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Three new *Cryptochetum* Rondani, 1875 (Diptera: Cryptochetidae) from Yunnan Province, China and an identification key to Chinese species

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Abstract. Three species of the genus *Cryptochetum* Rondani, 1875 from China are described and figured as new to science: *C. euthyiproboscise* sp. nov., *C. glochidiatusum* sp. nov., and *C. longilingum* sp. nov. An identification key to the known species of *Cryptochetum* from China is presented. The type specimens of the new species are deposited in the Henan Agricultural University.

Keywords. *Cryptochetum*, Diptera, new species, China.

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Introduction

Cryptochetum Rondani, 1875 is a genus of small (body length: 1.0–3.0 mm) cryptochetid flies. The genus is recognized by the following characteristics: body stubby and compact, shiny and brownish black with a metallic blue-green luster; eye very large, ocelli present; ocellar triangle shiny black with metallic luster; frons without setae, orbital setae lacking; postpedicel large, with complete absence of an antennal arista; scutellum large, approximately triangular; wing hyaline with greenish and purplish reflections; veins brown, costal vein (C) extending to end of R_{4+5} or M_1 (Yang & Yang 1996). The Chinese species were reviewed and 15 species are now recognized (Xi & Yang 2015; Yang & Yang 1996, 1998a, 1998b, 2001). Larvae of most *Cryptochetum* are endoparasitic of various scale insects of the family Monophlebidae (Coccoidea) (Thorpe 1941a, 1941b; Foote & Arnaud 1958; Yang & Yang 1996).

Yunan Province (21°08′–29°15′ N, 97°31′–106°11′ E) is located in the south-west part of China with various climates and is rich in wildlife resources. In this paper, three species of the genus *Cryptochetum*

from China are described as new to science. An identification key to the known species of *Cryptochetum* occurring in China is presented.

Material and methods

Terminalia preparations were made by removing and macerating the apical portion of the abdomen in glacial acetic acid, then rinsed in distilled water before being stored in glycerine-filled microvials. After examination, they were transferred to fresh glycerine and stored in a microvial on the pin below the specimen or moved to an ethanol tube together with the wet specimens. Specimens examined are deposited in the Entomological Museum of Henan Agricultural University (EMHAU), Zhengzhou. The general terminology follows Cumming & Wood (2017).

Abbreviations for morphological terms

C	=	costal vein
cerc	=	cercus
dm-m	=	discal medical crossvein
epand	=	epandrium
gon	=	gonopods
hypd	=	hypandrium
M_1	=	first branch of media
M_4	=	fourth branch of media
ph	=	phallus
R_1	=	anterior branch of radius
R_{2+3}	=	second branch of radius
R_{4+5}	=	third branch of radius
S_c	=	subcostal vein
sur	=	surstylus

Results

The genus *Cryptochetum* is now represented by 18 species from China and an identification key to species is provided below.

Key to species of Cryptochetum *Rondani, 1875*

1. Ocellar triangle small, separated from antennal base; costal vein (C) extending to vein M_1 2
– Ocellar triangle large, reaching antennal base; costal vein (C) extending to vein R_{4+5} or slightly beyond apex of wing 3

2. Wing crossvein dm-m curved inward (Fig. 22) ..... ***C. curvatum*** Yang & Yang, 1996
– Wing crossvein dm-m perpendicular (Fig. 23) ..... ***C. deltatum*** Yang & Yang, 1996

3. Wing vein R_{4+5} terminating at apex of wing 4
– Wing vein R_{4+5} terminating before apex of wing, located between R_{4+5} and M_1 9

4. Wing vein M_1 between r-m and dm-m crossveins as long as dm-m crossvein (Fig. 24) ..... ***C. tianmuense*** Yang & Yang, 2001
– Wing vein M_1 between r-m and dm-m crossveins longer than dm-m crossvein 5

5. Wing vein M_1 between r-m and dm-m crossveins 2.0 × as long as dm-m crossvein (Fig. 25) ..... ***C. acutulum*** Yang & Yang, 1996
– Wing vein M_1 between r-m and dm-m crossveins < 2.0 × as long as dm-m crossvein 6

6. Wing vein M_1 between r-m and dm-m crossveins 1.2 × as long as dm-m crossvein (Fig. 9) ..... ***C. glochidiatusum*** sp. nov.
– Wing vein M_1 between r-m and dm-m crossveins 1.5 × as long as dm-m crossvein 7

7. Antennal postpedicel slightly acute apically (Fig. 26) ..... ***C. zalatilabium*** Xi & Yang, 2015
– Antennal postpedicel slightly blunt apically 8

8. Knob of haltere dark brown; distal portion of M_4 (part beyond crossvein dm-m) 2.0 × as long as dm-m crossvein (Fig. 3) ..... ***C. euthyiproboscise*** sp. nov.
– Knob of haltere dark yellow; distal portion of wing vein M_4 (part beyond crossvein dm-m) 1.5 × as long as dm-m crossvein (Fig. 17) ..... ***C. longilingum*** sp. nov.

9. Costal wing vein (C) extending beyond end of vein R_{4+5}; vein M_1 between r-m and dm-m crossveins virtually as long as dm-m crossvein (Fig. 27) ..... ***C. kunmingense*** Yang & Yang, 1996
– Costal wing vein (C) extending to end of vein R_{4+5}; vein M_1 between r-m and dm-m crossveins shorter than dm-m crossvein 10

10. Apex of wing situated medially between veins R_{4+5} and M_1 11
– Apex of wing closer to vein R_{4+5} than to vein M_1 13

11. Wing vein M_1 between r-m and dm-m crossvein as long as vein M_4 (part beyond dm-m crossvein) (Fig. 28) ..... ***C. fanjingshanum*** Yang & Yang, 1988
– Wing vein M_1 between r-m and dm-m crossvein shorter than vein M_4 (part beyond dm-m crossvein) 12

12. Distal portion of wing vein M_4 (part beyond dm-m crossvein) 1.7 × as long as dm-m crossvein; dm-m crossvein virtually straight (Fig. 29) ..... ***C. maolanum*** Yang & Yang, 1996
– Distal portion of wing vein M_4 (part beyond dm-m crossvein) 3.0 × as long as dm-m crossvein; dm-m crossvein slightly curved (Fig. 30) ..... ***C. shaanxiense*** Xi & Yang, 2015

