

TWO NEW CRICKET SPECIES (ORTHOPTERA: GRYLLIDAE AND MOGOPLISTIDAE) FROM THE MANGROVE AREAS OF SINGAPORE

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ABSTRACT. — Two new species of crickets from the mangrove areas of Singapore are described: *Svistella chekjawa*, new species (Gryllidae: Trigonidiinae) and *Ornebius tampines*, new species (Mogoplistidae: Mogoplistinae). *Anaxipha venustula* (Saussure, 1878) is added to the genus *Svistella* under question.

KEY WORDS. — *Svistella*, *Ornebius*, new species, new combination, mangrove, Singapore

INTRODUCTION

Mangrove forest and fringes in Singapore and all around the world are continuously shrinking (Yee et al., 2010). However, baseline information on its orthopteran diversity, which may be important for the conservation of mangroves, is still poorly understood and studied. In 2011, an orthopteran study of Singapore was conducted by the National Biodiversity Centre, National Parks Board. Two new species of crickets from the mangrove areas of Singapore were revealed: *Svistella chekjawa*, new species (Gryllidae: Trigonidiinae), and *Ornebius tampines*, new species (Mogoplistidae: Mogoplistinae). The new taxa are described below. In addition, *Anaxipha venustula* (Saussure, 1878) was re-examined. Due to its similarities to *Svistella chekjawa*, this species is provisionally included in *Svistella* Gorochoff, 1987.

MATERIAL AND METHODS

Opportunistic collections of orthopteran specimens were carried out at night in the mangrove areas of Pasir Ris Park, Pulau (= Island) Ubin and Sungei Buloh Wetland Reserve. Specimens were preserved either by drying and pinning or storing in 90% alcohol. Photographs of habitus and larger details were taken using a digital SLR camera with compact-macro lens. Photographs of smaller details

were taken using a digital camera attached to a stereozoom microscope. Measurements were made using a vernier caliper with precision of 0.05 mm.

Male and female genitalia. — Dissections were done with softened specimens by cutting the membranes between the paraprocts and the subgenital plate, or between the ovipositor and the subgenital plate respectively. Genitalia were observed, after cleaning with cold KOH, using a binocular microscope Leica MZ16 at magnifications up to 160×, and subsequently kept in glycerine in vials pinned under the specimens. Terminology for male genitalia was used according to Desutter (1987), Desutter-Grandcolas (2003), and Robillard & Desutter-Grandcolas (2004). Photographs of male genitalia were done after colouration using blue artist acrylic ink (non permanent colouration) with a binocular microscope Leica MZ12 and the montage software Leica Application Suite ver. 2.8.1 (Leica Microsystems). Dotted parts in drawings correspond to membranous areas.

Abbreviations of terms used for male genitalia. —

ec ap	Ectophallic apodeme
en s	Endophallic sclerite
ps ind	Pseudephiphallic indentation
ps lo	Pseudephiphallic lophi
r	Pseudephiphallic rami
v	Ectophallic virgu (ectophallic fold)

Depositories

MHNG Museum d’Histoire naturelle de la Ville de Genève, Geneva
 MNHN Museum nationale d’Histoire naturelle, Paris
 ZRC Zoological Reference Collection, Raffles Museum of Biodiversity Research, Singapore

TAXONOMY

Gryllidae: Trigonidiinae
***Svistella* Gorochov, 1987**

Svistella Gorochov, 1987: 13

Type species. — *Svistella bifasciata* (Shiraki, 1911)

Diagnosis. — *Svistella* is characterised by the presence of both tympana on fore tibiae; strongly and characteristically notched hind edge of pseudepiphallus, hind pseudepiphallic lobes with long and narrow apical processes, median part of pseudepiphallus narrow and arcuate, guiding rod long, endophallus includes three sclerites (median one with apodeme, and a pair of lateral ones with transverse narrow ribbons directed aside), pseudepiphallic parameres not completely separated from pseudepiphallus (A. V. Gorochov, in litt.).

Discussion. — Trigonidiinae is in need of revision and genitalia of Indo-Malayan species are insufficiently studied. It is thus difficult to ascertain new species until all known species are examined and revised. The genus *Svistella* was erected by Gorochov (1987) and six species were described since then (He et al., 2009; Eades et al., 2012). More species may be added to this genus. Although only a few species of *Svistella* are hitherto described, we suspect that this genus is diverse in South East Asia, with some species having restricted distribution. These render us the description of the new species from mangroves.

***Svistella venustula* (Saussure, 1878), new combination**
 (Fig. 1)

Cyrtoxiphus venustulus, Saussure 1878: 482
Cyrtoxipha venustula, Kirby, 1906: 81
Anaxipha venustula, Chopard, 1931: 137; 1968: 317

Remarks. — Only photographs of one male syntype from MHNG from Sumatra were examined in the present study (Figs. 1A, B). It is unquestionable that this Indo-Malayan species does not belong to the American genus *Anaxipha*. As differences in the genitalia may divide the current *Anaxipha* into several different genera, the species is provisionally added to *Svistella* until the genitalia of the male syntype and other *Anaxipha* species are examined. This species resembles our new species and was used for comparisons.

