

## MANGROVE *HERCOSTOMUS* SENSU LATO (DIPTERA: DOLICHOPODIDAE) OF SINGAPORE

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**ABSTRACT.** – Seven new species of *Hercostomus* sensu lato are described from mangrove habitats in Singapore: *H. brevidigitalis*, new species, *H. brevicornis*, new species, *H. lanceolatus*, new species, *H. limosus*, new species, *H. meieri*, new species, *H. plumatus*, new species, and *H. singaporensis*, new species. A key is given to identify the mangrove *Hercostomus* of Singapore.

**KEY WORDS.** – Diptera, Dolichopodidae, *Hercostomus*, new species, Singapore.

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### INTRODUCTION

The dolichopodid fauna of mangroves in Singapore is very rich (Grootaert, 2006a). In a first paper on Dolichopodinae dealing mainly with mangrove species, we showed the presence of seven *Paraclius* species (Zhang et al., 2007), but there are additional species in other genera occurring in mangrove (Evenhuis & Grootaert, 2002; Grootaert, 2006b; Grootaert & Meuffels, 2001). Another good example is the genus *Hercostomus* sensu lato that is also speciose in Singapore's mangrove. The Island's terrestrial habitats have only two *Hercostomus* species that occur in low numbers (Grootaert, in litt.).

*Hercostomus* Loew, 1857, is one of the most speciose and morphological diverse Dolichopodinae genera in the world. The Oriental Region is especially rich with 271 described species (Yang et al., 2006). In fact, it actually became a dumping ground for species with parallel veins  $R_{4+5}$  and M that do not belong to genera like *Gymnopternus* that has hairs on the pteropleuron. It is polyphyletic (Brooks, 2005) and a revision of the genus is necessary but very difficult. All the Oriental species described so far inhabit terrestrial habitats so that our records seem to be the first from mangroves. Nevertheless, we suspect that some of Becker's (1922) species from Taiwan were collected in marine habitats. Unfortunately Becker does not give an indication of the habitat of the species.

In the present paper we describe and illustrate seven new *Hercostomus* species and provide a key to the mangrove species of Singapore.

### MATERIALS AND METHODS

Material was collected by sweep netting (5–13 Oct.2000, 4–13 Dec.2002, 19 Nov–11 Dec,2003 and Mar.2005–Feb.2006) and with Malaise traps (Nov.–Dec.2003). From 1 Mar.2005 to 28 Feb.2006, covering a whole year, eight Malaise traps were operated at the following sites in Singapore: Bukit Timah (primary rain forest, but secondary rain forest at place of sampling, 1 trap), Sime forest (2 traps in rain forest along small streams), Central Catchment Area (Nee Soon, swamp forest; 3 traps), Sungei Buloh (wetland reserve: 2 traps in mangrove). Malaise trap samples (Mal) were retrieved almost weekly (7–10 days interval) by P. Grootaert (PG) and/or the late K. L. Yeo. In addition three more Malaise traps were operated temporary (6 weeks) on the island Pulau Ubin (mangrove at Chek Jawa). The present study is based on 544 samples and most of the material was collected in terrestrial sites (70%) (see also Shamshev & Grootaert, 2007). It resulted in a sample of 302 marine *Hercostomus* specimens and 14 terrestrial specimens.

Most *Hercostomus* specimens in this study were collected with Malaise traps in the mangroves at Sungei Buloh

(Wetland reserve) and at Chek Jawa (Pulau Ubin). Few *Hercostomus* were present in sweep netting samples. Most material is conserved in 75% alcohol (a few voucher specimens are dry mounted on pins). The holotypes are deposited in the Zoological Reference Collection of the Raffles Museum of Biodiversity Research at the National University of Singapore (ZRC). Voucher specimens are conserved in the Royal Belgian Institute of Natural Sciences, Brussels (RBINS) and in the Institute of Zoology (IOZ), Beijing, China. For each record an accession number is given (accession numbers in a database are linked to collection data such as locality, date, collector, habitat). In addition, an inventory number (e.g. Si200) indicates where the specimens can be found in the wet collection. The holotypes were mainly identified by Lili Zhang (det. LZ), the paratypes mainly by Patrick Grootaert (det. PG.).

The following abbreviations are used: acr = acrostichal bristles, ad = anterodorsal bristle(s), av = anteroventral bristle(s), dc = dorsocentral bristles, LI = fore leg, LII = mid leg, LIII = hind leg, pd = posterodorsal bristle(s), pv = posteroventral bristle(s), vs. = ventral bristle(s).

## TAXONOMY

### *Hercostomus* Loew, 1857

**Diagnosis.** – Dolichopodinae with veins  $R_{4+5}$  and M straight and running almost parallel, usually slightly converging apically. Pteropleuron without hairs i.e. no hairs in front of the posterior thoracic spiracle. Fifth pair of dc not or rarely slightly convergent.

#### Key to species (males) of *Hercostomus* sensu lato from Singapore

1. Wing with grey to brown stigma at end of  $R_1$ ;  $R_{4+5}$  thickened from basal quarter onwards (Figs. 15, 20) ..... 2
  - Wing without stigma;  $R_{4+5}$  not thickened ..... 3
2. Stigma elongate, extending beyond start of thickening of vein  $R_{4+5}$  (Fig. 15); aedeagus with small denticle, in a more basal position (Fig. 16); knee hind femur darkened above .....
  - ..... *H. lanceolatus*, new species
  - Stigma shorter, reaching the level of thickening of vein  $R_{4+5}$  (Fig. 20); aedeagus with a larger denticle in a more anterior position (Fig. 22); knee hind femur not darkened above .....
    - ..... *H. limosus*, new species
3. First flagellomere distinctly elongated, at least 2.0 times as long as wide (Figs. 1, 25) ..... 4
  - First flagellomere not elongated, at most 1.6 times as long as wide ..... 5
4. First flagellomere 2.3 times as long as wide (Fig. 1); all coxae blackish; femora blackish except tip of fore and mid femora; cercus with 3 strong bristles on outer margin .....
  - ..... *H. brevidigitalis*, new species
  - First flagellomere distinctly elongated, 3.0 times as long as wide (Fig. 25), fore coxa yellow, mid and hind coxae brown, femora yellow; cercus without strong bristles on outer margin .....
    - ..... *H. meieri*, new species

5. Fore tarsomere 1 (Fig. 6) shortened, concave ventrally with 2 long curved ventral bristles; mid tarsomere 1 (Fig. 7) concave ventrally, with 1 strong ventral bristle near middle and 5 short ventrals basally; cercus large, with short apical tail (Fig. 8) ..
  - ..... *H. singaporensis*, new species
  - Fore tarsus normal; cercus triangular, without apical tail ... 6
6. Fore and hind coxae yellow; middle coxa pale brownish with a black anterior stripe; cercus strongly curved, nearly geniculate; aedeagus with 2 inner denticles (Fig. 12) .....
  - ..... *H. brevicornis*, new species
  - Fore coxa yellow, mid and hind coxae brownish; cercus triangular; aedeagus with 1 inner denticle (Fig. 30) .....
    - ..... *H. plumatus*, new species

### *Hercostomus brevidigitalis*, new species

(Figs. 1–3)

**Material examined.** – **Holotype.** Male, SINGAPORE, Sungei Buloh, 18 May 2005, Mal. 1 (25161, coll. PG, det. LZ, Si801, ZRC).

**Paratypes.** SINGAPORE: Pulau Ubin, Chek Jawa: 1 female, 2 Dec.2003; 1 male, 11 Dec.2003; 1 female, 26 Mar.2005; 2 females, 30 Dec.2005 (RBINS). Sungei Buloh, 5 males, 22 Apr.2005; 1 male, 3 females, 27 Apr.2005; 23 males, 5 females, 11 May 2005; 4 males, 6 females, 18 May 2005; 3 males, 2 females, 25 May 2005; 1 male, 9 females, 1 Jun.2005; 3 males, 4 females, 10 Jun.2005 (1 male and 2 females in IOZ); 4 females, 15 Jun.2005; 2 males, 2 females, 22 Jun.2005; 3 males, 7 females, 6 Jul.2005; 4 females, 20 Jul.2005; 1 female, 27 Jul.2005; 1 female, 5 Aug.2005; 1 male, 5 Aug.2005; 1 male, 3 females, 26 Aug.2005; 1 male, 4 females, 7 Sep.2005; 3 females, 16 Sep.2005; 1 male, 3 females, 28 Sep.2005; 6 females, 14 Oct.2005; 3 males, 8 females, 28 Oct.2005; 1 female, 9 Nov.2005; 2 males, 3 females, 18 Nov.2005; 1 male, 5 females, 3 Dec.2005; 4 females, 4 Jan.2006.