13. Mid section of dm-m crossvein appreciably curved 14
– Mid section of dm- m crossvein perpendicular 15

14. Antennal postpedicel wide and flat, margin inclined apically (Fig. 31) .....
.....***C. yunnanum*** Xi & Yang, 2015
– Antennal postpedicel slightly narrow and short, margin blunt and rounded apically (Fig. 32) ..... ***C. nonagintaseptem*** Yang & Yang, 1998

15. Ocellar triangle approximately in equilateral triangle 16
– Ocellar triangle approximately in obtuse triangle 17

16. Apex angle of ocellar triangle slightly wider than distance between antennae; body slightly smaller (body length 1.5 mm) (Fig. 33) ..... ***C. medianum*** Yang & Yang, 1998
– Apex angle of ocellar triangle slightly narrower than distance between antennae; body slightly larger (body length 3.5 mm) (Fig. 34) ..... ***C. sinicum*** Yang & Yang, 1996

17. Apical angle of ocellar triangle slightly wider than distance between antennae; antennal postpedicel acute apically (Fig. 35) ..... *C. acuticornutum* Yang & Yang, 1998
– Apical angle of ocellar triangle nearly equal to distance between antennae; antennal postpedicel with apical margin inclined inward (Fig. 36) ..... ***C. beijingense*** Yang & Yang, 1996

Descriptions of new species

Class Diptera Linnaeus, 1758
Family Chryptochetidae Brues & Melander, 1932
Genus *Cryptochetum* Rondani, 1875

Cryptochetum euthyiproboscise sp. nov.
urn:lsid:zoobank.org:act:0DD2BF7C-1EC1-48FD-AF31-5D3883B239CE
Figs 1–7

Diagnosis

Ocellar triangle approximately in isosceles triangle, apical angle shorter than the distance between antennae. Surstylus slightly narrowed and sharp apically.

Etymology

The species epithet refers to the straight palpus.

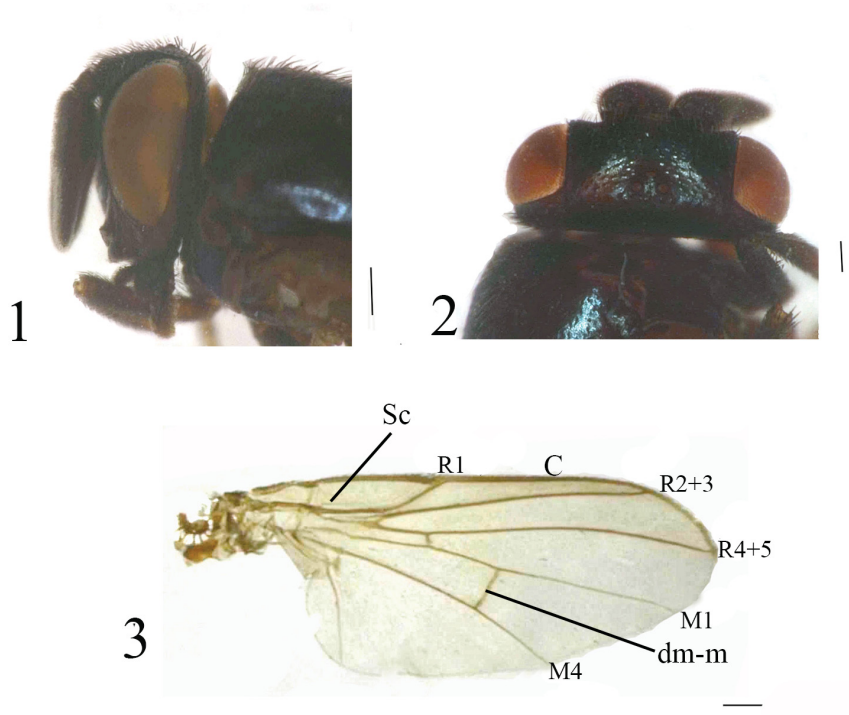
Type material

Holotype

CHINA • ♂; Yunnan, Tengchong, Zizhi; 25°44′24″ N, 98°33′36″ E; alt. 2100 m; 31 May 2007; Yan-L. Li leg.; EMHAU CR101.

Paratypes

CHINA: 2 ♂♂, Yunnan, Mangshi, Zhefang; 24°15′36″ N, 98°15′29″ E; alt. 1200 m; 4 Jul. 2014; Wei Zhang leg.; EMHAU DICR0013.