***Svistella chekjava*, new species**
 (Figs. 2–5)

Material examined. — Holotype: male (ZRC), Singapore, Pulau Ubin, Chek Jawa, along mangrove boardwalk, 27 Apr.2011, coll. M. K. Tan, J. J. Y. Chan, J.-Y. Sek, S. C. L. Chng, A. M. L. Ng & R. Ong.

Paratypes – Singapore: 3 males, 3 females (ZRC), Jurong mangrove, 7 Nov.1976, coll. D. H. Murphy; 1 male (ZRC), Changi mangrove “on *Sesurium*”, 15 Mar.1978, coll. D. H. Murphy; 1 male, 3 females (ZRC), Pasir Ris Park, Sungei Tampines, along mangrove boardwalk, 4 Mar.2011, 15 Apr.2011, 15 Sep.2011, coll. M. K. Tan; 1 female (ZRC), Pulau Ubin, Chek Jawa, along mangrove boardwalk, 27 Apr.2011, coll. M. K. Tan, J. J. Y. Chan, J.-Y. Sek, S. C. L. Chng, A. M. L. Ng & R. Ong; 1 male (MNHN), Pasir Ris Park, Sungei Tampines, along mangrove boardwalk, 17 Jun.2011, coll. M. K. Tan; 1 female (MNHN), Sungei Buloh Wetland Reserve, along mangrove boardwalk, 5 Aug.2011, coll. M. K. Tan & J. J. Y. Chan.

Diagnosis. — Similar to *S. venustula*, but differs by patterns of yellow colouration all over the body. Small



Fig. 1. *Svistella venustula*: Dorsal habitus of male holotype (A) and its labels (B). (Photographs by: P. Schwendinger, MHNG).

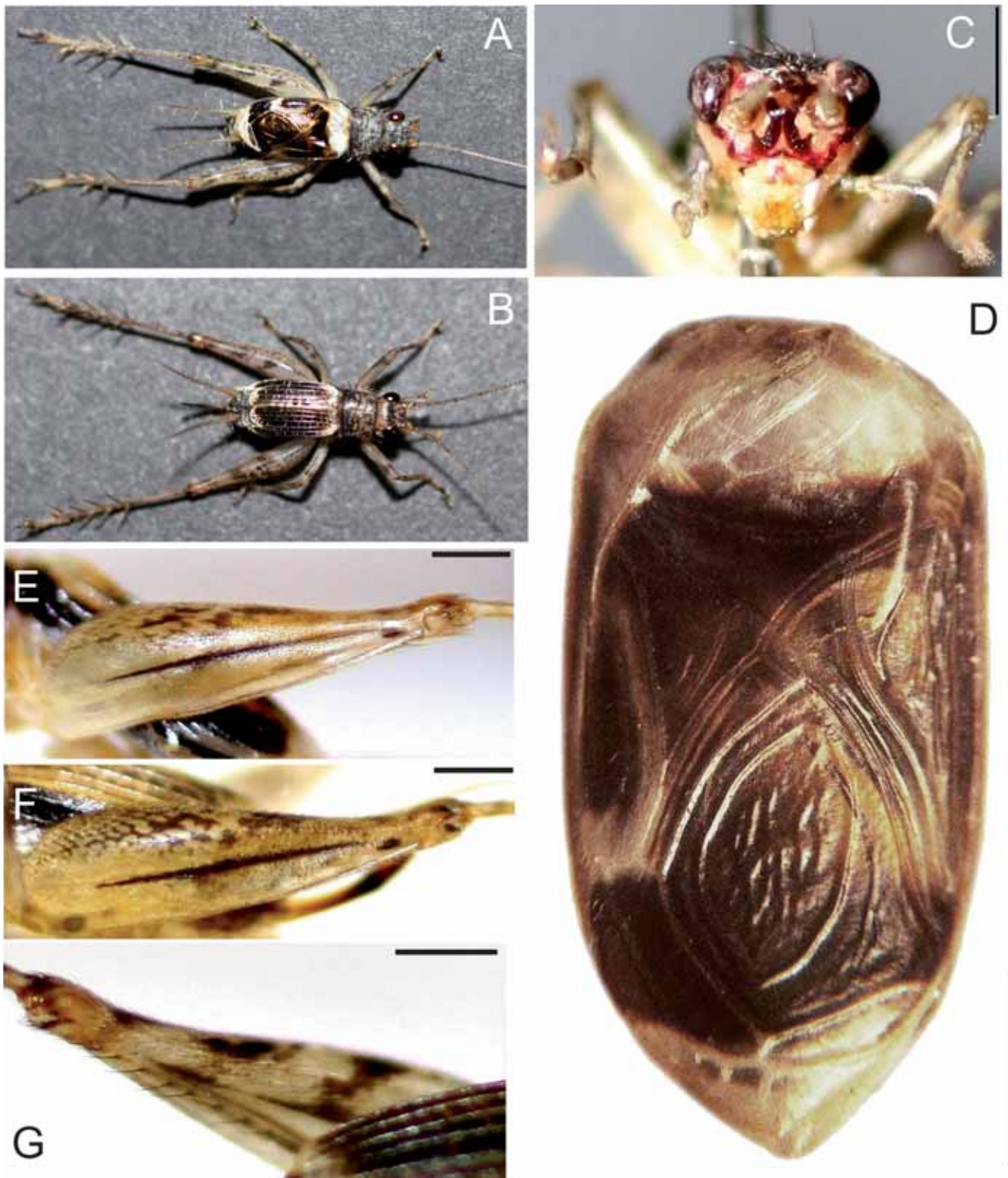


Fig. 2. *Svistella chekjawa*: Dorsal habitus of male (A) and female (B) paratypes; face of holotype in frontal view (C); dorsal field of tegmen of holotype (D); outside of the femur of holotype (E) and paratype (F) in profile view; inside of the hind femur of paratype (G) in dorso-profile view. Scale bars = 1 mm.

