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. euthyproboscise 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 R4+5 or M1 (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 Monophlebidaceae (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**<sub>1</sub> = first branch of media
- **M**<sub>4</sub> = fourth branch of media
- ph = phallus
- **R**<sub>1</sub> = anterior branch of radius
- **R**<sub>2+3</sub> = second branch of radius
- **R**<sub>4+5</sub> = third branch of radius
- **S**<sub>c</sub> = 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**<sub>1</sub> ........... 2
   - Ocellar triangle large, reaching antennal base; costal vein (C) extending to vein **R**<sub>4+5</sub> 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**<sub>4+5</sub> terminating at apex of wing ................................................................. 4
   - Wing vein **R**<sub>4+5</sub> terminating before apex of wing, located between **R**<sub>4+5</sub> and **M**<sub>1</sub> ....................... 9

4. Wing vein **M**<sub>1</sub> between r-m and dm-m crossveins as long as dm-m crossvein (Fig. 24) .......................................................... *C. tianmuense* Yang & Yang, 2001
   - Wing vein **M**<sub>1</sub> between r-m and dm-m crossveins longer than dm-m crossvein ....................... 5

5. Wing vein **M**<sub>1</sub> 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**<sub>1</sub> 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 $1.2 \times$ as long as dm-m crossvein (Fig. 9) ................................................................. $C. \text{ glochidiatusum}$ sp. nov.
   - Wing vein $M_1$ between r-m and dm-m crossveins $1.5 \times$ as long as dm-m crossvein ........................................ 7

7. Antennal postpedicel slightly acute apically (Fig. 26) ................. $C. \text{ zalatilabium}$ 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) $2.0 \times$ as long as dm-m crossvein (Fig. 3) ................................................................. $C. \text{ euthyproboscise}$ sp. nov.
   - Knob of haltere dark yellow; distal portion of wing vein $M_4$ (part beyond crossvein dm-m) $1.5 \times$ as long as dm-m crossvein (Fig. 17) ................................................................. $C. \text{ longilingum}$ 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) .................. $C. \text{ kunmingense}$ 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 crossveins as long as vein $M_4$ (part beyond dm-m crossvein) (Fig. 28) ................................................................. $C. \text{ fanjingshanum}$ Yang & Yang, 1988
    - Wing vein $M_1$ between r-m and dm-m crossveins shorter than vein $M_4$ (part beyond dm-m crossvein) ........................................................................ 12

12. Distal portion of wing vein $M_4$ (part beyond dm-m crossvein) $1.7 \times$ as long as dm-m crossvein; dm-m crossvein virtually straight (Fig. 29) .................. $C. \text{ maolanum}$ Yang & Yang, 1996
    - Distal portion of wing vein $M_4$ (part beyond dm-m crossvein) $3.0 \times$ as long as dm-m crossvein; dm-m crossvein slightly curved (Fig. 30) .................. $C. \text{ shaanxiense}$ 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) ................................................................. $C. \text{ yunnanum}$ Xi & Yang, 2015
    - Antennal postpedicel slightly narrow and short, margin blunt and rounded apically (Fig. 32) .................. $C. \text{ nonagintaseptem}$ 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) .................................................. $C. \text{ medianum}$ Yang & Yang, 1998
    - Apex angle of ocellar triangle slightly narrower than distance between antennae; body slightly larger (body length 3.5 mm) (Fig. 34) .................................................. $C. \text{ sinicum}$ Yang & Yang, 1996

17. Apical angle of ocellar triangle slightly wider than distance between antennae; antennal postpedicel acute apically (Fig. 35) .................................................. $C. \text{ acuticornutum}$ Yang & Yang, 1998
    - Apical angle of ocellar triangle nearly equal to distance between antennae; antennal postpedicel with apical margin inclined inward (Fig. 36) .................................................. $C. \text{ beijingense}$ Yang & Yang, 1996
Descriptions of new species

Class Diptera Linnaeus, 1758
Family Cryptochetidae 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 setulae.

Figs 4–7. Cryptochetum euthyproboscise 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, katepisternum 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.
urn:lsid:zoobank.org:act:AC6FB5F5-5312-4F14-BCD5-666297C62955
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.
XI Y. & YIN X., New Cryptochetum Rondani, 1875 from Yunnan Province

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 setulæ, punctures at bases of setulæ conspicuous; frons without setae, orbital setae lacking; postvertical setæ erect, considerably stouter and longer than other setulæ on vertex. Antenna darkish brown with microomentum, large, shorter than face; scape and pedicel with black setulæ 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 setulæ. Proboscis flat and short, brownish yellow, with short sparse black setulæ, labellum slightly wide. Palpus very short, apically enlarged and rounded, dark brown with short dense black pubescence, margin with short sparse setulæ.

THORAX. Shiny, blackish brown with metallic blue-green luster; scutellum shiny, blackish brown. Setae and setulæ on thorax black, punctures at bases of setulæ 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 setulæ, katepisternum and anepimeron brown, bare. Legs slender, blackish brown except tarsi darkish yellow. Setae and setulæ 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 R₄+₅ and terminating before apex of wing; subcostal vein (Sc) weak, not angulate; R₁ curved, not angulate, R₂₊₃ and R₄₊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; M₁ 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 M₄, distal portion of M₄ (the part beyond dm-m) 1.8 × as long as dm-m (Fig. 10). Calypter brownish, with brownish microtrichiae, margin with brownish setulæ. Knob of haltere blackish brown, stalk brownish.

**Abdomen.** Brownish black with a metallic blue-green luster, wide and slightly flattened. Setae and setulæ on abdomen black. Male terminalia: epandrium (Figs 11–12) slightly wide and spheroid dorsally, with setulæ apically; surstylus slightly blunt apically; cercus rather narrowed, with dense setulæ. 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.
XI Y. & YIN X., New *Cryptochetum* Rondani, 1875 from Yunnan Province

**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 microomentum, large, shorter than face; scape and pedicle 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 R₄₊₅ and terminating before apex of wing; subcostal vein (Sc) weak, slightly angulated; R₁ curved, not angulated, R₂₋₃ and R₄₋₅ parallel for 4/5 along their lengths, then diverging to wing margin; r-m short; M₁ between r-m and dm-m 1.5 × as long as dm-m, dm-m slightly sinuous, forming an angle nearly at 90° with M₄, distal portion of M₄ (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 M₁ between r-m and dm-m 1.2 × as long as dm-m, ocellar triangle approximately in isosceles triangle. In *C. sinicum*, M₁ 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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