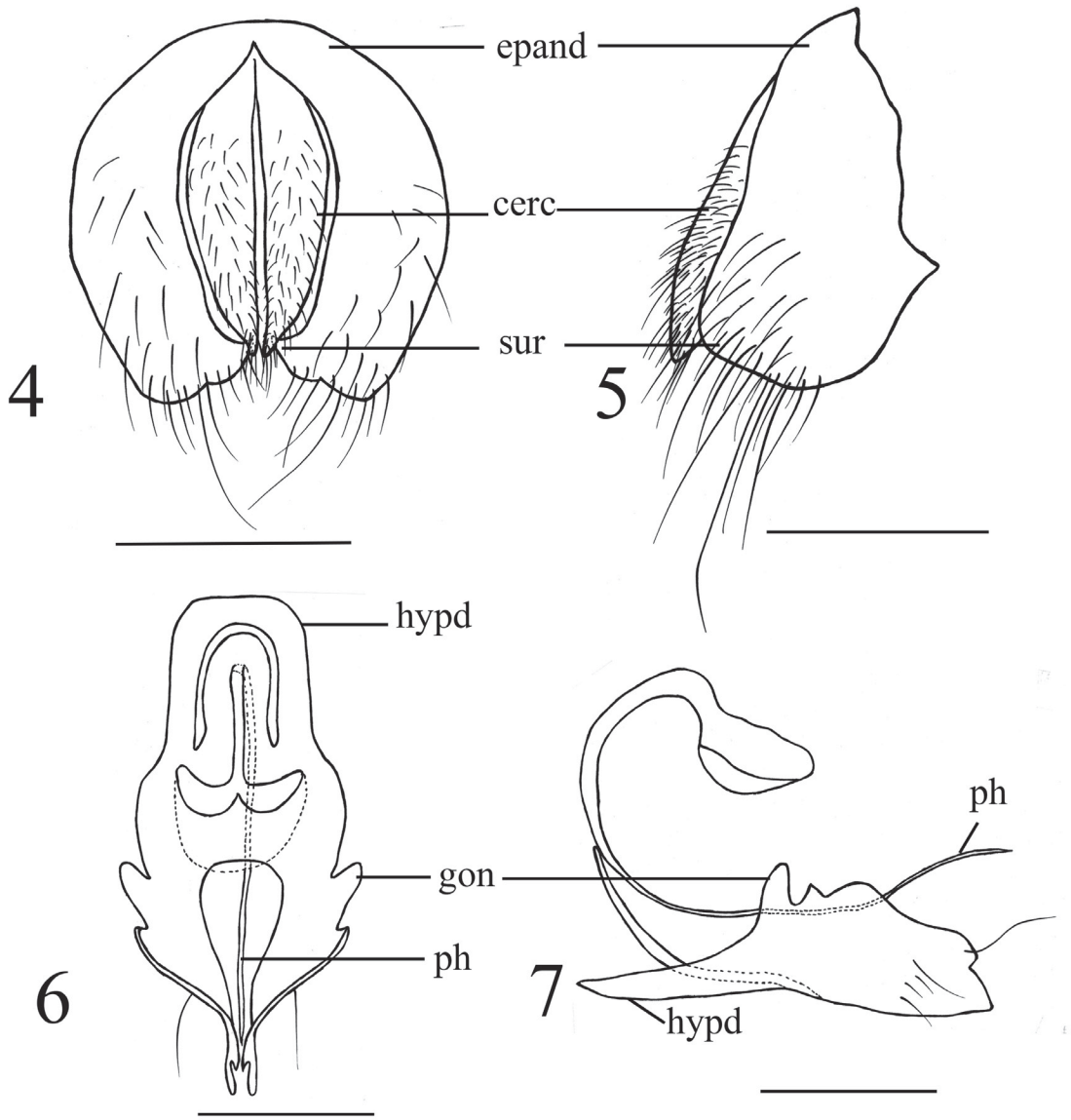


Figs 1–3. *Cryptochetum euthyiproboscise* sp. nov., holotype, ♂ (CR101). **1**. Head, lateral view. **2**. Head, dorsal view. **3**. Wing, dorsal view. Scale bar = 0.1 mm.

Description

Male. Body length: 2.2–2.4 mm; wing length: 2.6–2.8 mm.

Head. Darkish brown (Fig. 1); ocellar triangle shiny brown with metallic luster (Fig. 2), approximately in isosceles triangle, apex slightly flat; lunule strap-shaped, very narrow, brown. Eye red, bare, 1.8 × as high as long, gena approximately ⅛ of eye height. Setae and setulae on head black; ocelli darkish yellow, placed close together. Ocellar triangle with short setulae, punctures at bases of setulae conspicuous; frons without setae, orbital setae lacking; postvertical setae erect, considerably stouter and longer than other setulae on vertex. Antenna brown with microtomentum, large, same length as face; scape and pedicel with black setulae at middle and margin; postpedicel with pubescence, irregularly rectangular, front margin straight, apical margin curved, 0.5 mm long, 0.2 mm wide, apical angle with stout conical tubercle, a little longer than surrounding setulae. Proboscis flat and straight, brown, with short sparse



Figs 4–7. *Cryptochetum euthyiproboscise* sp. nov., holotype, ♂ (CR101). **4**. Dorsal view. **5**. Lateral view. **6**. Dorsal view. **7**. Lateral view. Scale bars: 4–5 = 0.1 mm; 6–7 = 0.05 mm.

black setulae, labellum slightly wide. Palpus short, ca 0.2 mm long, apically rounded, darkish brown with short dense black pubescence, margin with short sparse setulae.

Thorax. Shiny, darkish brown with brownish stripes and metallic blue-green luster; scutellum shiny, blackish brown. Setae and setulae on thorax black, punctures at bases of setulae deep and numerous; scutellum large, approximately triangular, wide and rounded apically, 0.5 × as long as thorax. Apical setae longer and stouter than other setae. Anepisternum brown with setulae, katepisterunum and anepimeron brownish, bare. Legs slender, blackish brown except tarsi yellowish. Setae and setulae on legs black. Wing hyaline with greenish and purplish reflections, unspotted, 2.3 × as long as wide; veins brown; costal vein (C) extending to end of R_{4+5} and terminating at apex of wing; subcostal vein (Sc) weak, slightly angulated; R_1 curved, not angulated, R_{2+3} and R_{4+5} parallel for 4/5 along their lengths, then diverging to wing margin; r-m short; M_1 between r-m and dm-m 1.5 × as long as dm-m, dm-m slightly sinuous, forming an angle nearly at 90° with M_4, distal portion of M_4 (the part beyond dm-m) 1.9 × as long as dm-m (Fig. 3). Calypter brownish, with brownish microtrichae, margin with brownish setulae. Knob of haltere dark brown, stalk brown.

Abdomen. Brownish black with a metallic blue-green luster, wide and slightly flattened. Setae and setulae on abdomen black. Male terminalia: epandrium (Figs 4–5) reduced to thick band dorsally, with sides broadest in middle, with setulae; surstylus slightly narrowed and sharp apically; cercus rather large, with dense setulae. Hypandrium (Figs 6–7) n-shaped; gonopods small and symmetric; phallus slender, distipallus slightly wide.

Female

Unknown.

Distribution

China (Yunnan).

Remarks

This new species is somewhat similar to *C. kunmingense* Yang & Yang, 1996, but may be separated from it by M_1 between r-m and dm-m 1.6 × as long as dm-m; distal potion of M_4 (the part beyond dm-m) 1.9 × as long as dm-m. In *C. kunmingense*, M_1 between r-m and dm-m 1.2 × as long as dm-m; distal potion of M_4 (the part beyond dm-m) 1.4 × as long as dm-m (Yang & Yang 1996).

Cryptochetum glochidiatusum sp. nov.