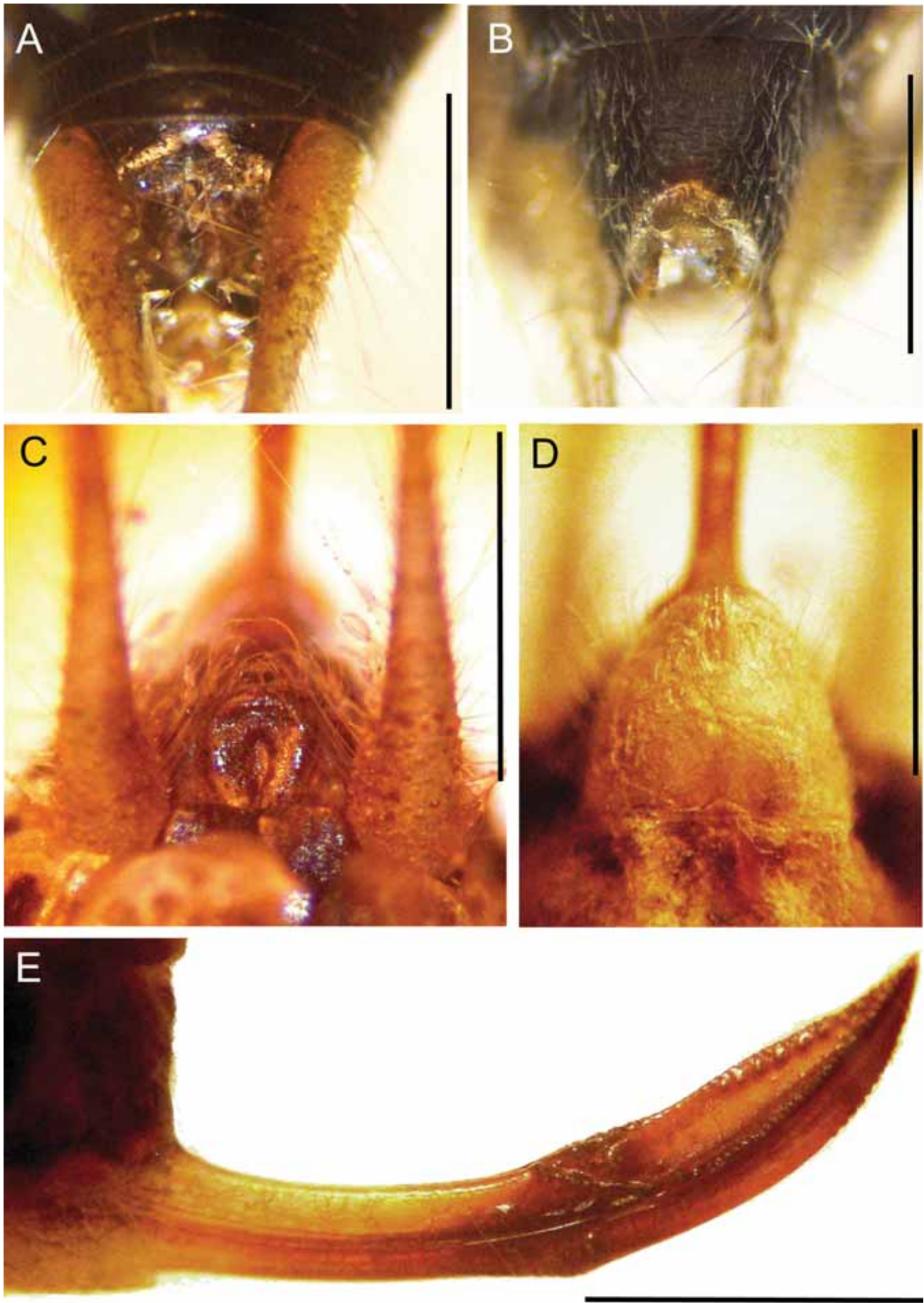


Fig. 3. *Svistella chekjawa*: Male abdominal apex of paratype in dorsal view (A) and holotype in ventral view (B); female abdominal apex of paratypes in dorsal (C), ventral (D), and profile (E) views. Scale bars = 1 mm.

genital differences are expected although no genitalia was examined.