Semakau Island, 1 female, 26 Jun.2005, sweeping.

**Diagnosis.** – First flagellomere elongate, 2.3 times as long as wide. All coxae blackish; femora blackish except tip of fore and mid femora. Hind femur with 3 brown ventral bristles near base (a little shorter than width of femur). Fore tarsomere 1 without ventral slit. Squama yellow with black hairs. Male genitalia very long, reaching thorax.

**Description.** – Male - Body length 3.2–3.6 mm, wing length 3.2–3.5 mm.

Head metallic green with pale grey pollen. Face narrowing downward, distinctly narrower than first flagellomere. Hairs and bristles black. Postocular bristles (including posteroventral hairs) black. Antenna (Fig. 1) blackish brown, first flagellomere elongated, 2.3 times as long as wide; arista apicodorsal, minutely pubescent with basal segment 0.3 times as long as apical segment. Proboscis blackish brown with black hairs, palpus black with black hairs and black apical bristles.

Thorax metallic green with pale grey pollen. Hairs and bristles black. Five strong dc, 6 pairs of acr; scutellum with two pairs of bristles (basal pair short and weak). Propleuron with 1 black bristle on lower part. Legs yellow; all coxae blackish; femora blackish except tip of fore and mid femora. Mid and hind tarsi from tip of tarsomere 1 onward brownish. Hairs and

bristles black. Mid and hind coxae each with 1 exterior bristle. Mid and hind femora each with 1 preapical bristle. Hind femur with 3 brown vs. near base (a little shorter than width of femur). Fore tibia with 2 ad and 1 weak pd, apically with 3 long bristles, the longest 0.8 times as long as tarsomere 1; mid tibia with 3 ad, 2 pd and 1 av, apically with 4 bristles; hind tibia with 3 ad, 3 pd and 1 av, apically with 3 bristles. Fore tarsomere 1 with 2 vs.; hind tarsomere 1 with 1 vs. at base. Relative lengths of tibia and 5 tarsomeres LI 0.8 : 0.45 : 0.2 : 0.2 : 0.15 : 0.15; LII 1.3 : 0.55 : 0.3 : 0.25 : 0.2 : 0.15; LIII 1.55 : 0.5 : 0.55 : 0.5 : 0.35 : 0.2. Wing hyaline, tinged with greyish; veins brown,  $R_{4+5}$  and M parallel apically, CuAx ratio 0.7. Squama yellow with black hairs. Halter yellow.

Abdomen metallic green with pale grey pollen. Hairs and bristles black. Male genitalia very long, reaching thorax. Epandrium longer than wide (Figs. 2), inner epandrial lobe short digitiform with 3 bristles; cercus triangular with 3 strong, black bristles on outer margin (Fig. 3); hypandrium somewhat acute apically; aedeagus obtuse apically.

**Female.** Body length 2.3–2.5 mm, wing length 2.1–2.2 mm. Similar to male, except first flagellomere as long as wide;

hind femur without vs. at base and fore tibia without long apical ventral bristles.

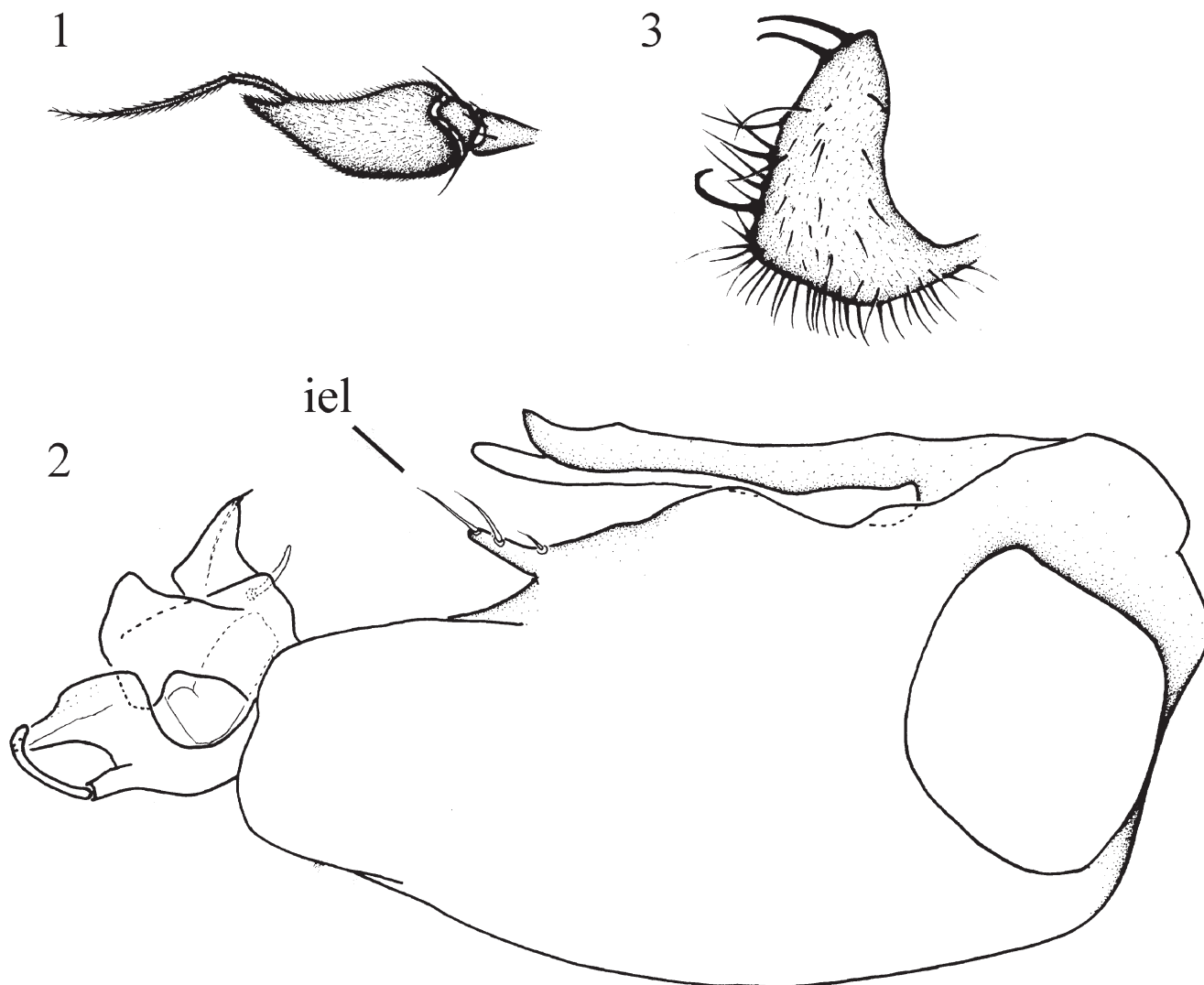
**Etymology.** – The name *brevidigitalis* refers to the short and digitiform epandrial lobe.

**Distribution.** – Singapore.

**Remarks.** – The new species is somewhat similar to *H. meieri*, new species, in having the first flagellomere elongated, but it has all coxae and femora blackish (except tip of fore and mid femora), and cercus bears 3 strong bristles on outer margin. In *H. meieri*, new species, fore coxa is yellow, mid and hind coxae are brown and femora are wholly yellow; cercus bears no strong bristles on outer margin.