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Figs 8–14

Diagnosis

Ocellar triangle approximately in equilateral triangle, apical angle slightly wider than the distance between antennae. Surstylus extremely narrowed and blunt apically.

Etymology

The species epithet refers to the shape of epandrium, which is spheroid in dorsal view.

Type material

Holotype

CHINA • ♂; Yunnan, Tengchong, Cizhuhe; 25°43′12″ N, 98°37′48″ E; alt. 2300 m; 8 Jun. 2012; Fei-Y. Liang leg.; EMHAU CR122.

Paratypes

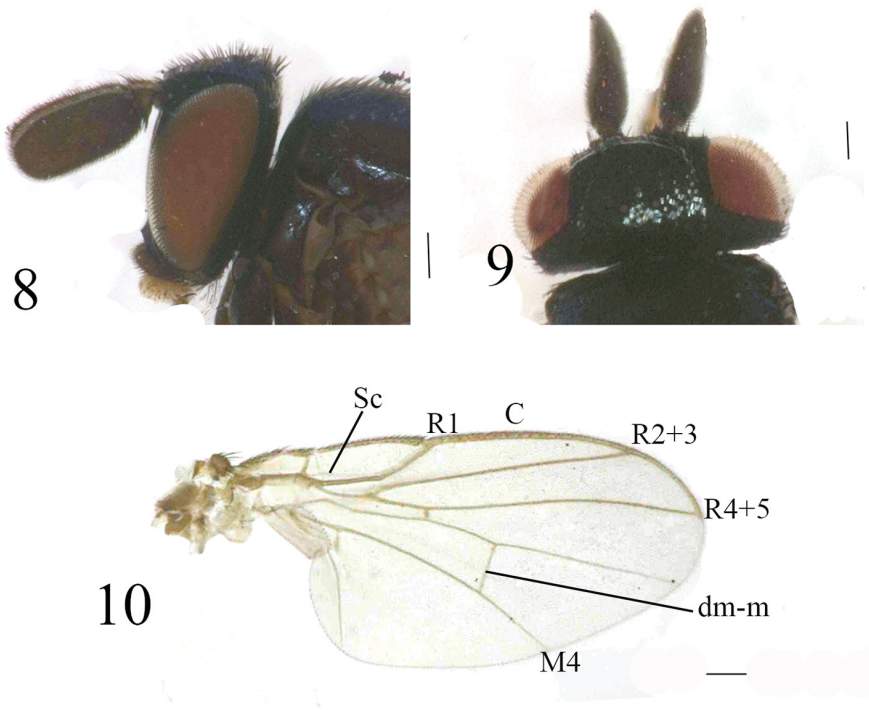
CHINA • 3 ♂♂; same data as for holotype; EMHAU DICR0074.

Description

Male. Body length: 1.6–1.8 mm; wing length: 1.5–1.6 mm.

Head. Black (Fig. 8); ocellar triangle shiny black with metallic luster (Fig. 9), approximately in equilateral triangle, apex slightly flat; lunule strap-shaped, very narrowed, sooty black. Eye darkish red, bare, 1.8 × as high as long, gena approximately one fourteenth of eye height. Setae and setulae on head black; ocelli darkish yellow, placed close together. Ocellar triangle with short setulae, punctures at bases of setulae conspicuous; frons without setae, orbital setae lacking; postvertical setae erect, considerably stouter and longer than other setulae on vertex. Antenna darkish brown with microtomentum, large, shorter than face; scape and pedicel with black setulae at middle and margin; postpedicel with pubescence, irregularly rectangular, front margin straight, apical margin curved, 0.4 mm long, 0.2 mm wide, apical angle with stout conical tubercle, nearly as long as surrounding setulae. Proboscis flat and short, brownish yellow, with short sparse black setulae, labellum slightly wide. Palpus very short, apically enlarged and rounded, dark brown with short dense black pubescence, margin with short sparse setulae.

