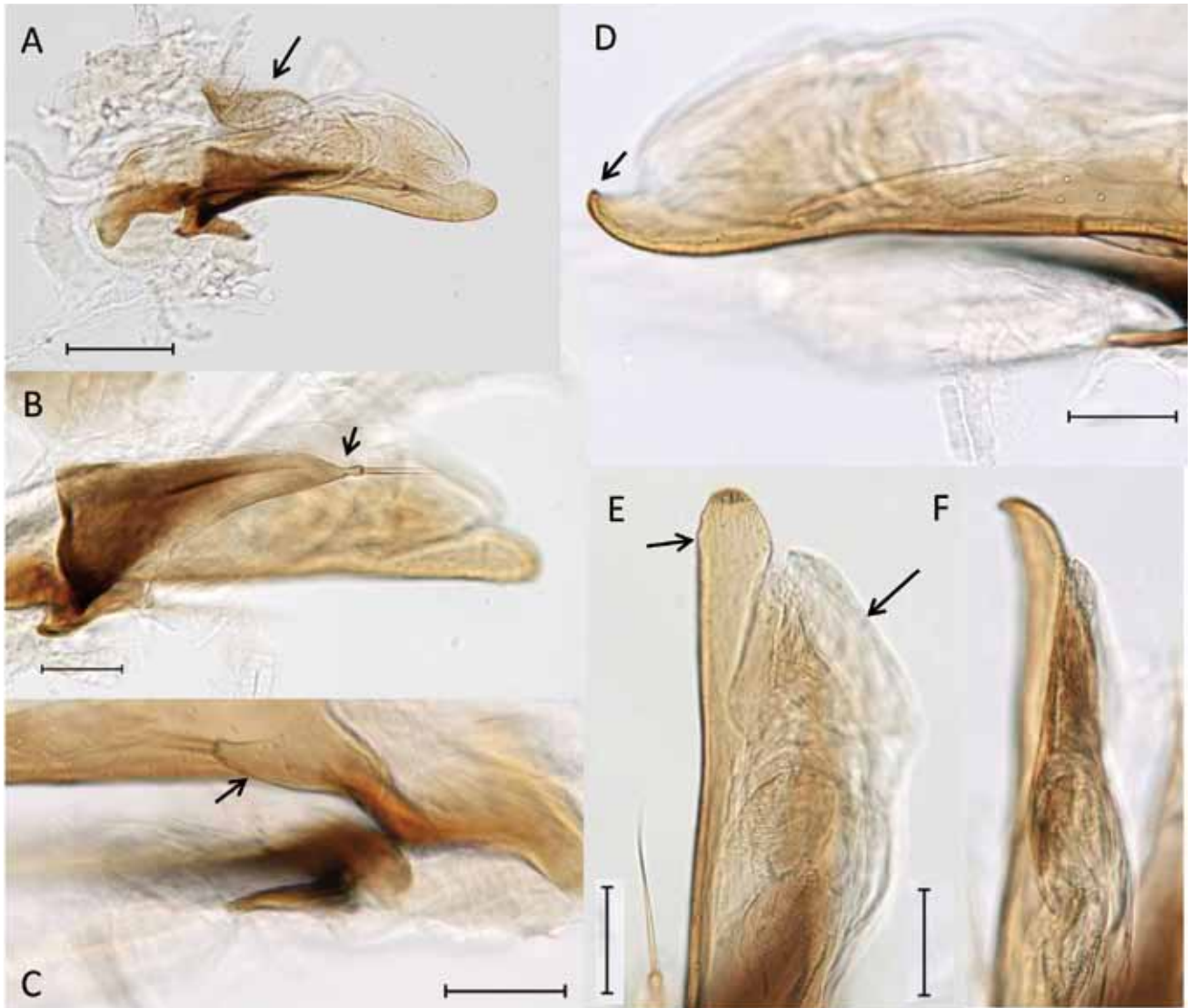


Fig. 6. Male genitalia of *Tachys fuscicauda*. A. Aedeagus, left lateral view. The arrow indicates a hairy patch on the aedeagus. B. Aedeagus, left lateral view (turned more to the ventral side), showing the left paramere (arrow). C. Basal portion of the aedeagus, right lateral view, showing the right paramere (arrow). D. Aedeagus, right lateral view. The arrow indicates the curled tip of the apical lamella. E. Apical portion of the aedeagus, right dorsal view, showing the dorsal membranous part (right arrow) and ventral chitinized lamella (left arrow). F. Apical portion of the aedeagus, left dorsal view (turned more to the right than the condition in image E), showing the dorsal and ventral parts separated from each other. Scale bar = 0.1 mm (A) and 0.05 mm (B-F).

1 and 2, hind spot on each elytron, and legs brown to dark-yellowish-brown. Microsculpture nearly isodiametric on head (becoming transverse meshes near neck), forming transverse meshes on pronotum, forming fine transverse lines on elytra.

Head and pronotum: Frontal impressions single, wide, divergent to rear; frontal carinae indistinct; eyes not prominent but slightly convex; antennae submoniliform; mentum without pores. Pronotum transverse or subcordate; sides slightly sinuate behind; hind angles nearly right, each with rudimentary carina and with distinct pore inside

carina; basal transverse impression very weakly crenulate, usually interrupted in middle.

Striae and pores on each elytron: Striae 1~4 clearly impressed (stria 1 entire, striae 2~4 barely reaching both elytral base and apex); stria 5 weakly impressed; striae 6 and 7 obsolete or barely traceable; stria 8 impressed, but widely interrupted in middle. Two dorsal pores present, both on third interval adjoining stria 3: front pore located at basal 1/3 of elytron; hind pore between apical 2/7 and 1/3 of elytron. Apical striole slightly arcuate, hooked at front extremity, with



Fig. 7. *Tachys exaratus*. A. Male from Hsintien, New Taipei City. B. Right antenna. C. Head with obvious microsculpture. D. Pronotum. E. Right elytron showing two dorsal pores (arrows) on the third interval. F. Apical portion of the elytra showing an arcuate apical striole. The arrow indicates the position of the subapical pore on the left elytron. Scale bar = 0.5 mm (A), 0.2 mm (B, D-F) and 0.1 mm (C).