Description. — General appearance typical of the genus. Male and female habitus as Figs. 2A, B. Body pubescent. Head, together with eyes, wider than pronotum. Frontal rostrum flattened, about as wide as first antennal segment; with long setae. Vertex not flattened dorsally. Antennal segments pubescent. Eyes slightly elongated from dorsal view; slightly hemispheric from lateral view. Genae swollen, pubescent. Maxillary palpi elongated; last three segments of about equal length; apical segment triangular, longer than wide, sometimes significantly longer. Labial palpi with apical segment long and triangular. Pronotum wider than long, slightly narrowed anteriorly; pubescent with long setae, otherwise fairly smooth; sulci indistinct; anterior and posterior margins straight; dorsal disc flattened. Lateral lobes of pronotum longer than high, ventral margin straight, anterior and posterior angles obtuse. Hind wings absent. Fore tibiae with inner and outer tympana, both open and oval, of about equal size; fore and median tibiae sometimes with one to two inner apical spurs on ventral surface, otherwise fore and median legs unarmed ventrally. Tarsal middle segments with prominent adhesive pads. Hind femora with long straight setae along inner-ventro carinula and near the knees along outer-ventro carinula. Hind tibiae with three inner and three outer subapical spurs; two inner and two to three outer apical

spurs, inner ones distinctly longer than outer ones. Cerci simple, tapering and long surpassing hind femora.

Male: Tegmina barely reaching abdominal apex (may surpass abdominal apex in dried specimens), but surpassing bases of cerci. Sclerotization of tegmina asymmetrical, the right one more sclerotized than the left one. Mirror larger than harp, longer than wide; within mirror with ovular vein, acute at base and apex. Harp as wide as long, with one sinuate harp vein. Diagonal sinuated. Stridulatory vein bow-shaped, more strongly curved in caudal area, with about 155 evenly distributed teeth ($n = 1$). Lateral field with five longitudinal veins, the two most ventral veins join the third most ventral vein, the first near apical area, the second near basal area. Last abdominal tergite simple (Fig. 3A). Epiproct transverse, wider than long; grooved medially; apex broadly emarginated (Fig. 3A). Subgenital plate with apex wide-roundedly excised (Fig. 3B). Male genitalia as in Fig. 4A. Pseudepiphallus deeply indented (three levels of indentation), separated into two lateral parts joined by an anterior sclerotized bridge between the bases of the rami. Posterior edges of pseudepiphallic sclerite with a ring of strong setae. Posterior apex of pseudepiphallus forming thin divergent and sclerotized lophi. Pseudepiphallic paremeres trilobate, with two posterior lobes oriented dorsally and posteriorly, and a wide membranous lobe. Ectophallic fold forming a thin sclerotized virga. Endophallic sclerite elongated along dorsal cavity, with a median crest, long lateral arms and lateral apodemes.