***Hercostomus singaporensis*, new species**  
(Figs. 4–10)

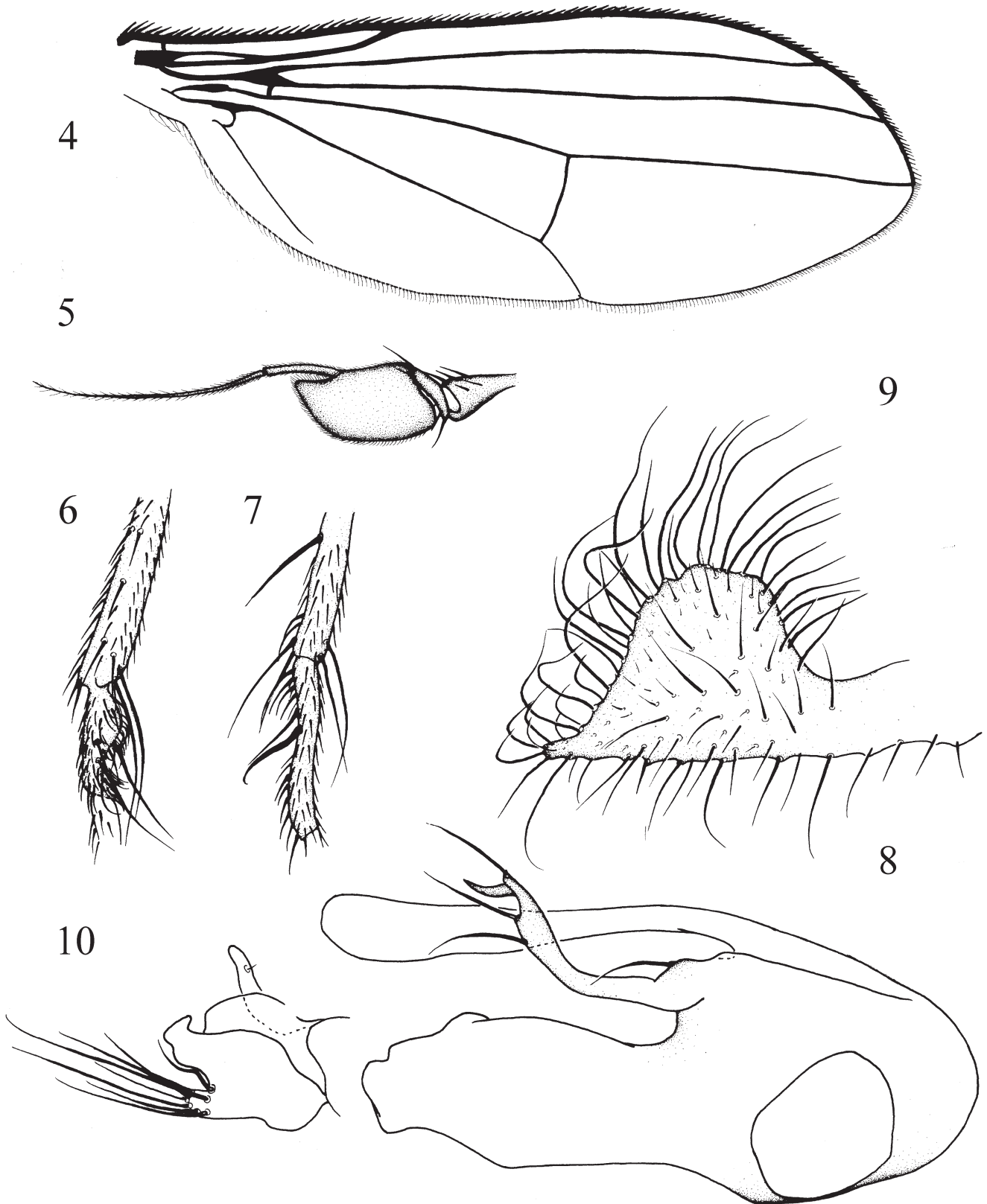
**Material examined.** – **Holotype.** Male: SINGAPORE: Sungei Buloh, 22 Jun.2005, sweeping in mangrove (25122, coll. PG, det. LZ, Si800, ZRC).



Figs. 1–3. *Hercostomus brevidigitalis*, new species, male: 1, antenna; 2, male genitalia; 3, cercus. iel, inner epandrial lobe.

**Diagnosis.** – First flagellomere 1.6 times as long as wide; arista with basal segment 0.3 times as long as apical segment. Femora wholly yellow. Fore tibia apically with 2 long black posterior bristles (longer than tarsomere 1); mid tibia concave

ventrally on apical half. Fore tarsomere 1 shortened, concave ventrally with 2 long curved ventral bristles; mid tarsomere 1 concave ventrally, with 1 strong ventral bristle near middle and 5 ventral bristles basally. CuAx ratio 1.3.



Figs. 4–10. *Hercostomus singaporensis*, new species, male: 4, wing; 5, antenna; 6, apex of fore tibia and tarsomere 1 (anterior lateral view); 7, apex of mid tibia and tarsomere 1 (posterior view); 8, male genitalia; 9, cercus; 10, surstyli.

**Description.** – **Male.** Body length 2.8 mm, wing length 2.3 mm.

Head metallic green with pale grey pollen. Face narrowing downward, distinctly narrower than first flagellomere. Hairs and bristles black. Antenna (Fig. 5) blackish-brown, first flagellomere 1.6 times as long as wide; arista minutely pubescent with basal segment 0.3 times as long as apical segment. Proboscis blackish brown with black hairs; palpus black with black hairs and black apical bristles.

Thorax metallic green with pale grey pollen. Hairs and bristles black. Five strong dc, 5 pairs of acr; scutellum with two pairs of bristles (basal pair short and weak). Propleuron with 1 black bristle on lower part. Legs yellow [hind tarsomeres 4–5 broken off], fore coxa yellow, mid coxa blackish, hind coxa dark yellow with 1 black outer spot. Mid tarsomeres 3–5 brownish, apex of hind tibia and entire hind tarsus brownish to brown. Hairs and bristles black. Mid and hind coxae each with 1 exterior bristle. Mid and hind femora each with 1 preapical bristle. Fore tibia with 1 ad and 2 pd, apically with 2 short bristles and 2 long black posterior bristles (longer than tarsomere 1); mid tibia concave ventrally on apical half, with 2 ad, 2 pd, 1 av and 8 thin vs. on basal half, apically with 4 bristles and 2 longer posterior bristles; hind tibia with 3 ad, 3 pd and 2 av, apically with 3 bristles. Fore tarsomere 1 (Fig. 6) shortened, concave ventrally with 2 long curved vs.; mid tarsomere 1 (Fig. 7) concave ventrally, with 1 strong vs. near middle and 5 vs. basally. Relative lengths of tibia and 5 tarsomeres LI 0.85 : 0.38 : 0.25 : 0.2 : 0.15 : 0.16; LII 1.0 : 0.6 : 0.45 : 0.3 : 0.2 : 0.2; LIII 1.75 : 0.5 : 0.7 : 0.55 : ? : ?. Wing (Fig. 4) hyaline, tinged with greyish; veins black,  $R_{4+5}$  and M parallel apically. CuAx ratio 1.3. Squama yellow with pale hairs. Halter yellow.

Abdomen metallic green with pale grey pollen. Hairs and bristles black. Male genitalia (Figs. 8–10): Epandrium elongated, distinctly longer than wide; lateral lobe long fingerlike, furcate apically with 3 bristles; cercus large, with short apical tail; hypandrium obtuse apically.

**Female.** Unknown.

**Etymology.** – The name refers to the type locality Singapore.

**Distribution.** – Singapore.

**Remarks.** – *Hercostomus singaporensis*, new species, can be distinguished from all other known species by its shortened fore tarsomere 1 being concave ventrally bearing 2 long curved ventral bristles. Mid tarsomere 1 is also concave ventrally.

***Hercostomus brevicornis*, new species**  
(Figs. 11–13)

**Material examined.** – **Holotype.** Male, SINGAPORE: Sungei Buloh, 11 May 2005, Mal. 1 (25159, coll. PG, det. LZ, Si811, ZRC).