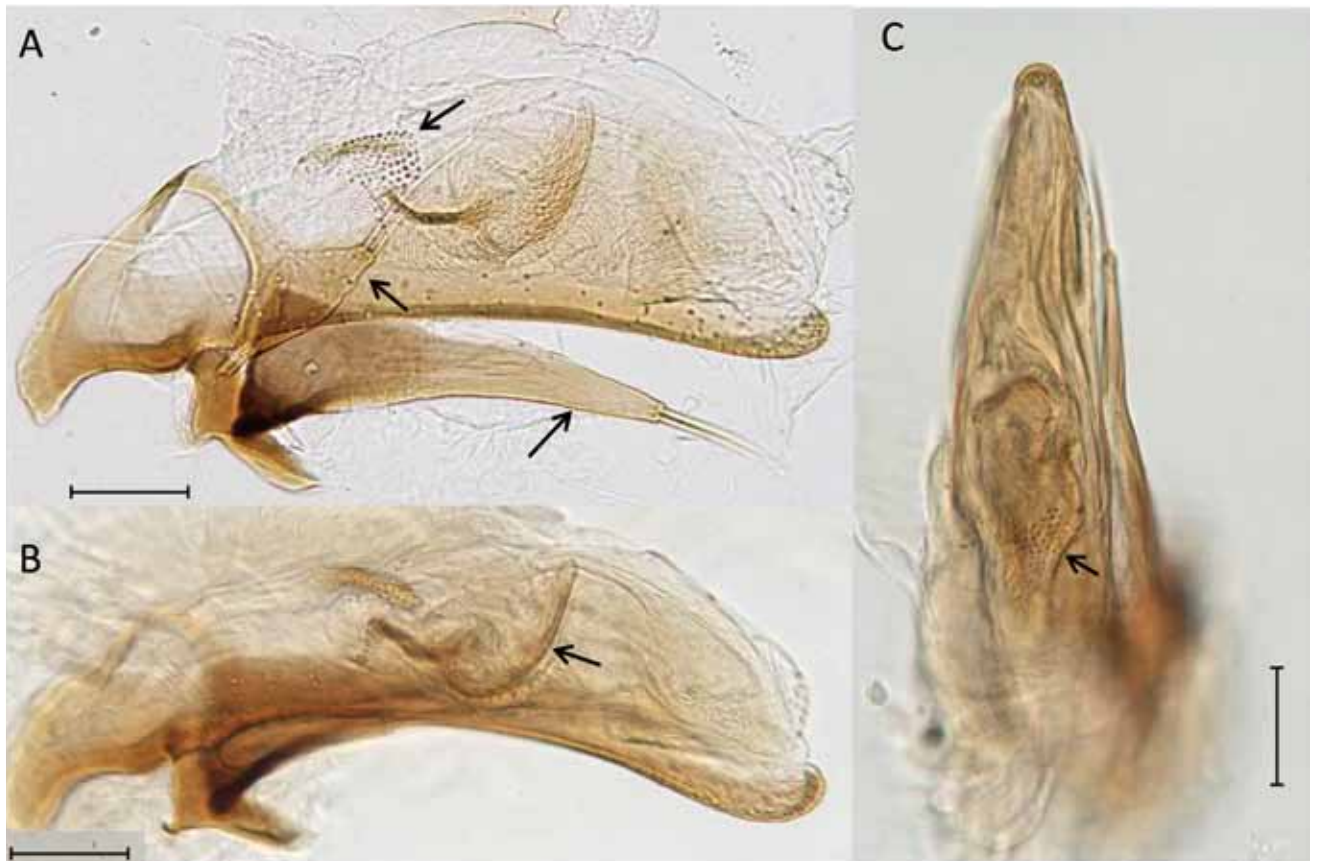


Fig. 8. Male genitalia of *Tachys exaratus*. A. Aedeagus, left lateral view. The upper arrow indicates the dotted membranous component of the endophallus. The central arrow indicates the right paramere. The lower arrow indicates the left paramere. B. Aedeagus, left lateral view. The arrow indicates the endophallic membranous component with a subspirally twisted, darkly pigmented margin. C. Aedeagus, dorsal view. The arrow indicates the dotted membranous component of the endophallus. Scale bar = 0.05 mm.

subapical pore located a little before middle and clearly distant from apical pore (Fig. 7F).

Male genitalia: Aedeagus (median lobe) more or less stout in lateral view (Fig. 8A); ventral side fully chitinized and lamellate; dorsal membranous part convex in lateral view, gradually narrowed toward apex in dorsal view (Fig. 8A, C); endophallus with dotted membrane and more or less scaly membrane, the margin of which is deeply pigmented and subspirally twisted (Fig. 8B); left paramere subtriangular (except for basal joint part), with 2 apical setae; length of right paramere 1/4 that of left paramere, with 2 apical setae longer than those of left paramere.

Measurements and proportions: Length 2.42~2.59 mm. Width 1.03~1.12 mm. Antennal segments I: II: III = 1: 1: 1. HW/FW = 1.60~1.70. PW/HW = 1.29~1.33. PW/PL = 1.45~1.56. PW/PA = 1.48~1.52. PW/PB = 1.25~1.29. PA/PB = 0.81~0.86. EW/PW = 1.42~1.51. EL/EW = 1.50~1.54. (Based on 4 specimens.)

Specimens examined: New Taipei City: Hsintien, Hsintien River [新北市 新店 新店溪]: 2 ♂♂, 1 ♀, 1-viii-2010, L.W. Yeh leg. (Terada-119). New Taipei City: Wulai, Nanshih River [新北市 烏來 南勢溪]: 2 ♂♂, 2 ♀♀, 16-ii-2002, K. Terada leg. (Terada-85). New Taipei City: Fulung [新北市 福隆]: 2 ♀♀, 16-v-2001, K. Terada leg. (Terada-9); 13-vi-2001, K. Terada leg. (Terada-18); 2 ♀♀, 11-i-2002, K. Terada leg. (Terada-79). New Taipei City: Kungliao, Shuanghsi River [新北市 貢寮 雙溪]: 1 ♀, 14-iii-2002, K. Terada & M. H. Hsu leg. (Terada-94). Taichung City: Kukuan, Tachia River [台中市 谷關 大甲溪]: 1 ♀, 10-vi-1977, K. Terada leg. (no number). Deposited in NMNS and KTHJ.

Remarks: This species is recognized by the relatively flat, oblong, dark-brownish elytra with a vague hind spot on each elytron. According to Andrewes (1925), the lateral margins of the pronotum are minutely setulose. This feature is also recognizable in our specimens, but faint and

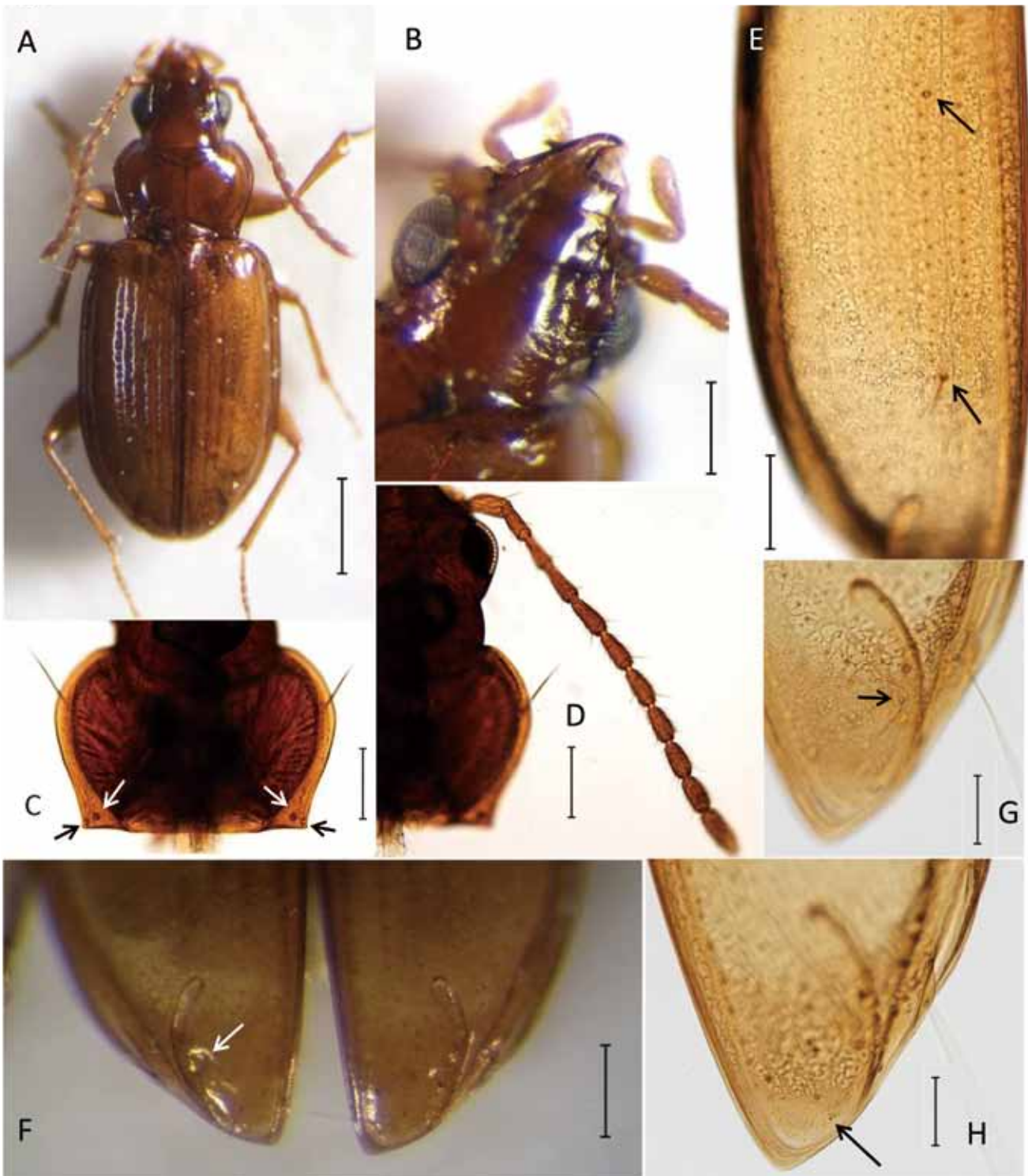


Fig. 9. *Tachys luteus*. A. Male from Fulung, New Taipei City. B. Head. C. Pronotum. The posterior seta on either side was removed, but only the pore can be seen at each hind angle (outer arrows). The inner two arrows indicate minute pits on the inner side of the basal angles. D. Right antenna. E. Left elytron, showing two dorsal pores (arrows) on the third interval. F. Apical portion of the elytra, showing an arcuate apical striole. The arrow indicates the position of the subapical pore on the left elytron. G. Apical portion of the right elytron, showing the subapical pore (arrow). H. Apical portion of the right elytron, showing the apical pore (arrow). Scale bar = 0.5 mm (A), 0.2 mm (B-F), 0.1 mm (G, H).

sparse. Taiwanese specimens are a little larger than those studied by Andrewes (1925). No records of this species from Taiwan were given before. The studied specimens were collected under gravel near streams.