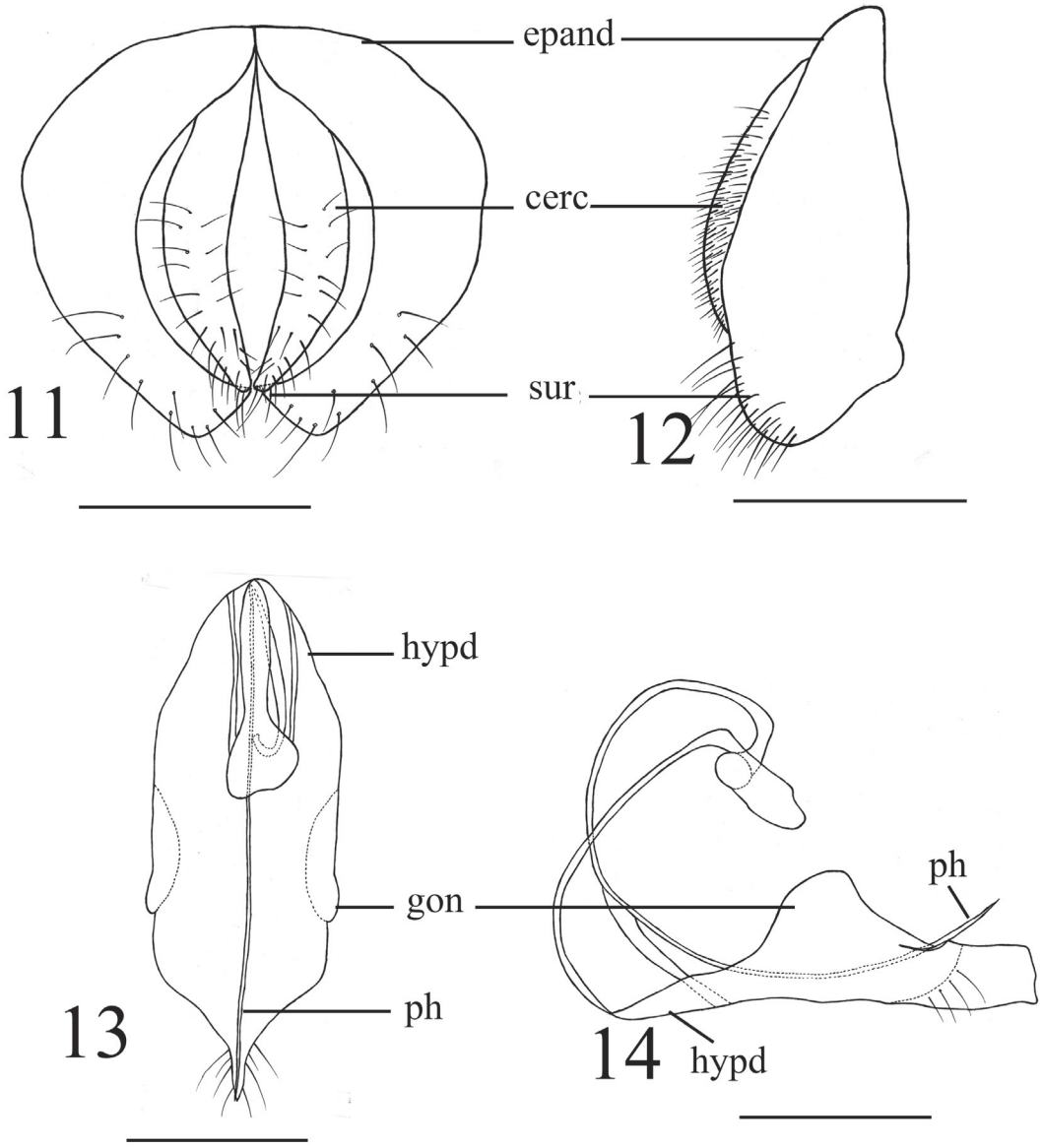
Thorax. Shiny, blackish brown with metallic blue-green luster; scutellum shiny, blackish brown. Setae and setulae on thorax black, punctures at bases of setulae deep and numerous; scutellum large, approximately triangular, wide and rounded apically, 0.5 × as long as thorax. Apical setae longer and stouter than other setae. Anepisternum darkish brown with setulae, katepisterunum and anepimeron brown, bare. Legs slender, blackish brown except tarsi darkish yellow. Setae and setulae on legs black. Wing hyaline with greenish and purplish reflections, unspotted, slightly 1.8 × as long as wide; veins brown; costa vein (C) extending to end of R_{4+5} and terminating before apex of wing; subcostal vein (Sc) weak, not angulate; R_1 curved, not angulate, R_{2+3} and R_{4+5} parallel for 4/5 along their lengths, then



Figs 8–10. *Cryptochetum glochidiatusum* sp. nov., holotype, ♂ (CR122). **8**. Head, lateral view. **9**. Head, dorsal view. **10**. Wing, dorsal view. Scale bar = 0.1 mm.

diverging to wing margin; r-m short; M_1 between r-m and dm-m 1.2 × as long as dm-m, dm-m slightly straight, not sinuous, forming an angle at 90° with M_4, distal portion of M_4 (the part beyond dm-m) 1.8 × as long as dm-m (Fig. 10). Calypter brownish, with brownish microtrichae, margin with brownish setulae. Knob of haltere blackish brown, stalk brownish.

Abdomen. Brownish black with a metallic blue-green luster, wide and slightly flattened. Setae and setulae on abdomen black. Male terminalia: epandrium (Figs 11–12) slightly wide and spheroid dorsally, with setulae apically; surstylus slightly blunt apically; cercus rather narrowed, with dense setulae. Hypandrium (Figs 13–14) irregularly rectangular; gonopods slightly small and symmetric; phallus thin, distipallus slightly enlarge.



Figs 11–14. *Cryptochetum glochidiatusum* sp. nov., holotype, ♂ (CR122). **11**. Dorsal view. **12**. Lateral view. **13**. Dorsal view. **14**. Lateral view. Scale bars: 11–12 = 0.1 mm; 13–14 = 0.05 mm.

Female

Unknown.

Distribution

China (Yunnan).

Remarks

This new species differs from other species of *Cryptochetum* as follows: the antenna is far away from the ocellar triangle, the postpedicel is irregularly rectangular; the epandrium is nearly circular and the cercus is rather narrowed.

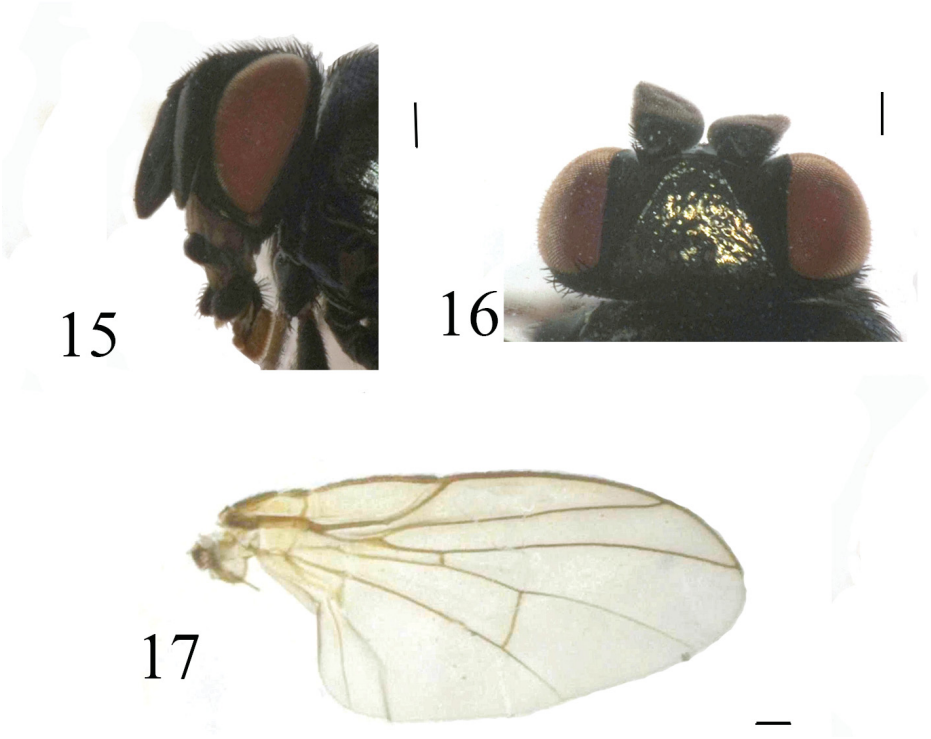
Cryptochetum longilingum sp. nov.
urn:lsid:zoobank.org:act:F512F49C-833B-4D78-9EA0-05C0C8B831B0
Figs 15–21

Diagnosis

Ocellar triangle approximately in isosceles triangle, apical angle shorter than the distance between antennae. Surstylus slightly narrowed and blunt apically.