Paratypes – SINGAPORE: Sungei Buloh, 1 male, 1 female, 22 Apr.2005; 1 male, 1 female, 27 Apr.2005; 4 males, 3 females, 11 May 2005 (IOZ); 1 female, 18 May 2005; 1 male, 1 female, 25 May 2005; 1 male, 1 Jun.2005; 1 male, 10 Jun.2005; 1 female, 6 Jul.2005; 1 male, 20 Jul.2005; 1 male, 27 Jul.2005; 2 females, 5 Aug.2005; 1 female, 26 Aug.2005; 1 male, 7 Sep.2005; 4 females, 16 Sep.2005; 1 female, 14 Oct.2005; 2 females, 28 Oct.2005; 1 female, 18 Nov.2005; 2 females, 3 Dec.2005; 3 males, 7 females, 4 Jan.2006.

**Diagnosis.** – All coxae yellow, but mid coxa at most pale brownish with a narrow black anterior stripe. Cercus strongly curved, nearly geniculate. Aedeagus with 2 small, inner denticles.

**Description.** – **Male.** Body length 2.9–3.1 mm, wing length 2.7–2.8 mm.

Head metallic green with pale grey pollen. Face wider than first flagellomere. Hairs and bristles black. Postocular bristles (including posteroventral hairs) black. Antenna (Fig. 11) yellow, with first flagellomere brownish, first flagellomere as long as wide, obtuse apically; arista brown, minutely pubescent with very short basal segment. Proboscis yellow with black hairs, palpus yellow with black hairs and black apical bristle.

Thorax metallic green with pale grey pollen. Six strong dc, 6–7 pairs of acr; scutellum with 2 pairs of bristles (basal pair short and weak). Propleuron with 1 black bristle on lower part. Legs yellow; all coxae yellow, except mid coxa pale brownish with a narrow black anterior stripe. Fore tarsus from tip of tarsomere 1 onward brownish, mid and hind tarsi from tip of tarsomere 1 onward brownish to brown. Hairs and bristles black. Mid and hind coxae each with 1 exterior bristle. Mid and hind femora each with 1 preapical bristle. Fore tibia with 2 ad, apically with 2 bristles; mid tibia with 3 ad, 2 pd and 1 av, apically with 4 bristles; hind tibia with 3 ad, 4 pd and 2 av, apically with 2 bristles. Hind tarsomere 1 with 1 vs. at base. Relative lengths of tibia and 5 tarsomeres LI 1.25 : 0.75 : 0.35 : 0.25 : 0.15 : 0.15; LII 2.0 : 1.0 : 0.55 : 0.45 : 0.2 : 0.2; LIII 2.15 : 0.7 : 1.0 : 0.6 : 0.4 : 0.24. Wing hyaline, tinged with greyish; veins brown,  $R_{4+5}$  and M parallel apically, CuAx ratio 1.0. Squama yellow with black hairs. Halter yellow.

Abdomen metallic green with pale grey pollen. Hairs and bristles black. Male genitalia (Figs. 12–13): Epandrium longer than wide, with inner lateral epandrial lobe spine-like, outer lateral lobe wide apically with 3 bristles; cercus strongly curved, nearly geniculate; hypandrium narrow and straight apically; aedeagus with 2 small inner denticles.

**Female.** Body length 2.3–2.5 mm, wing length 2.1–2.2 mm. Similar to male.

**Etymology.** – The specific name refers to the short first flagellomere, being as long as wide.

**Distribution.** – Singapore.

**Remarks.** – The new species is somewhat similar to *H. plumatus*, new species, but may be separated from the latter by the cercus being strongly curved and nearly geniculate. *Hercostomus brevicornis*, new species, is also somewhat similar to *Hercostomus congruens* Becker, 1922, described from Taiwan in having the first flagellomere as long as wide and all coxae yellow, but may be separated by the epandrial lobe being wide apically, aedeagus with 2 inner denticles and cercus strongly curved, nearly geniculate. In *H. congruens*, the lateral epandrial lobe is rather narrow apically, aedeagus is without denticles and cercus has a rounded ventral apex (Becker, 1922).

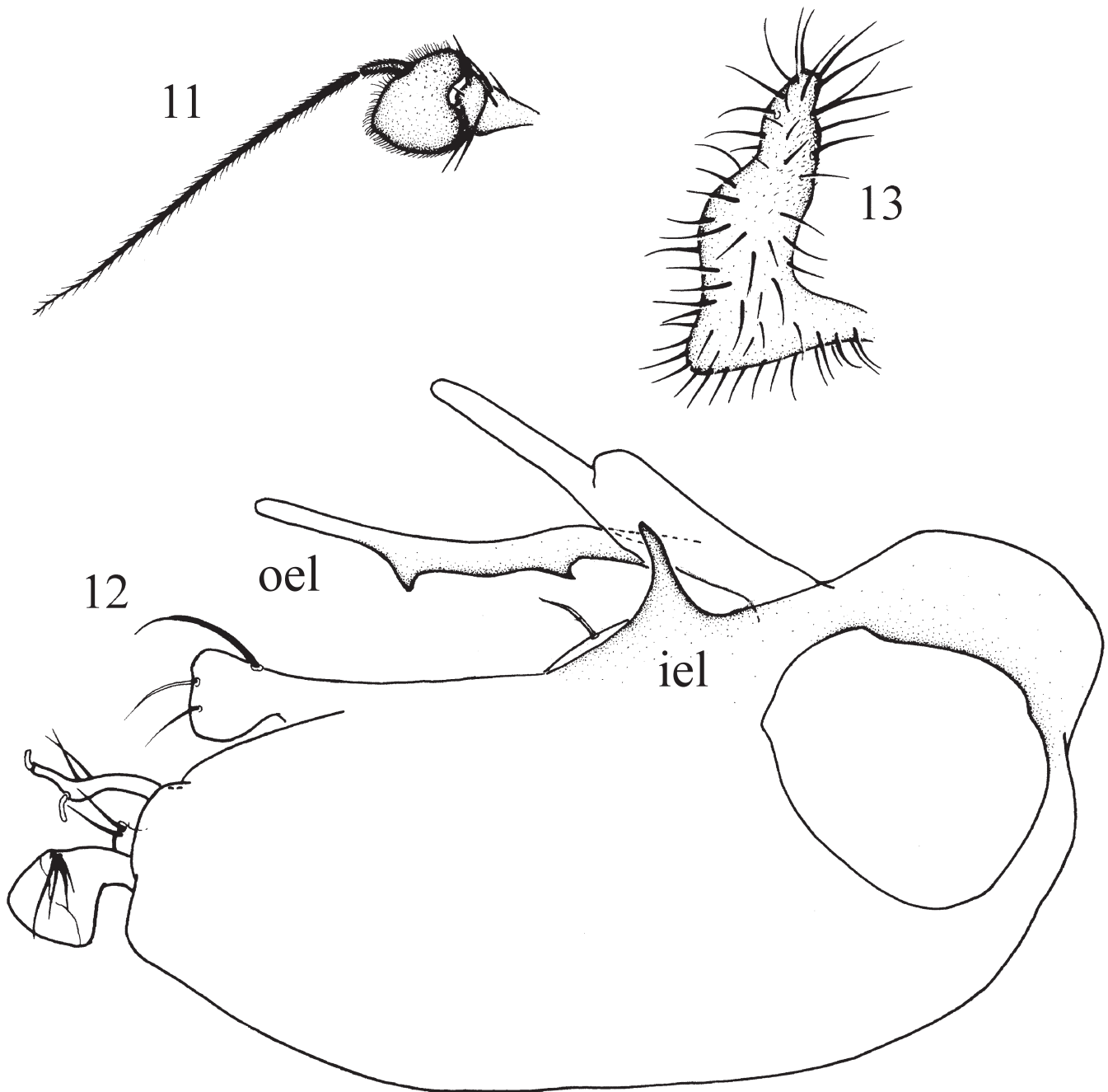
***Hercostomus lanceolatus*, new species**

(Figs. 14–19)

**Material examined.** – **Holotype.** Male, SINGAPORE: Pulau Ubin, Chek Jawa, 26 Oct.2005, Mal. 2 (25399, coll. PG, det. PG, Si1393, ZRC).