***Tachys luteus* Andrewes, 1925**

(Figs. 9, 10)

Tachys luteus Andrewes 1925: 390. [Singapore]; Jedlička 1965: 177; Kasahara 1987: 7.

Tachyura (Amaurotachys) lutea Kopecký, 2003: 277.

Color and microsculpture: Upper surface light-brown to yellowish-brown. Head, antennae, and pronotum usually a little deeper in color than elytra and legs. Microsculpture generally indistinct, but forming very faint isodiametric meshes on head, and fine transverse lines on elytra.

Head and pronotum: Frontal impressions single, divergent to rear; frontal carinae indistinct; eyes not prominent but slightly convex; short

irregular striations present around and behind eyes; antennae submoniliform; mentum without pores. Pronotum a little transverse or subcordate; sides slightly contracted and sinuate behind; hind angles nearly right, each with a distinct carina and distinct pore inside carina (Fig. 9C); basal transverse impression weakly crenulate, interrupted in middle, with short longitudinal wrinkles, without pore in middle.

Striae and pores on each elytron: Striae 1~5 clearly impressed and punctate (stria 1 entire, striae 2~5 not reaching either elytral base or apex); stria 6 weakly impressed and punctate; stria 7 barely traceable; stria 8 entire, weakly impressed and punctate in middle. Two dorsal pores present, both on third interval and adjoining stria 3: front pore located at basal 1/3 of elytron; hind pore at apical 1/3 or a little less than 1/3 of elytron. Apical striole slightly arcuate, not clearly hooked in front, with subapical pore located in middle and clearly distant from apical pore (Fig. 9G, H).

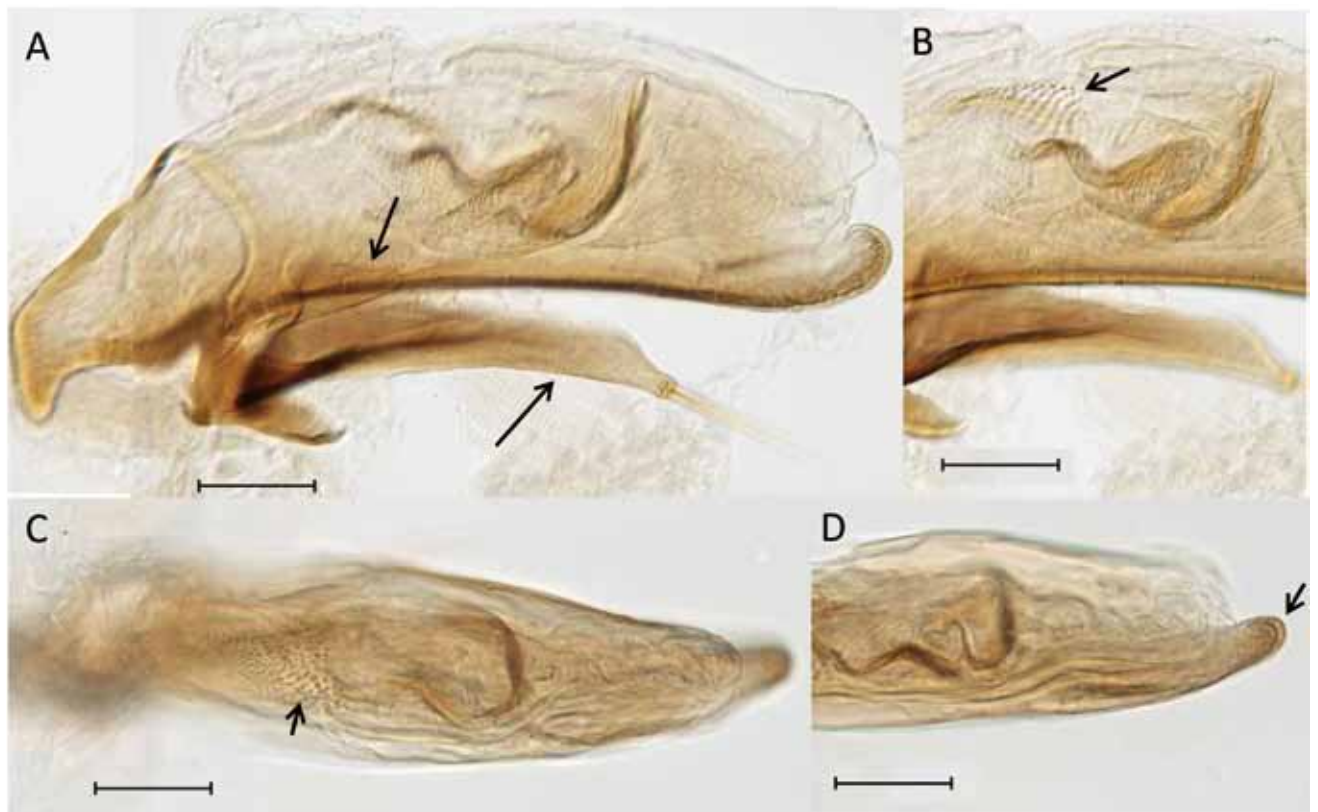


Fig. 10. Male genitalia of *Tachys luteus*. A. Aedeagus, left lateral view. The upper arrow indicates the right paramere, and the lower arrow indicates the left paramere. B. Middle portion of the aedeagus, left lateral view, showing more or less pigmented endophallic components. The arrow indicates a dotted membranous component. C. Aedeagus, dorsal view. The arrow indicates the dotted membrane of the endophallus. D. Aedeagus, left dorsal view, showing the apical lobe (arrow). Scale bar = 0.05 mm.

Male genitalia: Aedeagus (median lobe) less arcuate than in *T. exaratus*; ventral part fully chitinized and lamellate, somewhat extending beyond dorsal membranous part at apex (Fig. 10A, D); dorsal membranous part gently convex in lateral view; endophallus with slightly pigmented, twisted structure and dotted patch (Fig. 10B, C); left paramere subtriangular, with 2 apical setae; right paramere 2.5~3.0-times shorter than left paramere, with 2 apical setae longer than those of left paramere.

Measurements and proportions: Length 2.53~2.70 mm. Width 1.06~1.16 mm. Antennal segments I: II: III = 1: 1: 1. HW/FW = 1.47~1.58. PW/HW = 1.34~1.41. PW/PL = 1.47~1.49. PW/PA = 1.50~1.58. PW/PB = 1.25~1.27. PA/PB = 0.80~0.83. EW/PW = 1.43~1.48. EL/EW = 1.51~1.54. (Based on 3 specimens.)

Specimens examined: New Taipei City: Fulung [新北市 福隆]: 1 ♂, 16-v-2001, K. Terada leg. (Terada-9); 1 ♂, 1-x-2001 K. Terada leg. (Terada-53); 1 ♂, 11-i-2002, K. Terada leg. (Terada-79). New Taipei City: Hsintien, Hsintien River [新北市 新店 新店溪]: 1 ♂, 3-xii-2001, K. Terada leg. (Terada-74). Ilan County: Nanao, Tawan River [宜蘭縣 南澳 大灣溪]: 1 ♂, 1 ♀, 8-iii-2002, K. Terada leg. (Terada-91). Ilan County: Tungao, Tungao River [宜蘭縣 東澳 東澳溪]: 1 ♂, 1 ♀, 3-iv-2010, K. Terada & L.W. Yeh leg. (Terada-109). Deposited in NMNS, LWY, and KTHJ.

Remarks: This species is recognized by the light-brownish oblong body without spots on each elytron. It resembles *T. exaratus* in having a similar aedeagus, especially the endophallic components. In the type specimen of this species according to Andrewes (1925), the basal transverse impression on the pronotum is “not crenulate”, whereas in the studied specimens, some small, weak punctures were present on it. Kasahara (1987) also observed similar punctures. The subapical pore on the elytral apex is in the middle of the apical striole in our specimens, but a line drawing given by Kasahara (1987) shows it located more to the front than in the middle. Andrewes (1925) also wrote the position of this pore as “a little in front of middle”.

The first Taiwanese record of this species was from “Kosempo” = Chiahhsien (高雄市 甲仙) by Jedlička (1965). Kasahara (1987) recorded additional localities: Hungyeh Spa (花蓮縣 紅葉溫泉), Pishan Spa (台東縣 碧山溫泉), and

Liukuei (高雄市 六龜). The studied specimens, which were collected under gravel near streams, are slightly larger than those studied by Andrewes (1925).