Etymology

The species epithet refers to the long proboscis.



Figs 15–17. *Cryptochetum longilingum* sp. nov., holotype (CR154), ♂. **15**. Head, lateral view. **16**. Head, dorsal view. **17**. Wing, dorsal view. Scale bar = 0.1 mm.

Type material

Holotype

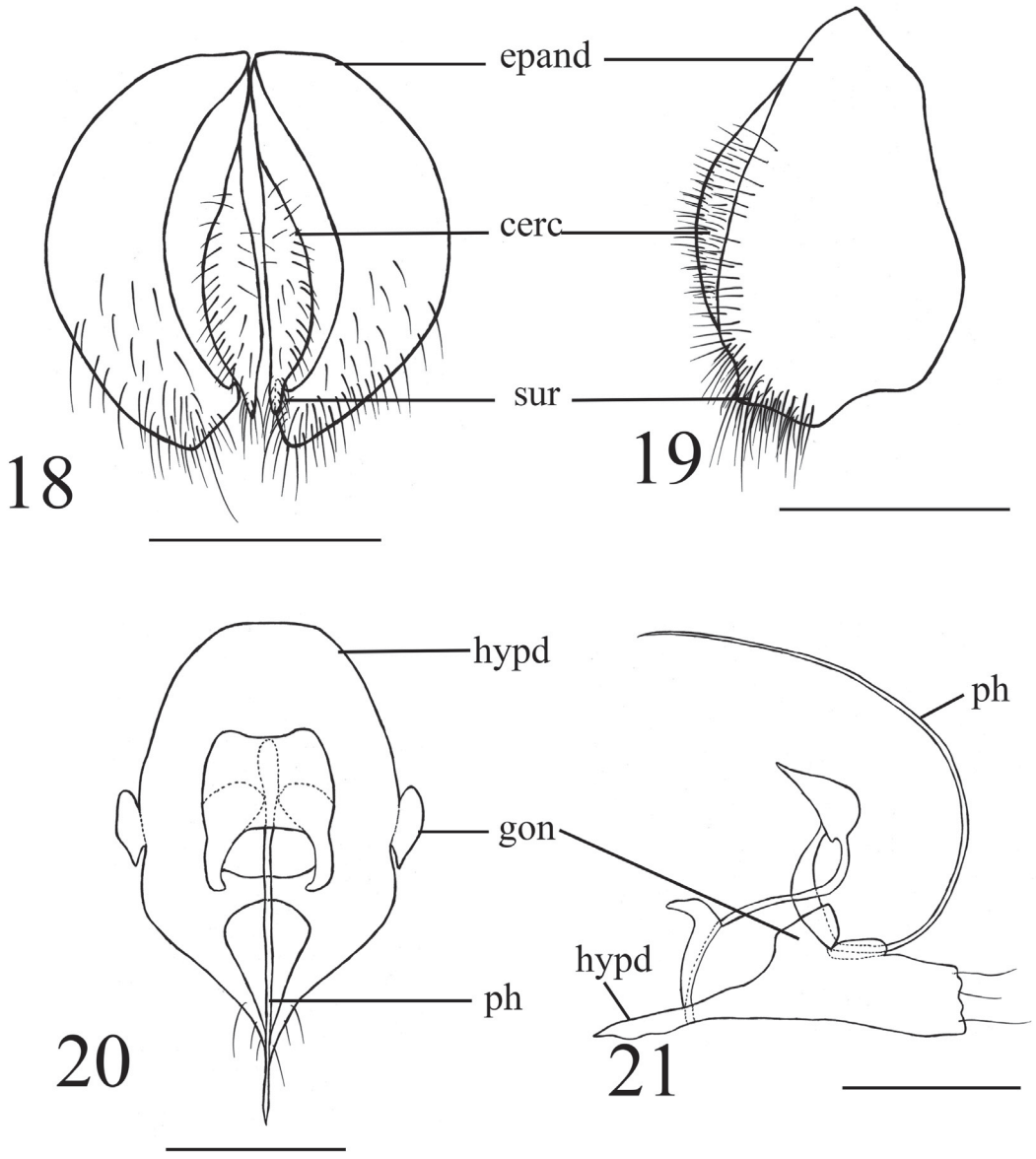
CHINA • ♂; Yunnan, Zhongdian, hongshan; 27°48′36″ N, 99°42′36″ E; alt. 3260 m; 12 Jun. 2012; Yu-Y. Wang leg.; EMHAU CR154.

Paratypes

CHINA: 2 ♂♂; Yunnan, Mangshi, Zhefang; 24°15′36″ N, 98°15′29″ E; alt. 1200 m; 4 Jul. 2014; Wei Zhang leg.; EMHAU DICR0096.

Description

Male. Body length: 2.4–2.5 mm; wing length: 2.6–2.7 mm.



Figs 18–21. *Cryptochetum longilingum* sp. nov., holotype, ♂ (CR154). **18**. Dorsal view. **19**. Lateral view. **20**. Dorsal view. **21**. Lateral view. Scale bars: 18–19 = 0.1 mm; 20–21 = 0.05 mm.

Head. Black (Fig. 15); ocellar triangle shiny black with metallic luster (Fig. 16), approximately in isosceles triangle, apex slightly flat; lunule strap-shaped, very narrow, sooty black. Eye darkish red, bare, 1.9 × as high as long, gena approximately 1/9 of eye height. Setae and setulae on head black; ocelli darkish yellow, placed close together. Ocellar triangle with short setulae, punctures at bases of setulae conspicuous; frons without setae, orbital setae lacking; postvertical setae erect, considerably stouter and longer than other setulae on vertex. Antenna darkish brown with microtomentum, large, shorter than face; scape and pedicel with black setulae at middle and margin; postpedicel with pubescence, irregularly rectangular, front margin straight, apical margin obtuse, 0.6 mm long, 0.3 mm wide, apical angle with stout conical tubercle, nearly as long as surrounding setulae. Proboscis flat and long, brownish yellow, with short sparse black setulae, labellum slightly wide. Palpus short, apically enlarged and rounded, dark brown with short dense black pubescence, margin with short sparse setulae.