**Paratypes.** SINGAPORE: Pulau Ubin, Chek Jawa, 1 male, 1 female, 22 Dec.2005; Sungei Buloh, 1 male, 15 Jun.2005; 1 male, 28 Oct.2005; 1 male, 4 Jan.2006.

**Diagnosis.** – Wing with long narrow, yellowish brown stigma at tip of  $R_1$ ; stigma reaching beyond level of thickening of



Figs. 11–13. *Hercostomus brevicornis*, new species, male: 11, antenna; 12, male genitalia; 13, cercus. iel, inner epandrial lobe; oel, outer epandrial lobe.

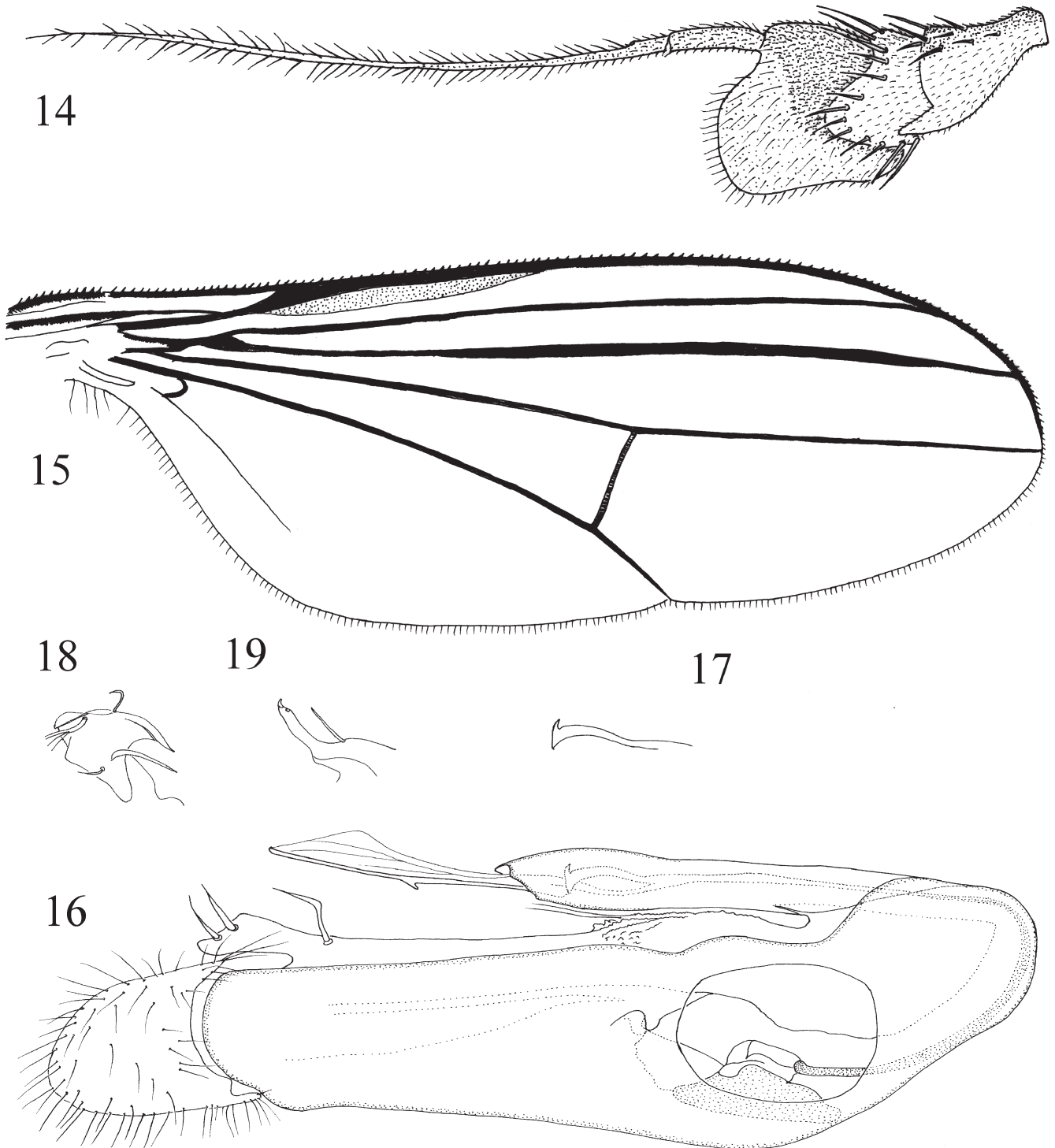
R<sub>4+5</sub>. R<sub>4+5</sub> thickened from basal quarter onward, but narrow again before reaching wing border. Aedeagus with a small denticle more basad in position than in *G. limosus*. Hind femur with tip dorsally darkened.

**Description.** – **Male.** Body length 2.8–3.4 mm, wing length 2.8–2.9 mm.

Head metallic green with pale grey pollen. Face wider than first flagellomere, densely grey dusted. Hairs and bristles

black. Postocular bristles (including posteroventral hairs) black. Antenna (Fig. 14) yellow; first flagellomere brown, 1.1 times as long as wide, obtuse apically; arista brown, minutely pubescent with very short basal segment. Proboscis brownish yellow with black hairs; palpus brownish yellow with black hairs and black apical bristle.

Thorax metallic green with pale grey pollen. Six strong dc, 7–8 pairs of acr short and hair-like; scutellum with 2 pairs of bristles (basal pair short and weak). Propleuron with 1 black



Figs. 14–19. *Hercostomus lanceolatus*, new species, male: 14, antenna; 15, wing; 16, male genitalia; 17, claw-like appendage on aedeagus; 18, ventral lobe of surstyli; 19, dorsal lobe of surstyli.

bristle on lower part. Legs yellow; fore coxa yellow with blackish base, mid and hind coxae black with yellow apex. Hind femur with knee dorsally brown. Fore tarsus from tip of tarsomere 2 onward brownish; mid and hind tarsi from tip of tarsomere 1 onward brownish to brown. Hairs and bristles black. Mid and hind coxae each with 1 exterior bristle. Mid and hind femora each with 1 preapical bristle. Fore tibia with 2 ad and 1 weak pd, apically with 2 bristles; mid tibia with 3 ad, 2 pd and 1 av, apically with 4 bristles; hind tibia with 3 ad, 4 pd and 1 av, apically with 2 bristles. Mid tarsomere 1 with 2 short vs.; hind tarsomere 1 with 1 vs. at base. Hind tarsomere 1 with a black, curved posterior spine at base, directed upwards underneath posterior comb of hind tibia. Relative lengths of femur, tibia and 5 tarsomeres: LI : 1.00 : 0.95 : 0.50 : 0.20 : 0.15 : 0.10 : 0.10 ; LII : 1.20 : 1.37 : 0.62 : 0.37 : 0.27 : 0.15 : 0.15 ; LIII : 1.25 : 1.55 : 0.45 : 0.62 : 0.45 : 0.30 : 0.20. Wing (Fig. 15) hyaline, with yellowish to brown stigma near end of  $R_1$ . The stigma consists of a widening of the tip of  $R_1$  and a yellowish to brown colouring of the wing membrane. The stigma is narrow (Fig. 15), widely separated from  $R_{2+3}$ . It extends beyond the level where the thickening of  $R_{4+5}$  starts.  $R_{4+5}$  thickened from basal quarter, to a little before ending in costa.  $R_{4+5}$  and M distinctly parallel apically. M a little thickened at bulge. Squama yellow with black hairs. Halter white.

Abdomen metallic green with pale grey pollen. Hairs and bristles black. Male genitalia (Figs. 16–19). Epandrium distinctly longer than wide, lateral epandrial lobe acute apically; cercus subrectangular, yellow with yellow hairs; hypandrium short and thick, aedeagus with 1 inner large, brown denticle near apex.