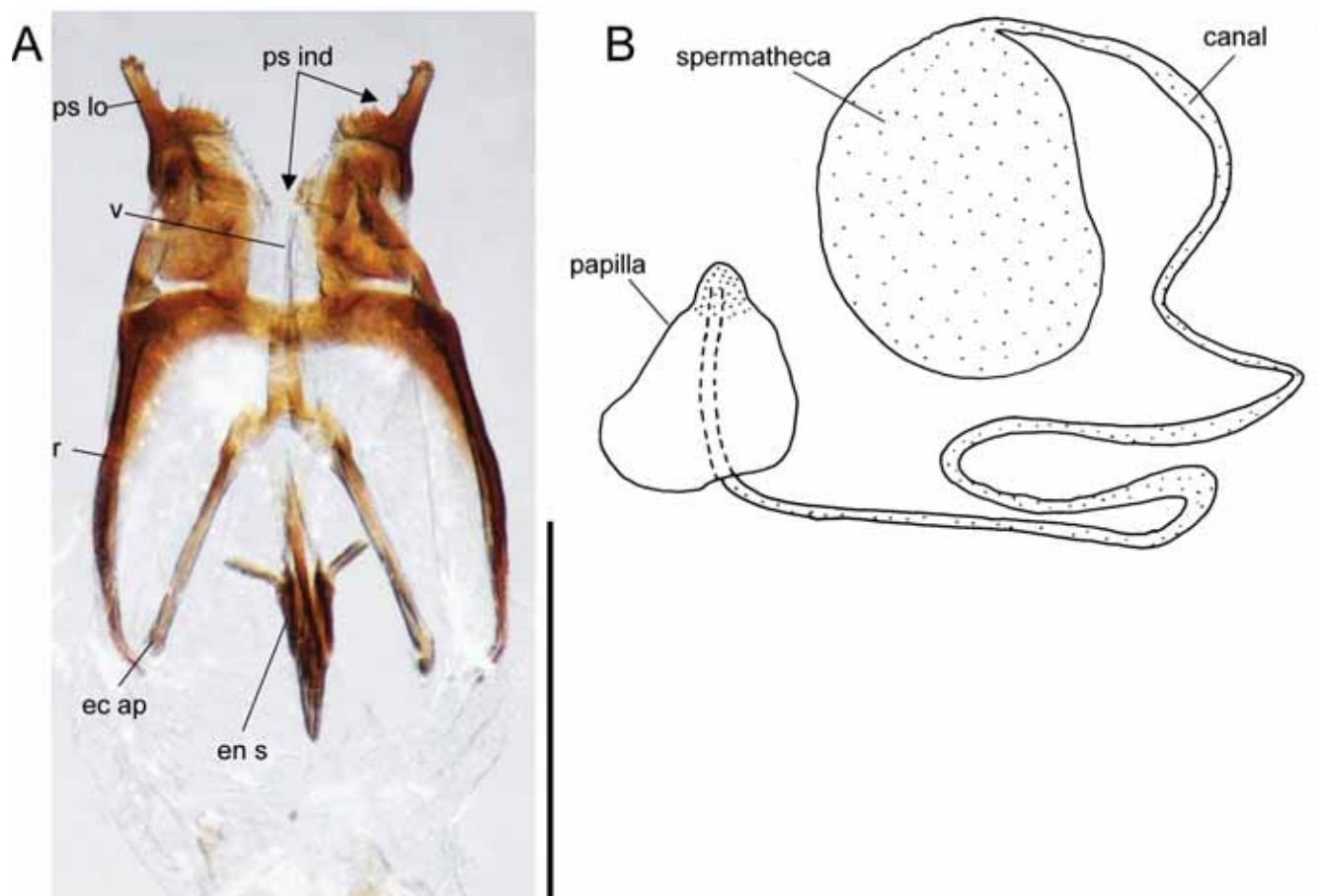


Fig. 4. *Svistella chekjawa*: Male genitalia in dorsal view (A); female copulatory papilla and spermatheca (B). Scale bars = 1 mm.

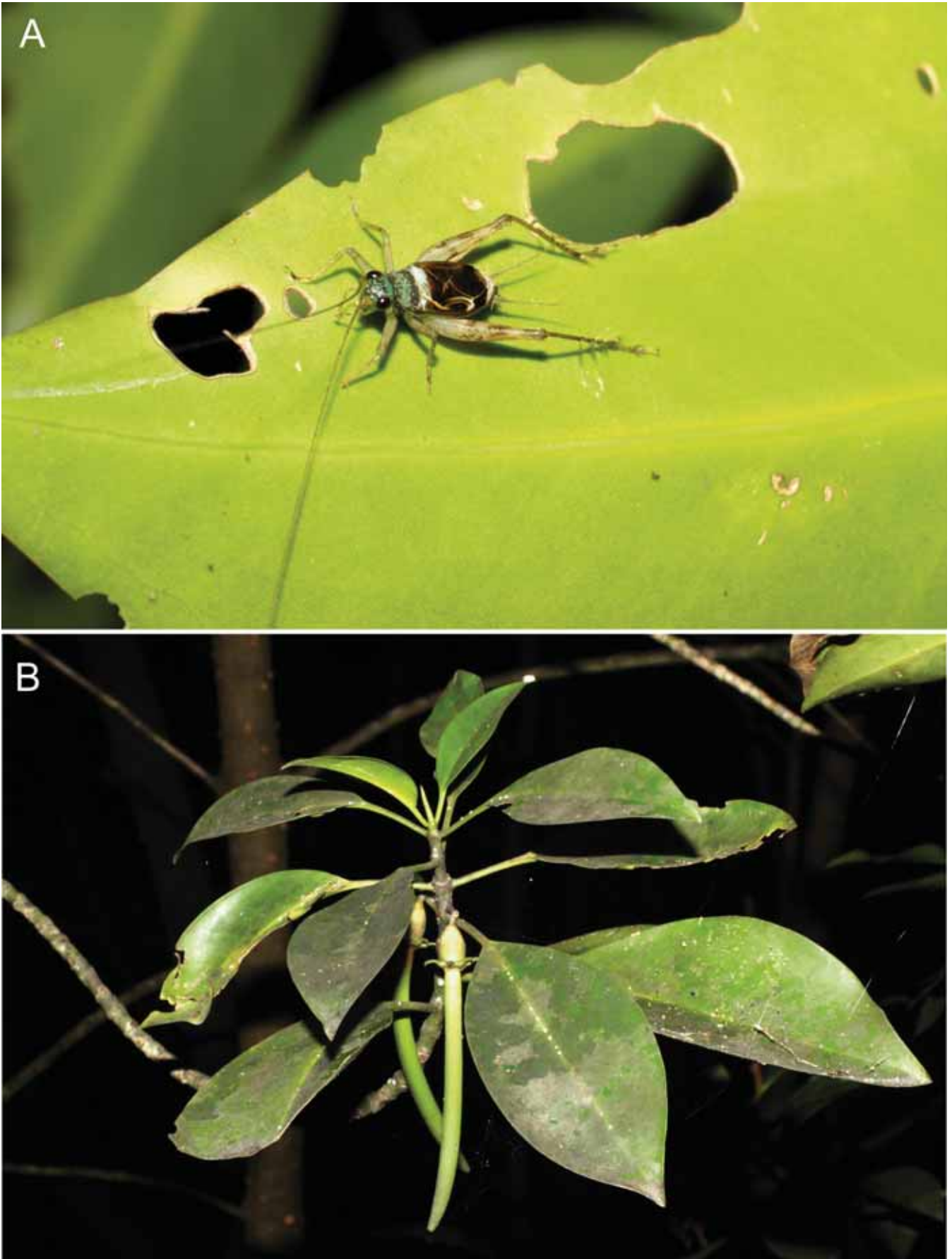


Fig. 5. *Svistella chekjawa*: Male adult on the underside of a leaf of *Bruguiera* species (A); *Bruguiera* species found in Pasir Ris Park, along Sungei Tampines (B).