Tachys fumicatus Motschulsky, 1851

(Figs. 11-13)

Tachys fumicatus Motschulsky, 1851: 509. [Ind. or.]; Andrewes, 1925: 466; Andrewes, 1935: 287; Jedlička 1940: 17.

Sphaerotachys fumigatus, Uéno, 1953b: 46.

Tachyura (Sphaerotachys) fumicata, Kopecký, 2003: 277.

Tachys fumigatoides Minowa, 1932: 290, fig. 9 [Taipei]; Jedlička, 1965: 175. New synonymy.

Color and microsculpture: Upper surface reddish-brown to dark-brown; antennomeres 1 and 2, legs, and vague spots on elytra yellowish. Microsculpture generally indistinct on head, forming fine transverse meshes on pronotum, and fine transverse lines on elytra. According to Andrewes (1925), however, microsculpture of this species is distinct and nearly isodiametric on pronotum, and forming very wide meshes on elytra.

Head and pronotum: Head convex on vertex; frontal impressions long and deep, convergent in front (V-shaped) and reaching front margin of clypeus; frontal carinae distinct, irregularly striated; eyes prominent; antennae submoniliform; labrum and clypeus deeply emarginate; mentum without pores. Pronotum subcordate; sides sinuate to rear; hind angles nearly right, without carina; basal transverse impression weakly crenulate, interrupted in middle, with pore in middle.

Striae and pores on elytron: Striae 1 and 2 clearly impressed (stria 1 entire; stria 2 not reaching either elytral base or apex); other striae except stria 8 barely traceable; stria 8 entire, deeply impressed. Two dorsal pores present, both on third interval: front pore located at basal 1/3 of elytron; hind pore at apical 2/5 of elytron. Apical striole relatively short, nearly straight, with subapical pore located in middle and clearly distant from apical pore (Fig. 11F).

Male genitalia: Aedeagus (median lobe) convex on dorsal side, nearly straight on ventral side, forming a blade-like edge at apex in lateral view (Fig. 12A); ventral part chitinized, somewhat extending beyond dorsal membranous part at apex (Fig. 12B-F); endophallus with C-shaped sclerite (left lateral view), and large,

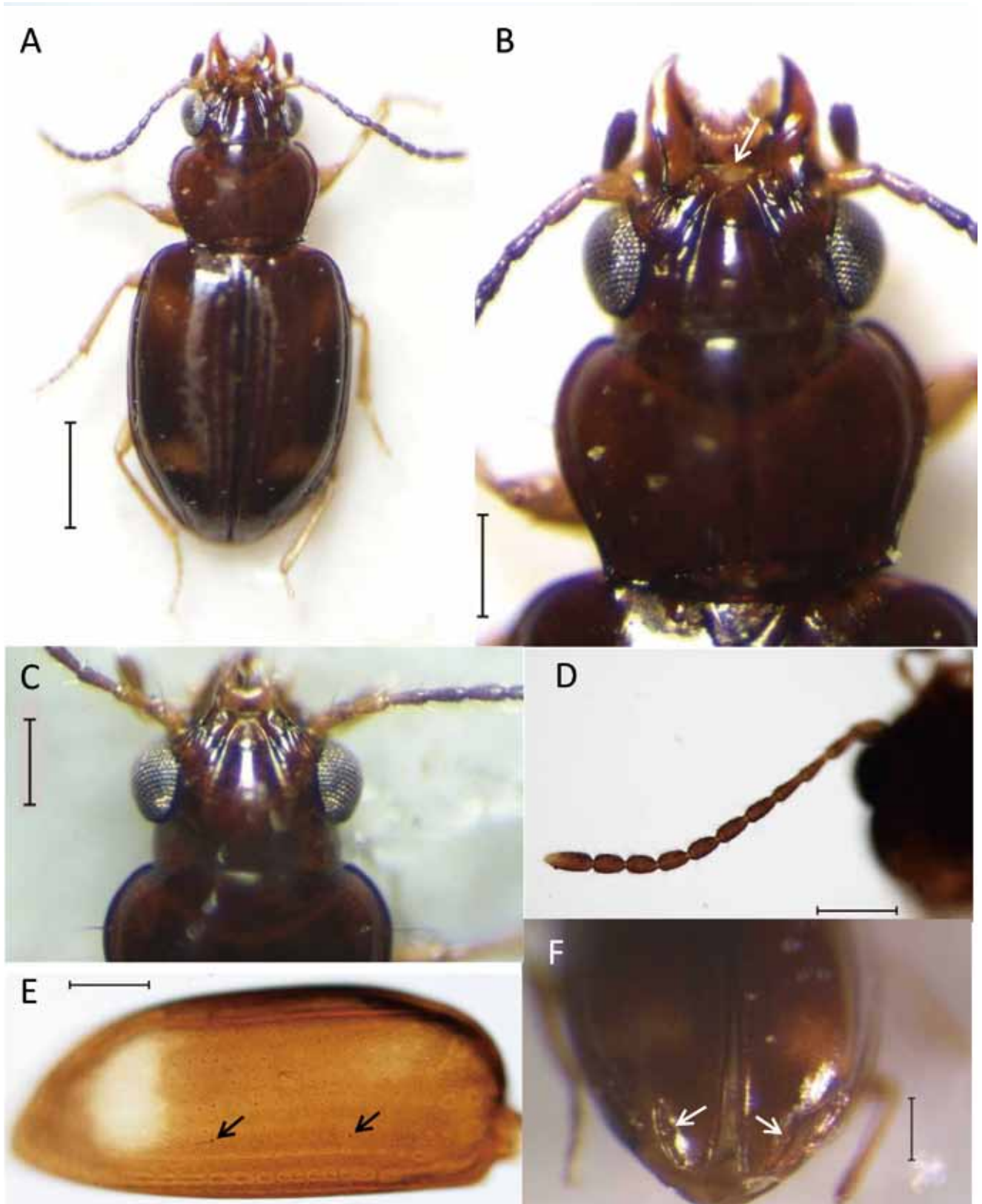


Fig. 11. *Tachys fumicatus*. A. Male from Tahu, Taipei City. B. Head and pronotum. The arrow indicates the basal margin of the labrum. C. Head with V-shaped frontal furrows. D. Left antenna. E. Left elytron, showing two dorsal pores (arrows) on the third interval. F. Apical portion of the elytra, showing an apical striole on either side. Each arrow indicates the position of a subapical pore. Scale bar = 0.5 mm (A) and 0.2 mm (B-F).