**Female.** Body length 2.3 mm, wing length 2.1 mm. Identical to male in most characters, but stigma absent.

**Etymology.** – The specific name refers to the lanceolate shape of the wing stigma.

**Distribution.** – Singapore

**Remarks.** – Although *H. lanceolatus*, new species, is very closely related to *H. limosus*, new species, we consider them as a distinct species. *H. lanceolatus* is much smaller, the stigma is lanceolate and longer and the denticle on the aedeagus is smaller and more basad in position. *H. limosus* is larger, has a shorter and wider stigma and a stronger denticle on the aedeagus, that is closer to the tip of the aedeagus. For a comparison with *H. notatus* Becker, 1922, we refer to the remarks under *H. limosus*.

### *Hercostomus limosus*, new species

(Figs. 20–24)

**Material examined.** – **Holotype.** Male, SINGAPORE: Pulau Ubin, Chek Jawa, 2 Dec.2003, mangrove, Mal. (23097, coll. PG, det. LZ, Si111, ZRC).

**Paratypes.** SINGAPORE: Pulau Ubin, Chek Jawa, 2 males, 4 females, 2 Dec.2003; 1 male, 11 Oct.2005; 1 male, 26 Oct.2005; 2

males, 2 females, 22 Dec.2005; 1 male, 1 female, 30 Dec.2005 (sweeping).

**Diagnosis.** – Wing with wide, yellowish brown to grey stigma behind tip of  $R_1$ , stigma reaching the level of thickening of  $R_{4+5}$ .  $R_{4+5}$  thickened from basal quarter, but narrow again before reaching wing border.

**Description.** – **Male.** Body length 3.7 mm, wing length 3.3 mm.

Head metallic green with pale grey pollen. Face wider than first flagellomere, densely grey dusted. Hairs and bristles black. Postocular bristles (including posteroventral hairs) black. Antenna (Fig. 21) yellow, first flagellomere brown, 1.1 times as long as wide, obtuse apically; arista brown, minutely pubescent with very short basal segment. Proboscis brownish yellow with black hairs, palpus brownish yellow with black hairs and black apical bristle.

Thorax metallic green with pale grey pollen. Six strong dc, 7–8 pairs of acr short and hair-like; scutellum with two pairs of bristles (basal pair short and weak). Propleuron with 1 black bristle on lower part. Legs yellow; fore coxa yellow with blackish base, mid and hind coxae black with yellow apex. Fore tarsus from tip of tarsomere 2 onward brownish; mid and hind tarsi from tip of tarsomere 1 onward brownish to brown. Hairs and bristles black. Mid and hind coxae each with 1 exterior bristle. Mid and hind femora each with 1 preapical bristle. Fore tibia with 2 ad and 1 weak pd, apically with 2 bristles; mid tibia with 3 ad, 2 pd and 1 av, apically with 4 bristles; hind tibia with 3 ad, 4 pd and 1 av, apically with 2 bristles. Mid tarsomere 1 with 2 short vs.; hind tarsomere 1 with 1 vs. at base. Hind tarsomere 1 with a black, curved posterior spine at base, directed upwards underneath posterior comb of hind tibia. Relative lengths of tibia and 5 tarsomeres LI 1.5 : 0.8 : 0.35 : 0.25 : 0.18 : 0.18; LII 2.25 : 1.0 : 0.65 : 0.5 : 0.26 : 0.24; LIII 2.5 : 0.85 : 1.05 : 0.75 : 0.5 : 0.32. Wing (Fig. 20) hyaline, with yellowish to brown stigma near end of  $R_1$ . The stigma consists of a widening of the tip of  $R_1$  and a yellowish to brown colouring of the wing membrane. The stigma is wide, and is narrowly separated from  $R_{2+3}$  (difference with *H. lanceolatus*, new species). It extends to the level where the thickening of  $R_{4+5}$  starts.  $R_{4+5}$  thickened from basal quarter, to a little before ending in costa.  $R_{4+5}$  and M distinctly parallel apically. M a little thickened at the bulge. CuAx ratio 1.2. Squama yellow with black hairs. Halter white.

Abdomen metallic green with pale grey pollen. Hairs and bristles black. Male genitalia (Figs. 22–24): Epandrium distinctly longer than wide, lateral lobe acute apically; cercus triangular, yellow with brown hairs; hypandrium short and thick, aedeagus with 1 inner large, brown denticle near apex.

**Female.** Body length 3.6 mm, wing length 3.3 mm. Similar to male, but wing without stigma and  $R_{4+5}$  not thickened.

**Etymology.** – The specific name refers to the habitat of *G. limosus*, new species, being the mudflats in mangrove (Lat. *limosus*: muddy).



**Distribution.** – Singapore.

**Remarks.** – *Hercostomus limosus*, new species, and *H. lanceolatus*, new species, are both similar to *H. notatus* Becker, 1922, from Taiwan in having a wing stigma. Examination of a male (Formosa Sauter, Takao 1907.V.3; *H. notatus* det. Becker), here designated as lectotype revealed that it has R<sub>4+5</sub> thickened from its base onwards and the thickening ends halfway the vein i.e. shortly beyond the stigma. Figure 18 in Becker (1922) does not show this thickening. Further it should be noted that the stigma is not black as Becker wrote, but also brownish like in both other species. Finally the cercus is set with pale hairs, not black ones and the aedeagus does not bear a denticle like in the other two species.

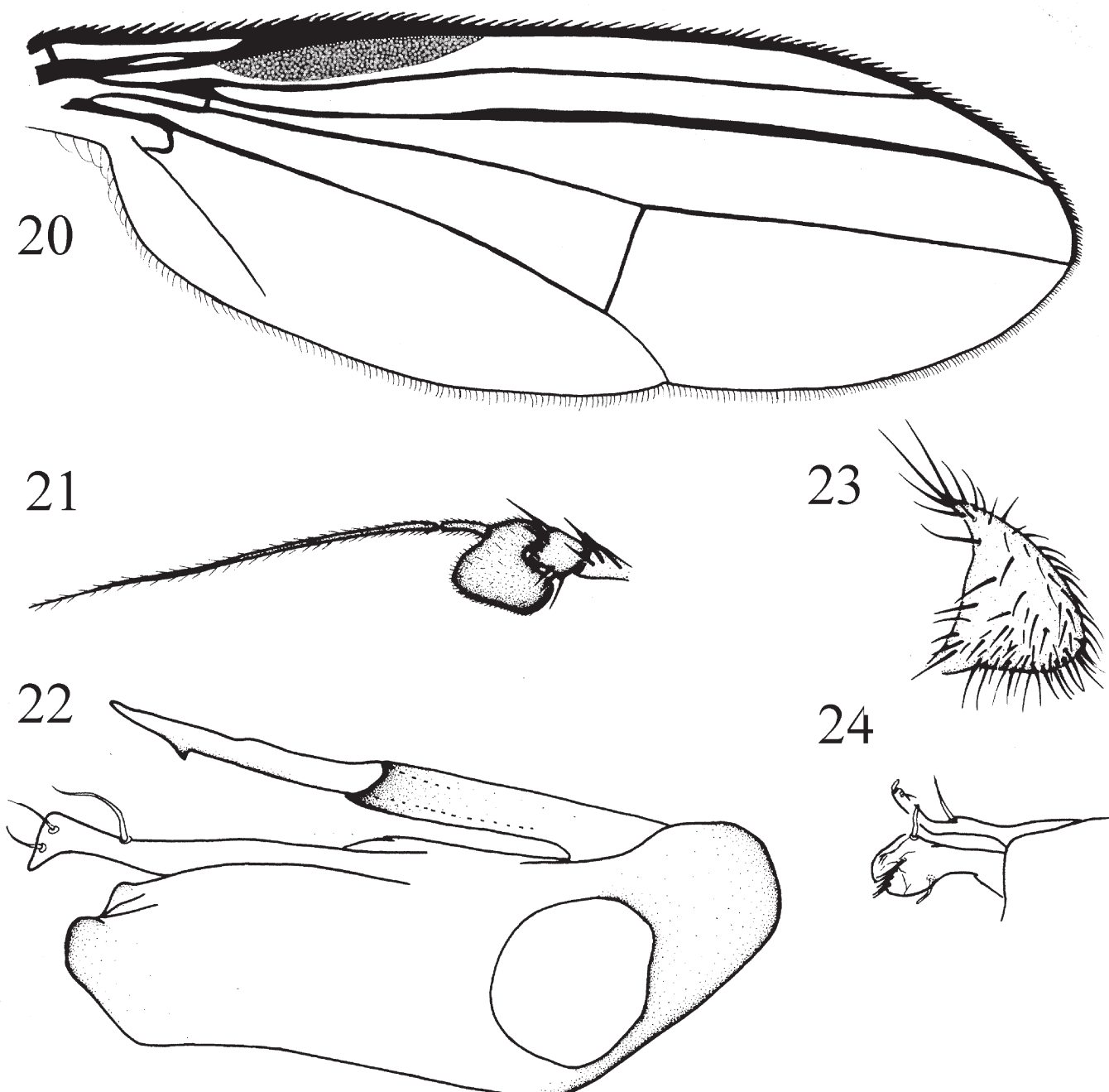
***Hercostomus meieri*, new species**

(Figs. 25–28)

**Material examined.** – **Holotype.** Male, SINGAPORE: Pulau Ubin, Chek Jawa, 2 Dec.2003, mangrove (23097, coll. PG, det. LZ, Si113, ZRC).