Thorax. Shiny, blackish brown with metallic blue-green luster; scutellum shiny, blackish brown. Setae and setulae on thorax black, punctures at bases of setulae deep and numerous; scutellum large, approximately triangular, wide and rounded apically, 0.6 × as long as thorax. Apical setae longer and stouter than other setae. Anepisternum darkish brown with setulae; katepisternum and anepimeron brown, bare. Legs slender, blackish brown except tarsi darkish yellow. Setae and setulae on legs black. Wing hyaline with greenish and purplish reflections, unspotted, slightly 1.5 × as long as wide; veins brown; costal vein (C) extending to end of R_{4+5} and terminating before apex of wing; subcostal vein (Sc) weak, slightly angulated; R_1 curved, not angulated, R_{2+3} and R_{4+5} parallel for 4/5 along their lengths, then diverging to wing margin; r-m short; M_1 between r-m and dm-m 1.5 × as long as dm-m, dm-m slightly sinuous, forming an angle nearly at 90° with M_4, distal portion of M_4 (the part beyond dm-m) 1.5 × as long as dm-m (Fig. 17). Calypter brownish, with brownish microtrichae, margin with brownish setulae. Knob of haltere darkish yellow, stalk brownish.

Abdomen. Brownish black with a metallic blue-green luster, wide and slightly flattened. Setae and setulae on abdomen black. Male terminalia: epandrium (Figs 18–19) slightly wide dorsally, broadest in middle, with setulae; surstylus slightly narrowed and blunt apically; cercus rather narrow, with dense setulae. Hypandrium (Figs 20–21) n-shaped; gonopods small and symmetric; phallus slender, distipallus slightly enlarged.

Female

Unknown.

Distribution

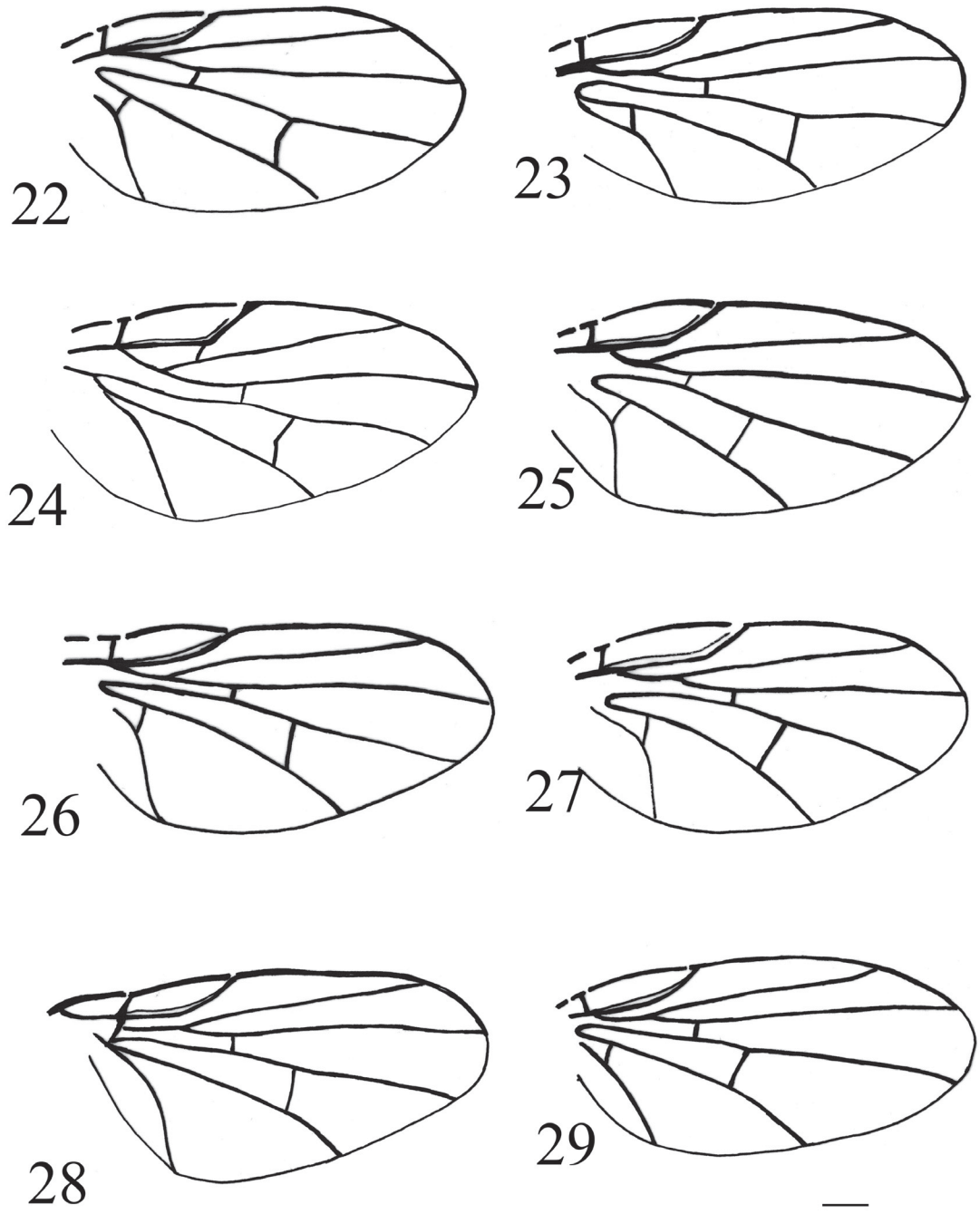
China (Yunnan).