Table 1. Measurements of *Svistella chekjawa* (in mm, mean values in brackets). BL, body length; PL, pronotum length; TL, tegmen length; HFL, hind femur length; OL, ovipositor length.

	BL	PL	TL	HFL	OL
Dry-pinned specimens					
Male holotype	6.3	1.4	4.9	6.1	—
Males (n = 6)	5.0–6.6 (6.0)	1.1–1.6 (1.4)	4.0–4.9 (4.5)	4.8–6.1 (5.6)	—
Females (n = 7)	4.9–6.7 (6.0)	1.1–1.8 (1.5)	2.7–4.2 (3.5)	4.6–6.1 (5.1)	1.6–2.4 (2.1)
Wet specimens					
Male (n = 1)	6.6	1.5	4.4	5.7	—
Female (n = 1)	7.4	1.8	4.0	6.1	2.3

Female: Tegmina not reaching abdominal apex and barely reaching bases of cerci. Female venation made of strong longitudinal veins, seven dorsal and five lateral. Last abdominal tergite setose, truncated with shallow triangular notch, with median furrow, with carinula on lateral margins. Epiproct setose, tongue-shaped, weakly transverse with furrow near each lateral margin (Fig. 3C). Subgenital plate with anterior margin straight, apex gently rounded (Fig. 3D). Ovipositor not surpassing cerci; its margins smooth, barely curved basally; middle part appears rugose, becomes slightly curved thereafter; ventral valves longer than dorsal valves; apex denticulate at dorsal and ventral margins and lateral ridges (Fig. 3E). Copulatory papilla small, conical and slightly sclerotized, apex membranous (Fig. 4B).

Colouration: Males and females with dark markings, exhibit sexual dimorphism. In fresh specimens, head (including scapes) and pronotum blue green in males, brown in females. First antennal segment brown in males and females. Vertex with thick transverse mottled black band with irregular margins, at times broken in middle. Face with pi-shaped dark marking, a small transverse dark band with dark spot on the sides above pi-shaped marking (Fig. 2C). Palpi with segments light, sometimes slightly dark at anterior and posterior margins. Pronotum light brown, densely mottled with dark patterns, with margins dark, most obvious along hind margin. Tegmina generally dark brown, basal and apical areas infumate white; male right tegmen coloured, posterior part of chords infumate white in males; lateral field dark with light margins; left tegmen transparent except lateral field; white infumation more distinct in males (Fig. 2D). Thoracic sternites white, slightly blue in males. Abdominal tergites dark brown (brown in females), darkening towards abdominal apex (appearing darker in dried specimens). Abdominal sternites in males light in middle, black at the sides with lateral margins yellow; light in females; last two sternites (including subgenital plate) completely black in males, light in females. Legs in both males and females generally light with dark markings. Fore and median femora with black bands near knees, sometimes longitudinal stripes on both inner and outer ventral surface; tibiae with black bands near knees; knees black; tarsi dark. Hind femora outer surface with black longitudinal stripe in middle, irregular black pattern above stripe and near knees (Figs. 2E, F); inner surface with two oblique black markings which intensify towards dorsal

edge (Fig. 2G). Hind tibiae with faint dark bands near knees and at base of subapical spurs; dark apically. Middle and last segments of hind tarsi black. Ovipositor very light brown basally, dark brown in middle, brown thereafter.

Measurements: See Table 1.

Etymology. — The species is named after type locality Tanjong Chek Jawa, Pulau Ubin, Singapore; noun in apposition.

Biology. — In Singapore, this species appears to be restricted to mangrove areas (Fig. 5A). During the recent collections, adults and nymphs were found mostly on the leaves and branches of *Bruguiera* species (family Rhizophoraceae) (Fig. 5B). Morphologically similar species were not encountered in other habitats. Additionally, salt particles were also found in some old specimens collected by D. H. Murphy.

Remarks. — The new species described above was already collected by D. H. Murphy during his Orthoptera collection in Singapore from the 1960s to 1980s, though the specimens remained unidentified prior to this study.

Mogoplistidae: Mogoplistinae ***Ornebius* Guérin-Méneville, 1844**

Ornebius Guérin-Méneville, 1844: 331

Type species. — *Ornebius xanthopterus* Guérin-Méneville, 1844

Diagnosis. — South East Asian species of the genus are characterised by presence of anterior tibiae with inner tympanum; males with pronotum produced backward, covering base of tegmina in some species and tegmina reduced to stridulatory apparatus, females without tegmen.

Discussion. — Although a comprehensive treatment of the Mogoplistidae from South East Asia was published by Ingrisch (2006), the explorations of the crickets in South East Asia are fragmented and many species are restricted in distribution. Therefore, it is not uncommon for previously unknown species to be revealed as the faunal exploration of a given area is continued or intensified.