**Paratypes.** Pulau Ubin, Chek Jawa, 4 males, 3 females, 11 Dec.2002 (sweeping); 5 males, 1 female, 2 Dec.2003 (3 males and 1 female kept in IOZ); 5 males, 11 Dec.2003; 4 males, 5 females, 22 Dec.2005; 4 males, 1 female, 30 Dec.2005. Sungei Buloh, 1 female, 25 May 2005; 3 females, Sungei Buloh, 6 Jul.2005; 1 female, 3 Dec.2005.

**Diagnosis.** – First flagellomere 3.0 times as long as wide. Fore coxa yellow, mid and hind coxae brown.



Figs. 20–24. *Hercostomus limosus*, new species, male: 20, wing; 21, antenna; 22, male genitalia; 23, cercus; 24, surstyli.

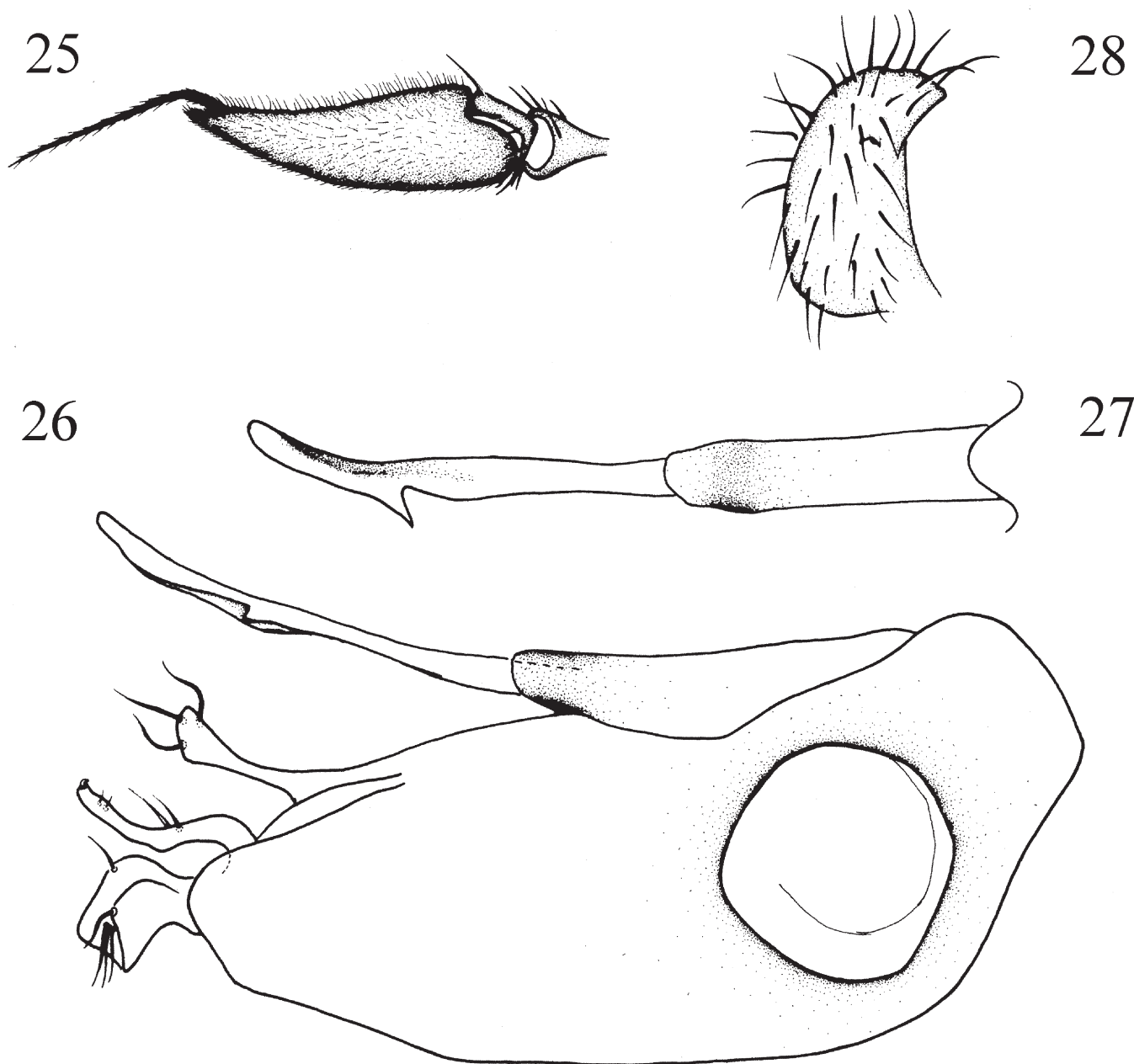
**Description.** – **Male.** Body length 2.4–2.5 mm, wing length 2.1–2.2 mm.

Head metallic green with pale grey pollen. Face narrowing downward, slightly narrower than first flagellomere. Hairs and bristles black. Postocular bristles (including posteroventral hairs) black. Antenna (Fig. 25) brown, first flagellomere 3.0 times as long as wide; arista black, apicodorsal, minutely pubescent with short basal segment. Proboscis blackish brown with black hairs, palpus blackish brown with black hairs and black apical bristles.

Thorax metallic green with pale grey pollen. Six strong dc, 5–6 pairs of acr; scutellum with two pairs of bristles (basal pair short and weak). Propleuron with 1 black bristle on lower part. Legs yellow; fore coxa yellow, mid and hind coxae brown. Mid tarsus from tip of tarsomere 1 onward brownish;

hind tarsus brownish to brown. Hairs and bristles black. Mid and hind coxae each with 1 exterior bristle. Mid and hind femora each with 1 preapical bristle. Fore tibia with 2 ad, 1 weak pd and 1 pv, apically with 3 bristles; mid tibia with 3 ad, 2 pd and 1 av, apically with 4 bristles; hind tibia with 4 ad, 3 pd and 2 av, apically with 3 bristles. Relative lengths of tibia and 5 tarsomeres LI 1.0 : 0.5 : 0.2 : 0.15 : 0.15 : 0.15; LII 1.35 : 0.6 : 0.35 : 0.25 : 0.17 : 0.17; LIII 1.5 : 0.5 : 0.65 : 0.45 : 0.3 : 0.25. Wing hyaline, tinged with grey, veins brown; CuAx ratio 1.0. Squama yellow with black hairs. Halter yellow.

Abdomen metallic green with pale grey pollen. Hairs and bristles black. Male genitalia (Figs. 26–28): Epandrium longer than wide, lateral epandrial lobe slightly swollen apically with 3 bristles; cercus nearly triangular; hypandrium short and obtuse apically; aedeagus with 1 inner denticle.



Figs. 25–28. *Hercostomus meieri*, new species, male: 25, antenna; 26, male genitalia; 27, hypandrium and aedeagus, ventral view; 28, cercus.

**Female.** Body length 2.4 mm, wing length 2.4 mm. Similar to male, but first flagellomere shorter, 1.7 times as long as wide.