Remarks

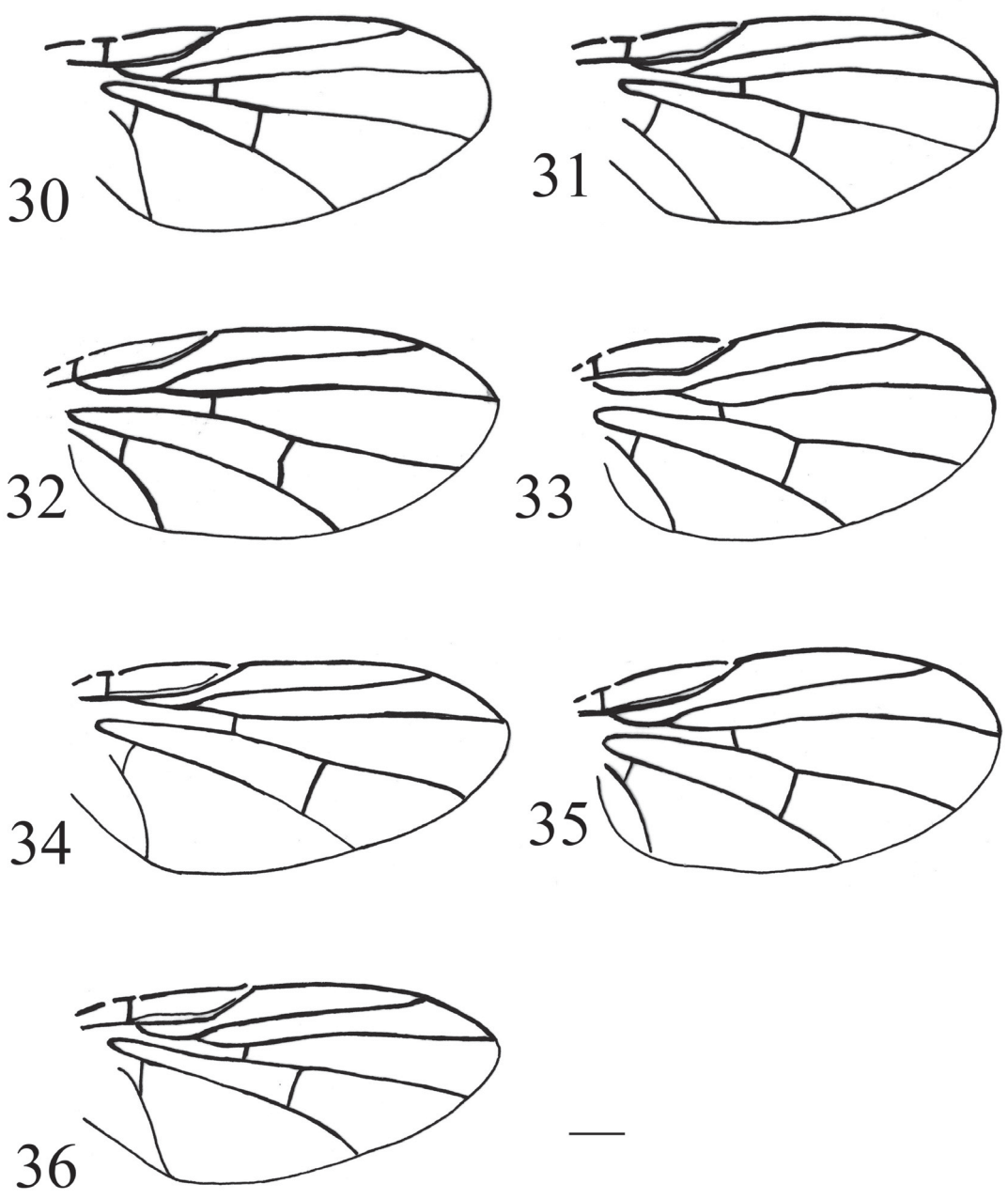
This new species is somewhat similar to *C. sinicum* Yang & Yang, but may be separated from it by M_1 between r-m and dm-m 1.2 × as long as dm-m, ocellar triangle approximately in isosceles triangle. In *C. sinicum*, M_1 between r-m and dm-m 1.7 × as long as dm-m, ocellar triangle approximately in equilateral triangle (Yang & Yang 1996).

Discussion

The Cryptochetidae is the smallest family in the superfamily Carnoidea. Although the life-habits of cryptochetid flies are rather well known, species are hard to collect. In some places, cryptochetids fly around the human head or eyes. The three new species – *C. euthyiproboscise* sp. nov., *C. glochidiatusum* sp. nov. and *C. longilingum* sp. nov. – described in the present paper have some obviously different morphological characters. There are 43 known species of *Cryptochetum* in the world, ten species are



Figs 22–29. Wings of eight species of *Cryptochetum*. **22**. *C. curvatum* Yang & Yang, 1996. **23**. *C. deltatum* Yang & Yang, 1996. **24**. *C. tianmuense* Yang & Yang, 2001. **25**. *C. acutulum* Yang & Yang, 1996. **26**. *C. zalatilabium* Xi & Yang, 2015. **27**. *C. kunmingense* Yang & Yang, 1996. **28**. *C. fanjingshanum* Yang & Yang, 1988. **29**. *C. maolanum* Yang & Yang, 1996. Scale bar = 0.1 mm



Figs 30–36. Wings of seven species of *Cryptochetum*. **30**. *C. shaanxiense* Xi & Yang, 2015. **31**. *C. yunnanum* Xi & Yang, 2015. **32**. *C. nonagintaseptem* Yang & Yang, 1998. **33**. *C. medianum* Yang & Yang, 1998. **34**. *C. sinicum* Yang & Yang, 1996. **35**. *C. acuticornutum* Yang & Yang, 1998. **36**. *C. beijingense* Yang & Yang, 1996. Scale bars = 0.1 mm.

known in the Palearctic Region (Rondani 1875; Hendel 1933; Cadahia 1984; Nartshuk 1984; Papp *et al.* 2018) and until now, 15 species were known to occur in China. Five species of Cryptochetidae have been recorded from Yunnan Province (Yang & Yang 1996; Xi & Yang 2015). Yunnan is one of the world's well-known regions for extremely rich biodiversity, which reveals the potential cryptochetid species-rich areas in China. The Chinese fauna of Cryptochetidae is extraordinarily rich, with the continued discovery and description of further species.

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