Table 2. Measurements of *Ornebius tampines* (in mm, mean values in brackets). BL, body length; PL, pronotum length; PW, pronotum width; TL, tegmen length; TW, tegmen width; HFL, hind femur length; HTL, hind tibia length; HML, hind metastarsus length.

	BL	PL	PW	TL	TW	HFL	HTL	HML
Dry-pinned specimens								
Male holotype	9.1	3.4	2.5	3.6	2.4	5.0	2.9	1.5
Males (n = 3)	9.1–11.5 (10.2)	3.0–3.4 (3.2)	2.4–2.5 (2.5)	3.5–3.7 (3.6)	2.4–2.5 (2.5)	4.8–5.0 (4.9)	2.9–3.1 (3.0)	1.5 (1.5)
Wet specimen								
Males (n = 1)	—	3.1	2.3	3.3	2.4	5.0	3.2	1.6

***Ornebius tampines*, new species**

(Fig. 6)

Material examined. — Holotype: male (ZRC), Singapore, Pasir Ris Park, Sungei Tampines, along mangrove boardwalk, 17 Jun.2011, coll. M. K. Tan.

Paratypes – Singapore: 3 males (ZRC), Pasir Ris Park, Sungei Tampines, along mangrove boardwalk, 17 Jun.2011 (preserved in alcohol, specimen badly damaged during dissection of male genitalia), 15 Sep.2011, coll. M. K. Tan.

Diagnosis. — Similar to *O. cibodas* Ingrisch, 2006, *O. aureus* Ingrisch, 2006, and *O. peniculatus* Ingrisch, 2006 in the presence of two spots of strong hairs on the epiproct, but differs by shorter maxillary palpi, swollen apices of paraproct processes, and male genitalia.

Description. — General appearance typical for the genus. Male habitus as Fig. 6A. Vertex plain, with transverse swelling. Frontal rostrum about as wide as, if not narrower than, scape; not furrowed medially. Maxillary palpi with apical segment distinctly widened; all three apical segments of subequal length, second apical segment shortest, followed by third and first apical segments respectively; fourth and fifth segments short, shorter than second apical segment (Fig. 6B). Pronotum 1.3 times (n = 3) longer than wide; with anterior dorsal margin feebly concave; lateral margins slightly widening posteriorly; posterior margin convex. Fore tibiae with internal tympanum, small and slightly oval; without external tympanum. Hind femora 1.6 times (n = 3) longer than hind tibiae; hind tibiae 2.0 times (n = 3) longer than postmetatarsi.

Male: Pronotum slightly produced backwards, not covering base of mirror in most specimens. Tegmina reduced to stridulatory apparatus; about 1.5 times (n = 3) longer than wide; barely wider than posterior area of pronotum; posterior margin convex (Fig. 6C). Supra-anal plate with tenth abdominal tergite and epiproct completely fused; basal area with two spots of strong short setae standing together as in a brush at the end of the groove; strongly converging margins in basal two thirds, both areas separated by folds; apical area tongue-shaped, swollen in middle, faintly converging margins; apex transverse, if not feebly convex (Fig. 6D). Paraproct process emerging medially, long, cylindrical, black, a little compressed at base, slightly swollen apically, sparsely setose ventrally (Fig. 6D). Subgenital plate triangular; basal

half with parallel margins, apical half broadly rounded with upcurved margins; apex setose, gently rounded (Fig. 6E). Epiphallus membranous. Sclerotised part of male genitalia as in Fig. 6F. Lateral valves dorsoventrally compressed, separate; apices of valves curved ventrally together almost forming a tube with dorsal and ventral areas open, granular along external apical areas. Apex of medial valve pointed and bifurcate. Internal sclerite of medial valve elongate, tapering smoothly from base to apex, apical half straight and apex obtusely pointed. Ventral lobes gently curved upwards.

Female: Unknown.

Colouration: Yellow brown in fresh specimens, red brown after scales removed. In fresh specimens, head red brown, scales yellow brown with black marmoration; tip of frontal rostrum, antennae and scapes red brown; maxillary palpi light brown, apex of apical segments infumated black. Pronotum red brown covered with yellow brown scales; posterior margin covered with a band of pale yellow scales. Tegmina infumated pale yellow transparent; basal area covered by pronotum infumated black; apex with broad black margin (Fig. 6C); lateral field pale yellow transparent, lower margin black. Mesosternum and metasternum pale yellow. Legs, including tarsi, generally pale yellow with fairly dense dark scales; internal surface of femora mostly pale yellow basally, with dark scales near the knees; tibiae sometimes brown. Hind femora outer surface with dark scales forming a longitudinal stripe in middle, irregular black pattern above stripe and near knees. Abdomen dorsum mostly covered with black scales, silvery light brown and pale yellow scales in about equal proportions, supra-anal plate covered with mostly black scales; ventrally with anterior segments covered mostly with silvery light brown scales and pale yellow scales, posterior segments covered mostly with black scales. Cerci yellowish brown with black marmoration, sometimes black marmoration appears as band.

Measurements: See Table 2.

Etymology. — The species is named after type locality Sungei Tampines, Pasir Ris Park, Singapore; noun in apposition.