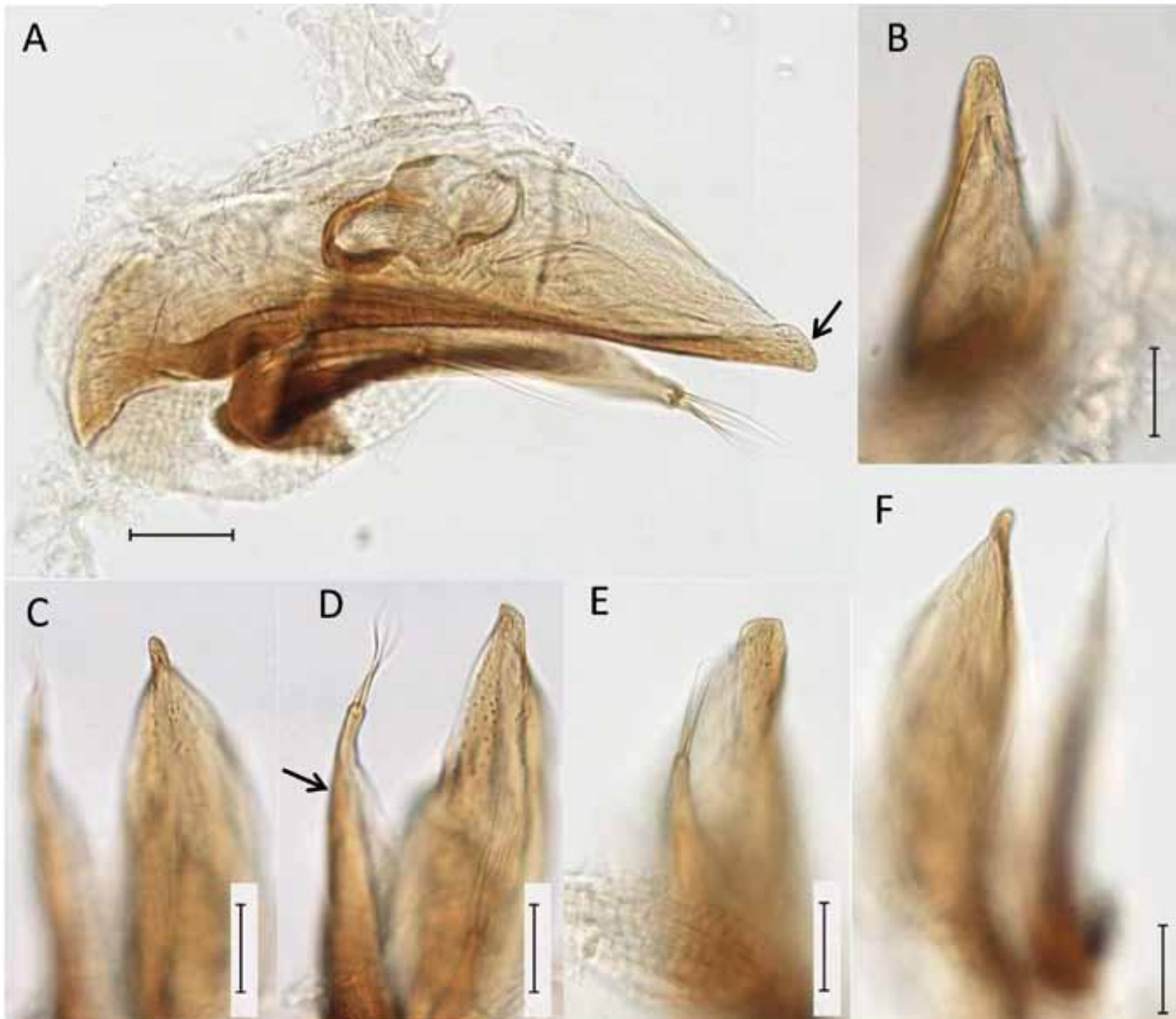


Fig. 12. Male genitalia of *Tachys fumicatus*. A. Aedeagus, left lateral view. The arrow indicates a blade-shaped tip of the apical lobe. B. Aedeagus, dorsal view, showing the symmetrical apex. C. Aedeagus, ventral view, showing the protruding apex. D. Aedeagus, right ventral view, showing the obliquely truncate apex. The arrow indicates the left paramere. E. Aedeagus, left ventral view, showing the truncate apex. F. Aedeagus, left dorsal view, showing the beak-like apex. Scale bar = 0.05 mm.

semicircular patch with more or less deeply pigmented margin (Fig. 12A); left paramere subtriangular (except for basal joint part), with 3 (-6) apical setae; right paramere about 2.5-times shorter than left paramere, with 3 (-6) apical setae longer than those of left paramere.

Measurements and proportions: Length 2.16~2.20 mm. Width 0.98~1.01 mm. Antennal segments I: II: III = 1: 1: 1. HW/FW = 1.61~1.70. PW/HW = 1.23~1.25. PW/PL = 1.36~1.38. PW/PA = 1.47~1.51. PW/PB = 1.28~1.33. PA/PB = 0.86~0.88. EW/PW = 1.40~1.45. EL/EW = 1.37~1.44. (Based on 3 specimens.)

Specimens examined: Taipei City: Tahu [

台北市 大湖]: 1 ♂, 30-v-2001, K. Terada leg. (Terada-14). New Taipei City: Kungliao, Shuanghsi [新北市 貢寮 雙溪]: 1 ♀, 14-iii-2002, K. Terada & M.H. Hsu leg. (Terada-94). Taoyuan County: Yangmei [桃園縣 楊梅]: 1 ♂, 1 ♀, 16-viii-2001, K. Terada & M.H. Hsu leg. (Terada-40); 1 ♂, 1 ♀, 18-vi-2002, M.H. Hsu leg. (Terada-103). Taichung City: Kaomei [台中市 高美]: 1 ♀, 31-vii-2010, K. Terada & L.W. Yeh leg. (Terada-118). Ilan County: Nanao, Nanao River [宜蘭縣 南澳 南澳溪]: 1 ♂, 1 ♀, 3-iv-2010, K. Terada & L.W. Yeh leg. (Terada-109). Hualien County: Lienhuachih [花蓮縣 蓮花池]: 5 ♂♂, 6 ♀♀, 12-iii-2002, K. Terada leg.

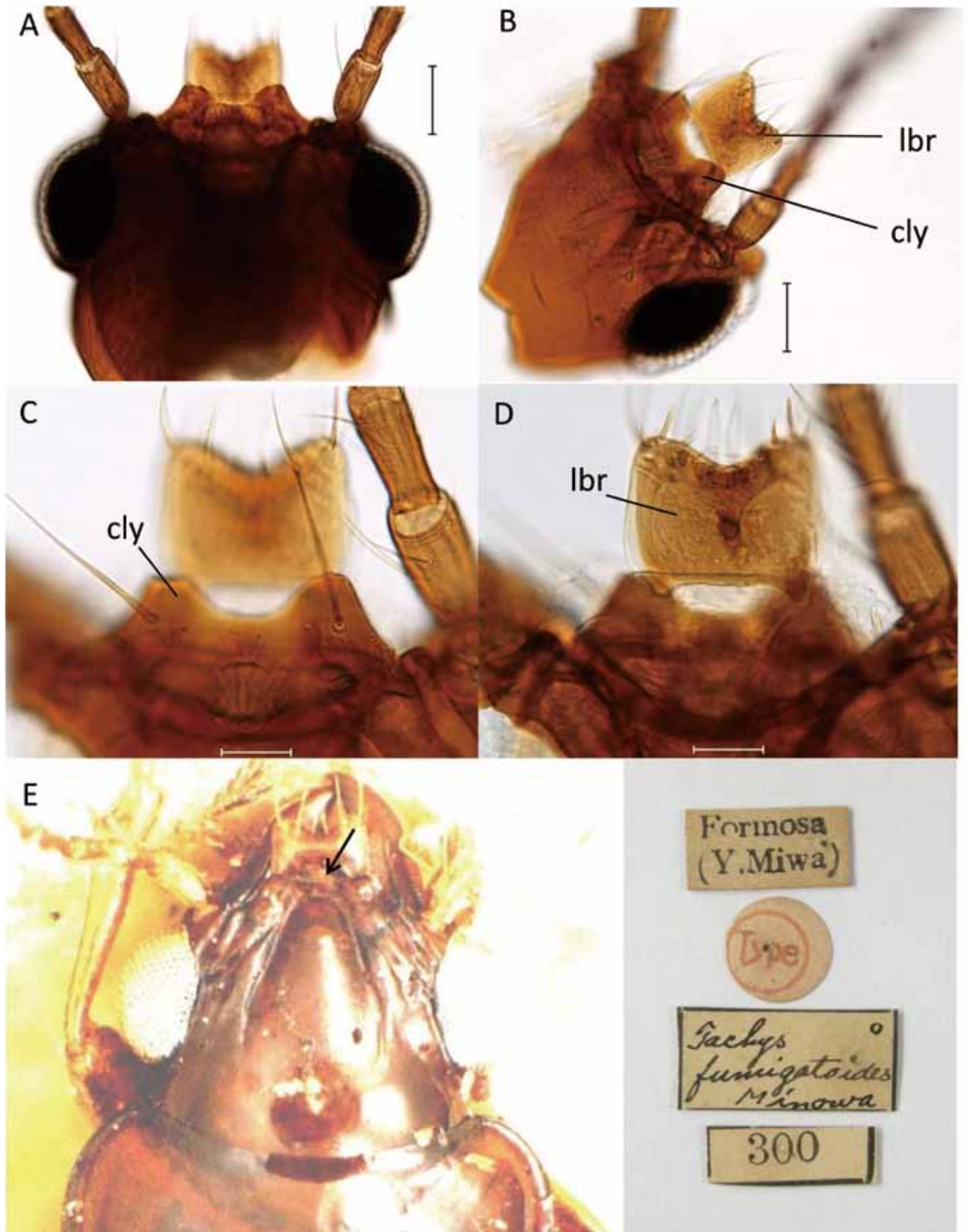


Fig. 13. *Tachys fumicatus*. A. Head, dorsal view. The mandibles, maxilla, labium, and other parts of the ventral side are removed. B. Head, oblique-lateral view, showing the labrum (lbr)-clypeus (cly) joint part. C. Emarginate clypeus (cly) with a long seta on either side. D. Labrum (lbr) with a deeply emarginate front margin. E. Head from type specimen (no. 300) of *Tachys fumigatoides* Minowa in the TARI collection. The arrow indicates labrum-clypeus joint part. Scale bar = 0.1 mm (A, B), 0.05 mm (C, D).