**Etymology.** – The species is dedicated to Dr. Rudolf Meier from National University of Singapore.

**Distribution.** – Singapore.

**Remarks.** – The new species is distinguished from other known species by the long first flagellomere that is three times as long as wide.

males, 27 Apr.2005; 4 males, 5 females, 11 May 2005 (3 males and 2 females in IOZ); 11 males, 11 May 2005; 2 males, 18 May 2005; 4 males, 25 May 2005; 1 female, 1 Jun.2005; 1 male, 10 June 2005; 1 male, 15 Jun.2005; 1 male, 5 Aug.2005; 1 male, 26 Aug.2005; 1 male, 1 female, 18 Nov.2005; 1 female, 3 Dec.2005; 1 male, 4 Jan.2006.

**Diagnosis.** – First flagellomere 1.2 times as long as wide. Fore coxa yellow, mid and hind coxae brownish. Dorsal lobe of surstyli with plumose hair.

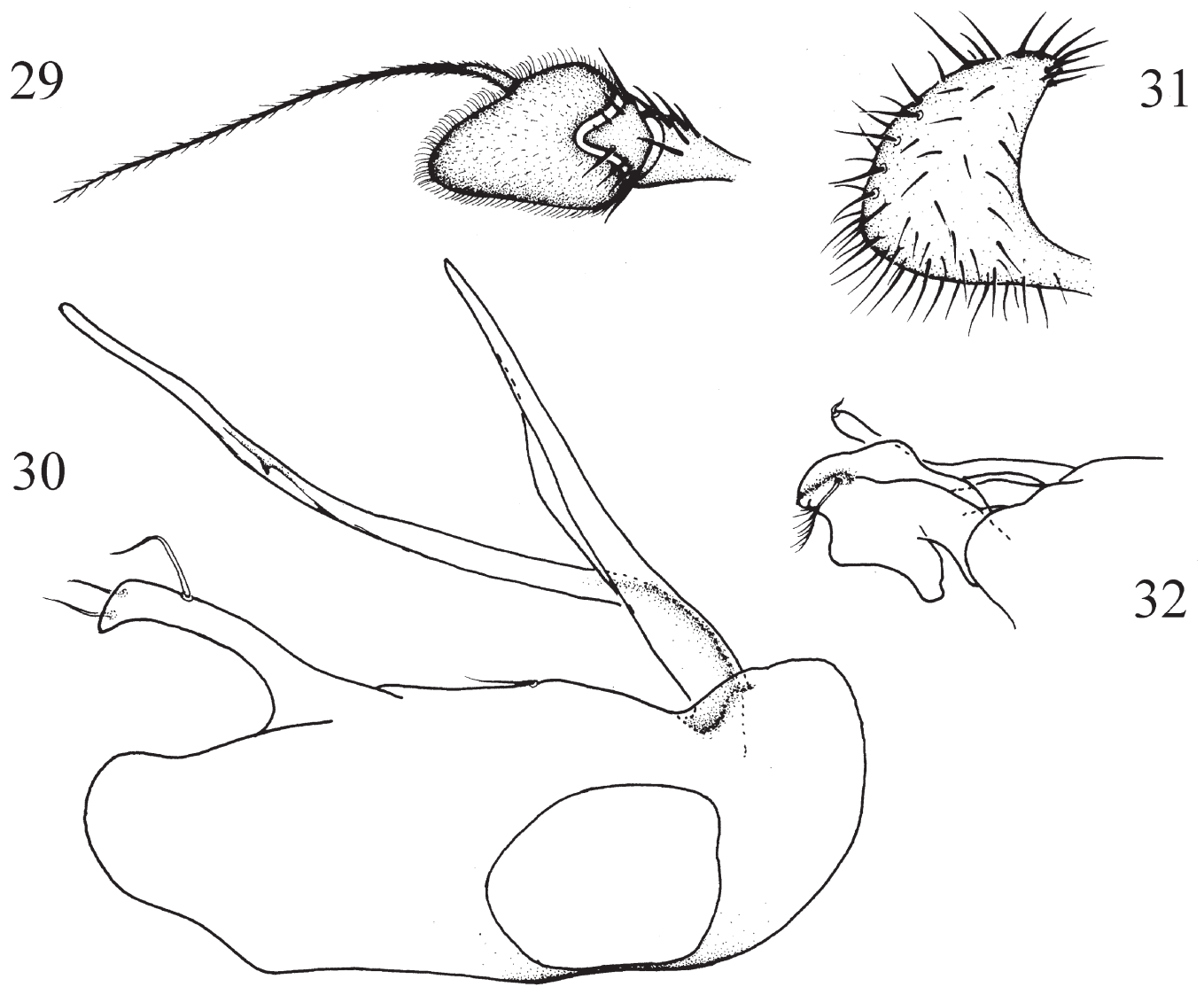
**Description.** – **Male.** Body length 2.4–2.7 mm, wing length 2.2–2.5 mm.

Head metallic green with pale grey pollen. Face narrowing downward, narrower than first flagellomere. Hairs and bristles black. Postocular bristles (including posteroventral hairs) black. Antenna (Fig. 29) brownish; first flagellomere darker, 1.2 times as long as wide; arista dark brown, minutely pubescent with short basal segment. Proboscis brownish yellow with black hairs, palpus brownish yellow with black hairs and black apical bristle.

***Hercostomus plumatus*, new species**  
(Figs. 29–32)

**Material examined.** – **Holotype.** Male, SINGAPORE: Sungei Buloh, 11 May 2005, Mal. 1 (25159, coll. PG, det. LZ, Si812, ZRC).

**Paratypes.** SINGAPORE: Pulau Ubin, Chek Jawa, 2 females, 30 Dec.2005; 4 females, 30 Dec.2005 (sweeping). Sungei Buloh, 1 male, 27 Nov.2003 (sweeping); 3 males, 1 female, 22 Apr.2005; 5



Figs. 29–32. *Hercostomus plumatus*, new species, male: 29, antenna; 30, male genitalia; 31, cercus; 32, surstyli.

Thorax metallic green with pale grey pollen. Six strong dc, 5–6 pairs of acr; scutellum with two pairs of bristles (basal pair short and weak). Propleuron with 1 black bristle on lower part. Legs yellow; fore coxa yellow, mid and hind coxae brownish. Mid and hind tarsi from tip of tarsomere 1 onward brownish to brown. Hairs and bristles black. Mid and hind coxae each with 1 exterior bristle. Mid and hind femora each with 1 preapical bristle. Fore tibia with 2 ad and 1 weak pd, apically with 3 bristles; mid tibia with 3 ad, 2 pd and 1 av, apically with 4 bristles; hind tibia with 4 ad, 3 pd and 2 vs., apically with 3 bristles. Relative lengths of tibia and 5 tarsomeres LI 1.0 : 0.5 : 0.2 : 0.15 : 0.15 : 0.15; LII 1.5 : 0.65 : 0.4 : 0.3 : 0.2 : 0.2; LIII 1.65 : 0.5 : 0.7 : 0.5 : 0.35 : 0.25. Wing hyaline, tinged with greyish, veins brown; CuAx ratio 0.9, R<sub>4+5</sub> and M parallel apically. Squama yellow with black hairs. Halter yellow.

Abdomen metallic green with pale grey pollen. Hairs and bristles black. Male genitalia (Figs. 30–32): Epandrium longer than wide, lateral epandrial lobe slightly curved apically with 3 bristles; cercus nearly triangular; hypandrium narrow and straight; aedeagus with 1 minute, inner denticle.

**Female.** Body length 3.3 mm, wing length 2.9 mm. Similar to male, but fore tibia without weak pd.

**Etymology.** – The specific name refers to the plumose hair on the dorsal lobe of surstyli.

**Distribution.** – Singapore.

**Remarks.** – The new species is somewhat similar to *H. brevicornis*, new species, but may be separated from the latter by its triangular cercus and aedeagus with 1 inner denticle; in *H. brevicornis*, new species, the cercus is strongly curved and nearly geniculate and the aedeagus has 2 inner denticles.

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