Biology. — This species is found in environment similar to *S. chekjawa*. So far, all specimens were collected from the leaves and branches of *Bruguiera* species (family Rhizophoraceae).

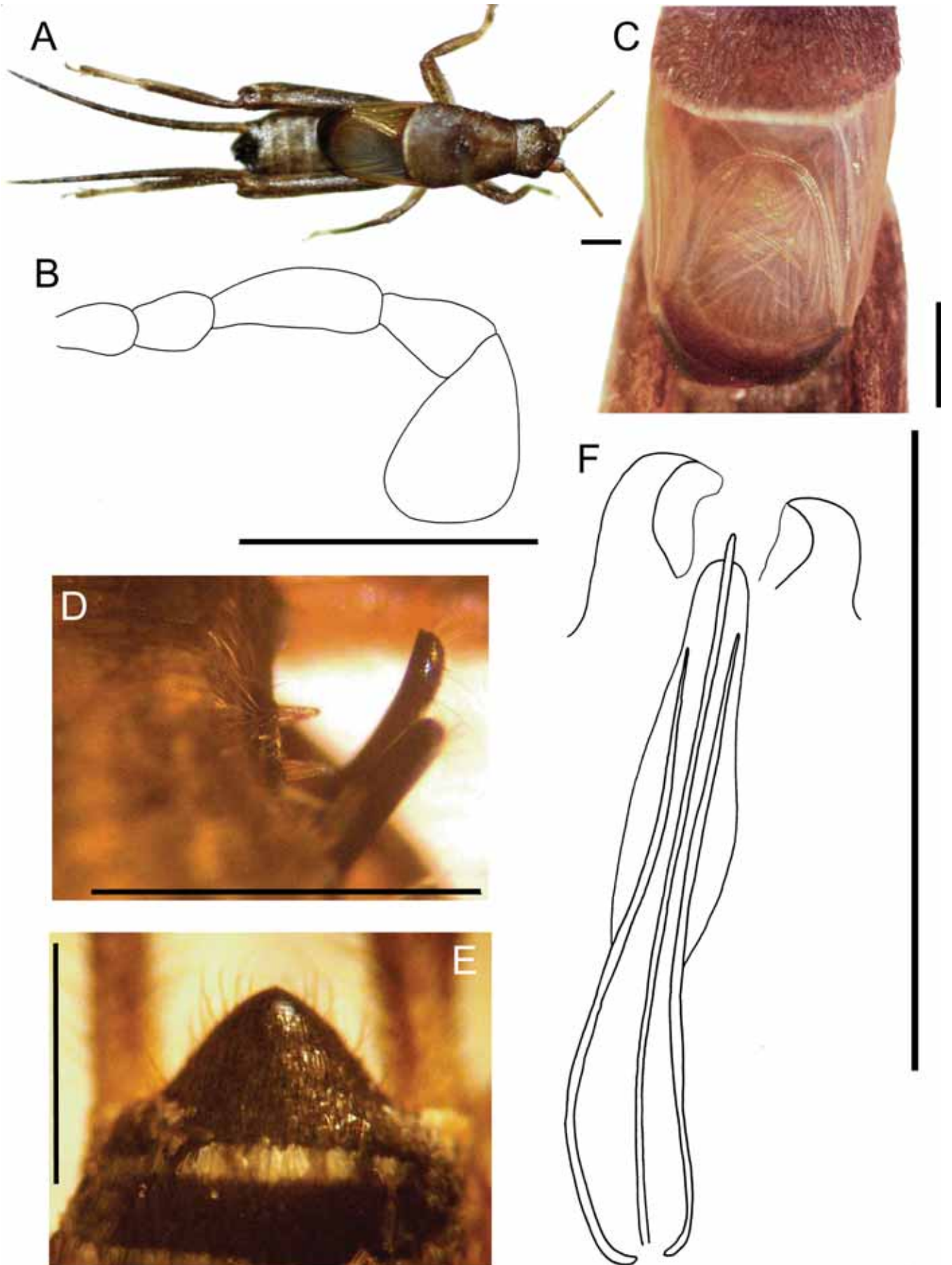


Fig. 6. *Ornebius tampines*: Dorsal habitus of male holotype (A); maxillary palpi of male paratype in profile view (B); dorsal field of tegmen of holotype (C); male supra-anal plate and paraproct of holotype in dorso-lateral view (D); male subgenital plate of holotype in ventral view (E); male phallic complex of paratype in dorsal (F) view. Scale bars = 1 mm.

Remarks. — The term supra-anal plate, according to Ingrisch (2006), refers to the unit consisting of the complete or incomplete fusion of epiproct and tenth abdominal tergite, found in the genus *Ornebius*.

CONCLUSIONS

The discovery of two undescribed species of crickets from the mangrove forests of Singapore indicates that Singapore's mangrove forests remain rich and elusive in species in spite of the massive habitat loss (Chou, 2011). We may consider such discovery as a testimony and future justification of the importance to protect and conserve the mangrove forests of Singapore. In particular, the efforts by the general public to save Tanjong Chek Jawa from land reclamation in 2001 as well as the mangrove reforestation in Pasir Ris Park are worthy of mention (Tan et al., 2007; Yee et al., 2010).

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