(Terada-93). Pingtung County: Wanluan [屏東縣萬巒]: 3 ♂♂, 3 ♀♀, 24-xi-2001, K. Terada & M.H. Hsu leg. (Terada-70). Deposited in NMNS, LWY, and KTHJ.

Remarks: This species is recognized by the small, convex, dark-reddish-brown body, the head with deep, V-shaped frontal impressions, and the elytra with vague yellowish spots on the humeral and hind parts. The clypeal front margin is somewhat deeply emarginate, and the basal margin of the labrum is almost always visible in dorsal view (Fig. 11B, arrow). A somewhat pale-colored, semicircular space is also visible below the base of the labrum. This space may be misinterpreted as part of the clypeus (see discussion below).

The aedeagal apex changes the shape when rotating the aedeagus on a slide glass. Some patterns of the shapes are shown in Fig. 12B-F. The apical setae of the parameres vary in number (from 2 to 6), but most have 3. Uéno (1953b) observed Taiwanese specimens and confirmed that each paramere of the aedeagus has 3 setae.

The first record of this species from Taiwan was by Jedlička (1940), although he did not provide collection data for those specimens. Our specimens were collected under gravel near streams or under plant debris around ponds.

A synonymical note on *Tachys fumigatoides* Minowa, 1932

Tachys fumigatoides was described by S. Minowa in 1932, based on three specimens collected in Taipei by Y. Miwa on June 24, 1930, and one specimen with a doubtful record. According to Minowa (1932), *T. fumigatoides* quite resembles *T. fumicatus*, but is distinguished from the latter species by the front margin of the clypeus not being emarginate. When he described the species, Minowa attached a line drawing with his description. It might not be correctly drawn, especially in terms of the head structure. Through the courtesy of Dr. C. F. Lee of TARI, one of the four type specimens of *T. fumigatoides* (no. 300), kept at TARI is pictured in Fig. 13. This picture shows that the clypeus of *T. fumigatoides* is clearly emarginate (Fig. 13E). Why did Minowa think the clypeus was not emarginate? In his large monograph of the New Guinean Carabidae, Darlington (1962) gives an interesting comment on the *T. fumicatus* group as follows:

“The clypeus as well as the labrum appears

deeply emarginate in some individuals, but this is partly a matter of change of pigmentation rather than change of structure: the edge of the clypeus at middle tends to be depigmented, transparent, and therefore apparently emarginate except in carefully adjusted lighting”.

To clarify this point, some of the studied specimens of *T. fumicatus* were dissected. Thus, it was confirmed that the clypeus is clearly emarginate (Fig. 13A, B). The clypeus is jointed with the labrum at the front angles of the clypeus (Fig. 13D). A narrow semicircular space exists between the front angles of the clypeus (Fig. 13C, D). The depigmented, transparent edge of the clypeus might be related to this space. The basal margin of the labrum is visible as a horizontal line shown in Figs. 11B and 13E (indicated by an arrow). Consequently, it is clear that the structures of the head in *T. fumigatoides* and *T. fumicatus* are fundamentally the same. This fact suggests that the former species is synonymous with the latter.

***Tachys klugi* (Nietner, 1858)**

(Figs. 14, 15)

Bembidium klugi Nietner, 1858: 423. [Ceylon].

Tachys klugi, Andrewes, 1925: 414; 1935: 252.

Tachyura (Tachyphanes) klugi klugi, Uéno, 1953b: 49.

Tachyura (Tachyphanes) klugi, Kopecký, 2003: 278.

Color and microsculpture: Upper surface black with bronze-luster, strongly polished; antennomere 1, hind spots on elytra, and legs except femora yellowish-brown; antennae except antennomere 1, and femora blackish-brown. Microsculpture absent from head, pronotum, and elytra.

Head and pronotum: Frontal impressions relatively short, duplicate, nearly parallel or slightly divergent to rear; frontal carinae distinct; eyes relatively prominent; antennae submoniliform; mentum without pores. Pronotum subquadrate, convex; sides very slightly contracted and sinuate to rear; hind angles right, each with distinct carina; basal transverse impression strongly crenulate, with pore in middle.

Striae and pores on each elytron: All striae deeply impressed and punctured: striae 1 and 8 entire, striae 2~7 barely reaching both elytral base and apex. Two dorsal pores present, both on stria

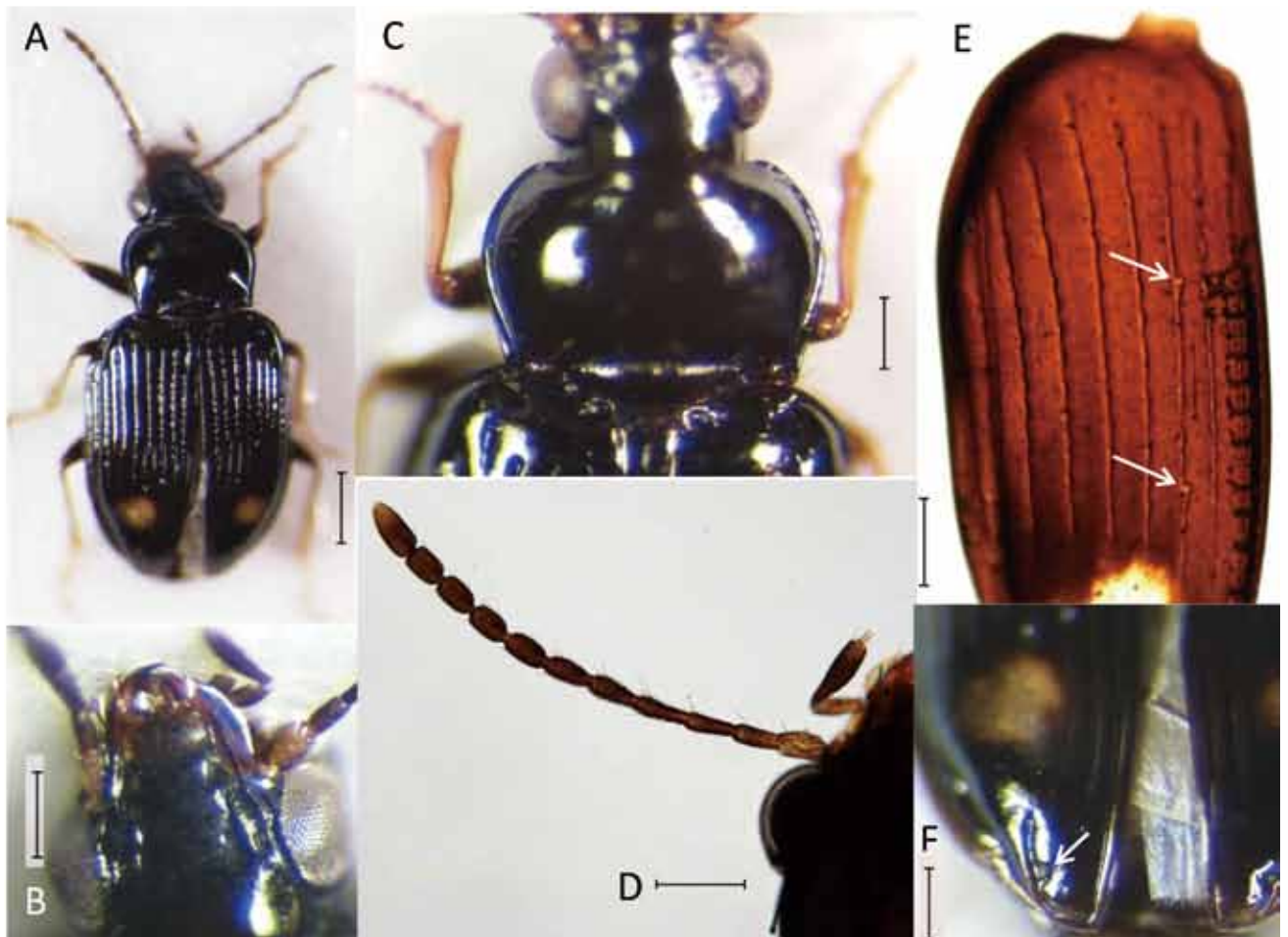


Fig. 14. *Tachys klugi*. A. Male from Hualien City. B. Head with duplicate furrows. C. Pronotum. D. Left antenna. E. Left elytron, showing two dorsal pores (arrows) on stria 3. F. Apical portion of the elytra. The arrow indicates the position of the subapical pore adjoining apical striole. Scale bar = 0.5 mm (A) and 0.2 mm (B-F)



Fig. 15. Male genitalia of *Tachys klugi*. A. Aedeagus, left lateral view. The left arrow indicates the right paramere, and the right arrow indicates the left paramere. B. Apical portion of the aedeagus, left ventral view, showing the narrow, keel-like apex. Scale bar = 0.05 mm.

3: front pore located at basal 2/7 of elytron; hind pore located at apical 2/5 of elytron. Apical striole nearly straight, with subapical pore located near middle (Fig. 14F) and clearly distant from apical pore.

Male genitalia: Aedeagus (median lobe) slightly arcuate on dorsal side (Fig. 15A); ventral side chitinized, broadly rounded at apex (narrowed in ventral view as shown in Fig. 15B); endophallus without distinct sclerites, whereas vaguely reticulate or scaly patches present; left paramere subtriangular (except for basal joint part), abruptly narrowed or constricted just before apex, with 3 apical setae (1 usually subapical); length of right paramere 1/3 that of left paramere, with 3 apical setae (1 usually subapical) longer than those of left paramere.

Measurements and proportions: Length 2.40~2.95 mm. Width 1.22~1.37 mm. Antennal segments I: II: III = 1: 1.1: 1.1. HW/FW = 1.66~1.76. PW/HW = 1.33~1.39. PW/PL = 1.41~1.44. PW/PA = 1.56~1.65. PW/PB = 1.14~1.18. PA/PB = 0.71~0.76. EW/PW = 1.3~1.42. EL/EW = 1.41~1.43. (Based on 3 specimens.)

Specimens examined: New Taipei City: Fulung, near mouth of Shuanghsi [新北市 福隆 雙溪口]: 1 ♀, 13-iii-2002, K. Terada leg. (Terada-94). Taoyuan County: Tahsi, Yuehmei [桃園縣 大溪 月眉]: 2 ♂♂, 6-xi-2001, K. Terada & M.H. Hsu leg. (Terada-64). Ilan County: Nanao, Tawan River [宜蘭縣 南澳 大灣溪]: 1 ♂, 4-iii-2002, K. Terada leg. (Terada-90); 1 ♂, 18-iv-2002, M. H. Hsu leg. (Terada-102). Hualien City (detailed locality unknown) [花蓮市]: 2 ♀♀, 12-xi-2008, L. W. Ye leg. Deposited in NMNS, LWY, and KTHJ.

Remarks: This species is recognized by the shiny, blackish, robust body with a yellowish spot on each elytron. According to Andrewes' description (1925), the basal 3 antennomeres of each antenna are testaceous. In our specimens, however, antennomere 3 and the apical half of antennomere 2 of each antenna were dark-colored.

No records of this species from Taiwan were made except by Uéno (1953b) who described the aedeagus based on his specimens.

***Tachys ovatus* (Motschulsky, 1851)**

(Figs. 16, 17)

Lopha ovata Motschulsky, 1851: 509. [Ind. or.].

Tachylopha ovata, Motschulsky, 1862: 27.

Tachys ovatus, Andrewes 1925: 463; 1935: 284; Miwa, 1931: 8; Jedlička, 1965: 177.

Tachyura (Tachylopha) ovata, Kopecký, 2003: 278.

Tachys (Barytachys) mirandus Dupuis, 1913: 170. [Pingtung].

Color and microsculpture: Upper surface blackish-brown to dark-reddish-brown, strongly polished; head and pronotum darker in color than elytra; antennae tricolored, with antennomeres 1 and 2 yellowish-brown, antennomeres 3~6 dark-brown, and antennomeres 7~11 whitish; legs and 2 vague spots on each elytron yellowish.

Microsculpture absent from head, pronotum, and elytra.

Head and pronotum: Frontal impressions duplicate; frontal carinae distinct; eyes more or less prominent; antennae filiform; mentum without pores. Pronotum cordate; sides strongly contracted and not sinuate to rear, widely explanate in middle; hind angles nearly right, each with deep fovea bounded by carina; basal transverse impression obscure.

Striae and pores on elytron: Striae 1 and 8 entire, striae 2~7 barely traceable except for a deep, longitudinal furrow (inner side somewhat carinate) extending downward but not extending beyond middle. Two dorsal pores present, front pore located at about basal 1/7 of elytron (very near base); hind pore at about middle of elytron. Apical striole nearly straight but usually faint, with subapical pore located in middle and clearly distant from apical pore (Fig. 16F).

Male genitalia: Aedeagus (median lobe) fully convex on dorsal side (Fig. 17A); ventral side broadly rounded at apex (much narrowed in ventral view as shown in Fig. 17C); endophallus without deeply pigmented sclerites, whereas somewhat vaguely reticulate or scaly patches present; left paramere subtriangular (except for basal joint part), with 3 apical setae; length of right paramere 1/4 that of left paramere, with 3 apical setae.

Measurements and proportions: Length 2.42~2.67 mm. Width 1.05~1.19 mm. Antennal segments I: II: III = 1: 1.1: 1.2. HW/FW = 1.61~1.65. PW/HW = 1.25~1.29. PW/PL = 1.16~1.19. PW/PA = 1.56~1.58. PW/PB = 1.48~1.53. PA/PB = 0.93~0.97. EW/PW = 1.47~1.58. EL/EW = 1.35~1.41. (Based on 3 specimens.)

Specimens examined: New Taipei City:

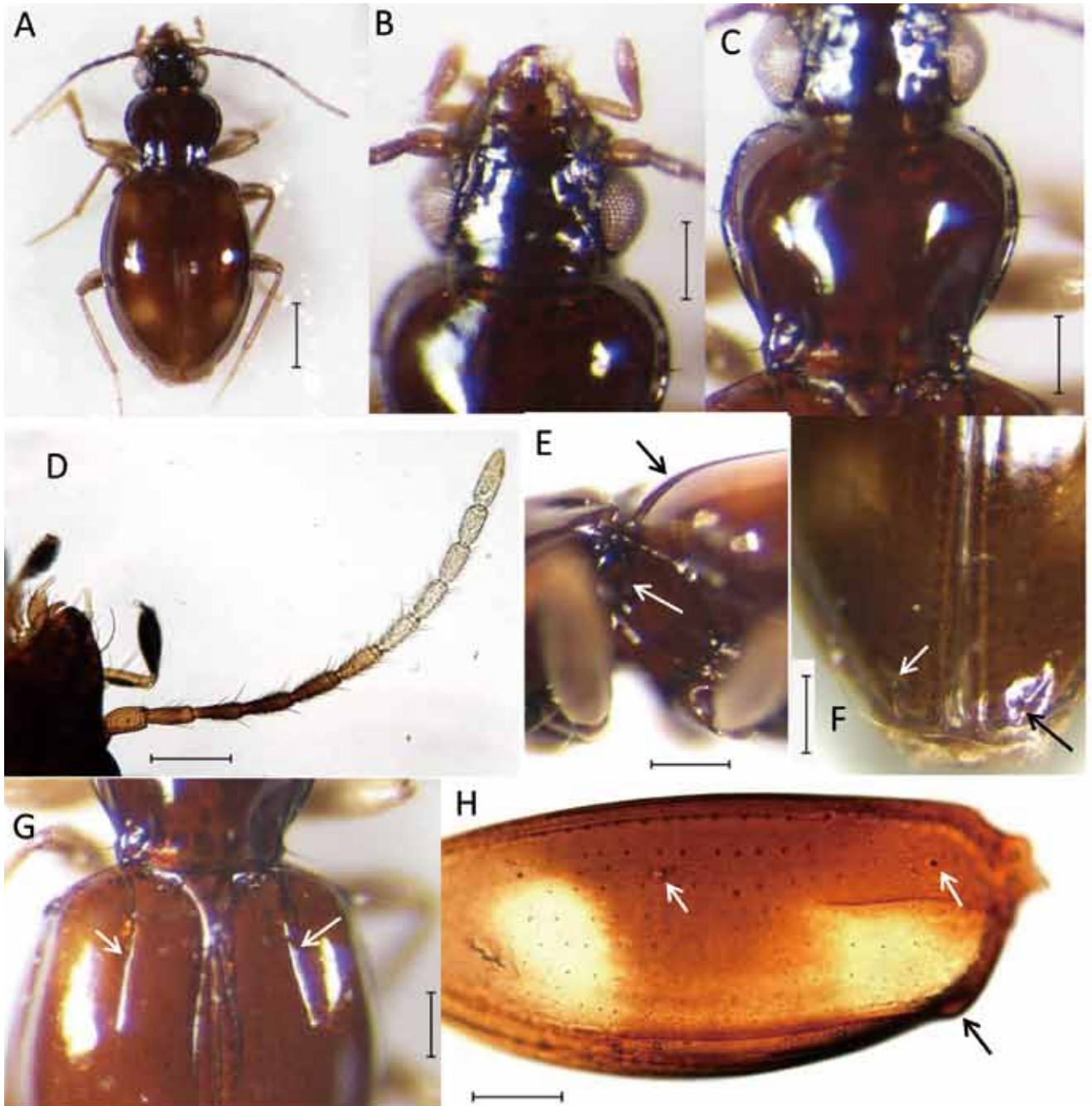


Fig. 16. *Tachys ovatus*. A. Male from Wanluan, Pingtung County. B. Head. C. Pronotum. D. Right antenna. E. Left side of the abdomen, showing a longitudinal carina (upper arrow) on the left elytron. The lower arrow indicates a large pit that opens on the lateral side of the mesothorax. F. Apical portion of the elytra. Each arrow indicates the position of the subapical pore adjoining apical striole. G. Basal half of the elytra, showing the deeply impressed longitudinal furrow on either side (arrows). H. Right elytron, showing two dorsal pores (upper two arrows). The lower arrow indicates a blunt projection at the shoulder. Scale bar = 0.5 mm (A) and 0.2 mm (B-H).

Sanchih [新北市 三芝]: 1 ♀, 26-v-2001, K. Terada leg. (Terada-13). New Taipei City: Fulung [新北市 福隆]: 1 ♂, 13-vi-2001, K. Terada leg. (Terada-18); 1 ♀, 1-x-2001, K. Terada leg. (Terada-53); 1 ♀, 11-i-2002, K. Terada leg. (Terada-79). New Taipei City: Kungliao, Lungmen [新北市 貢寮 龍門]: 1 ♀, 14-iii-2002, K. Terada leg. (Terada-94). Pingtung County:

Wanluan [屏東縣 萬巒]: 1 ♂, 11-xi-2001, K. Terada & M.H. Hsu leg. (Terada-68); 1 ♀, 24-xi-2001, K. Terada & M.H. Hsu leg. (Terada-70). Deposited in NMNS and KTHJ.

Remarks: This species is recognized by the smooth, shiny, convex elytra with 2 vague spots and a longitudinal furrow on each elytron. The blunt projection at the shoulder of each elytron

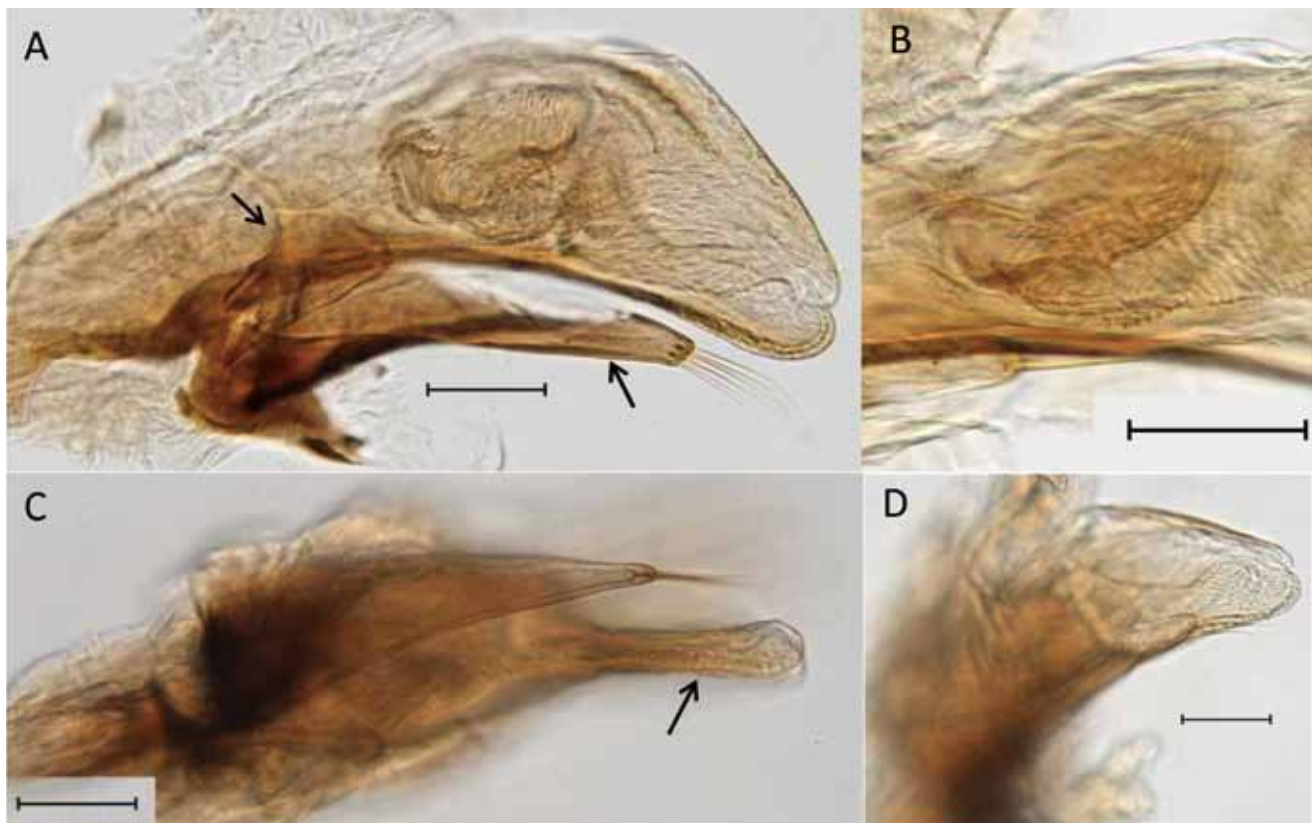


Fig. 17. Male genitalia of *Tachys ovatus*. A. Aedeagus with parameres, left lateral view. The left arrow indicates the right paramere, and the right arrow indicates the left paramere. B. Middle portion of the aedeagus, left lateral view, showing the more-or-less pigmented membranous components of the endophallus. C. Aedeagus, ventral view, showing the narrow, keel-like apical portion (arrow). D. Apical portion of the aedeagus, showing the apical orifice. Scale bar = 0.05 mm.

(Fig. 16H) and a peculiar pit that opens on the lateral side of the mesothorax (Fig. 16E) are also characteristic. The aedeagus of this species somewhat resembles that of *T. klugi*, although it is a little smaller and a little more arcuate.

The first record of this species from Taiwan was by Dupuis (1913) as *T. (Barytachys) mirandus* Dupuis from Pingtung, southern Taiwan. However, it is considered to be synonymous with *T. ovatus*, (Andrewes, 1925). Our specimens were collected at grassy places near streams.

ACKNOWLEDGEMENTS

We wish to express our sincere thanks to Dr. Meng-Hao Hsu of the Bureau of Animal and Plant Health Inspection and Quarantine, Council of Agriculture, Dr. Chin-Gi Huang of National Taiwan University, Dr. Hsien-Tzung Shih of the Taiwan Agricultural Research Institute (TARI), Dr. Kazuyoshi Kurosa, Tokyo, and Mr. Masato

Mori, Osaka, for giving their kind support to our study. Special thanks are also due to Dr. Chi-Feng Lee of the TARI for reviewing this manuscript, giving valuable suggestion, and providing pictures of the type specimen of *Tachys fumigatoides* kept at TARI.

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臺灣產步行蟲總科(鞘翅目)之記註(I)—*Tachys* 屬 8 種 (步行蟲科: Bembidiini)

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本文記述8種 *Tachys* 屬臺灣產種類 (步行蟲科: Bembidiini), 包括 *T. plagiatus sexmaculatus* Andrewes, 1925, *T. fasciatus* (Motschulsky, 1851), *T. fuscicauda* Bates, 1873, *T. exaratus* Bates, 1873, *T. luteus* Andrewes, 1925, *T. fumicatus* Motschulsky, 1851, *T. klugi* (Nietner, 1858) 及 *T. ovatus* (Motschulsky, 1851), 其中 *T. exaratus* 和 *T. fuscicauda* 為新紀錄種; *T. fumigatoides* Minowa, 1932 為 *T. fumicatus* 的新同物異名; 此外, 每一種類均有簡要描述及附圖。

關鍵詞: 步行蟲科, Bembidiini, 新同物異名, *Tachys* 屬, 臺灣。