A new Brachineurini genus and two new species
(Diptera: Cecidomyiidae: Cecidomyiinae) from Yunnan, China

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Abstract: A new free-living genus of the mycophagous tribe Brachineurini, Loborrhizomyia gen. nov., and its type species Loborrhizomyia phaneroectata sp. nov. and another new species Loborrhizomyia aphanata sp. nov. are described from the Caiyang River Nature Reserve, Pu’er, Yunnan, China. The new genus is characterized in the tribe Brachineurini by the unique gonostylus having a ventral lobe protruding to the distal. The taxonomic status of the new genus and two new species is discussed with a comparison between the other related groups and an updated key to all known Brachineurini genera including the new genus is provided.

Key words: Cecidomyiidae, Brachineurini, Loborrhizomyia, new genus, new species, Yunnan, China

1. Introduction
The latest revised concept of the mycophagous tribe Brachineurini was given by Gagné and Jaschhof (2014), including 15 genera. The classification of Brachineurini was reviewed by Jiao et al. (2013), Jiao and Bu (2014), and Jiao et al. (2016), which included 14 genera by transferring Acinacistyla Fedotova & Sidorenko and Compositola Fedotova & Sidorenko to the supertribe Lasiopteridi and adding Pennaticoxita into Brachineurini, respectively. During an examination research on an early collection of Brachineurini specimens from southwestern China, another new genus, Loborrhizomyia gen. nov., and two new species were discovered from the Caiyang River Nature Reserve, Pu’er, Yunnan Province, China. We provide the generic diagnosis of Loborrhizomyia gen. nov., focusing on distinctions between the new genus and related congeners with a new revised key to the updated 15 genera of the tribe Brachineurini including the new genus. The two new species, Loborrhizomyia phaneroectata sp. nov. and Loborrhizomyia aphanata sp. nov., are described and illustrated in the present paper with the male discussed and compared between them.

2. Materials and methods
Tiny midge specimens of both of the new species were collected by Malaise traps. Adult specimens were preserved in 90% ethanol in the field immediately after collection. For morphological observation, some of the ethanol-preserved specimens were mounted on slides using Canada balsam. The morphological terminology follows Gagné (1981). The holotypes and other type specimens are deposited in the Institute of Entomology, College of Life Sciences, Nankai University (abbreviated as NKUM), Tianjin, China. All figures in the present article are based on holotypes of the two new species (slide numbers NKUCecid. No. BAN001 & BAO001).

3. Results
At present, the tribe Brachineurini is represented by the updated 15 genera, including the new genus Loborrhizomyia gen. nov. from China. A key for their separation is given below.

Key to males of all known genera in the tribe Brachineurini including the new genus in the present paper (modified according to the original key from Jiao et al., 2016)

1. Gonocoxite having mediobasal lobe undeveloped, only with one to several setae or prominences ................. 2
   - Gonocoxite having mediobasal lobe well developed ................................................................. 13

2. Veni Cu forked ......................................................................................................................... 3
   - Vein Cu not forked .................................................................................................................. 7
3. Gonocoxite with a stout distal lobe to keep gonostylus inserted on the middle of gonocoxite ................................................. 9
   - Gonocoxite without distal lobe .............................................................................................. 4
4. Gonostylus modified variously or with lobes ........ 5
   - Gonostylus normally shaped, without any modifications or lobes ................................................................. 6
5. Gonostylus modified to be hippocampus-shaped but without any lobes protruding to the distal ................................................................. Effusomyia Fedotova
   - Gonostylus having a ventral lobe protruding to the distal with the other parts normally shaped ................ Loborrhizomyia gen. nov.
6. Gonocoxite having mediobasal lobe with a smaller, slender and sclerotized prominence ................................................ Stabiliola Fedotova & Sidorenko
   - Gonocoxite having mediobasal lobe only with setae and without sclerotized prominences .......................... Rhizomyia Kieffer
7. Vein R₅ bent a little backward, joining vein C at wing apex ...................... 8
   - Vein R₅ bent a little forward in the middle, joining vein C distinctly anterior to wing apex ...................... 10
8. Hypoproct slightly emarginated in the distal ..................... Coccidomyia Felt
   - Hypoproct emarginated forming two distinct lobes ........................................ 9
9. Gonostylus with a subconical basolobe protruding outwardly; gonocoxite without any modifications or lobes .................. Alatostyla Fedotova & Sidorenko
   - Gonostylus normally shaped, without lobes; gonocoxite with a wing-shaped dorsal lobe .................. Pennaticoxita Jiao & Bu
10. Gonocoxite inwardly with a stout distal lobe; cerci with a depression forming two slender lobes .................. Epimyia Felt
   - Gonocoxite without distal lobes; cerci with a deep depression forming two broad lobes .................. 11
11. Gonocoxite with basolobe distinctly protruding outwardly .................. Nodalistyla Fedotova & Sidorenko
   - Gonocoxite without basolobe lobes .................. 12
12. Scutum completely covered with scales ........................ Brachineura Rondani
   - Scutum with most areas devoid of scales .................................. Chrybanae Gagné
13. Vein R₅ bent a little forward in the middle, joining vein C distinctly anterior to wing apex .................. Undoneura Fedotova & Sidorenko
   - Vein R₅ bent a little backward at distal 1/3, joining vein C slightly anterior to wing apex .................. 14
14. Gonocoxite with one or two swollen, un sclerotized, and densely pubescent mediobasal lobes .................. Brachyneurina Mamaev
   - Gonocoxite with a sclerotized and snowman-shaped mediobasal lobe .................. Volsatiola Fedotova & Sidorenko

3.1. Genus Loborrhizomyia gen. nov.  
   Type species: Loborrhizomyia phaneroectata sp. nov.  
   http://zoobank.org/urn:lsid:zoobank.org:act:5DC6C0F8-9CE0-4619-8930-3E1221AE8394

   **Etymology:** The generic name Loborrhizomyia means that this new genus is similar to Rhizomyia Kieffer except for the male gonostylus having a ventral lobe protruding to the distal.

   **Diagnosis:** The new genus Loborrhizomyia gen. nov. is characterized in the tribe Brachineurini by the unique gonostylus having a ventral lobe protruding to the distal.

   **Description:** Adult. Palpus sparsely setose, with 3 segments, last two segments longer than first one (Figure 1A). Antenna with 10 uninodeal flagellomeres (Figure 1B); pedicel subglobular, smaller than scape, both densely covered with setae ventrally; node of all flagellomeres subcylindrical, neck of all flagellomeres approximately as long as node except for the last node without neck; each node with 2 horizontal, appressed, band-shaped circumfila, subapically and subbasally respectively linked by two similar longitudinal circumfila, and 2 whorls of long, strong, and irregular setae, one subbasal and one subapical; first and second flagellomeres fused. Wing (Figure 1C) hyaline, sparsely covered with narrow scales and setose; vein Sc weak, veins C, R₁, and R₅ strong; R₅ joining C at basal 2/5; R₅ bent a little backward at distal 1/3, joining C at wing apex; vein M missing; Cu forked and straight, vein PCu approximately parallel with Cu. Legs densely covered with narrow scales and sparse setae; tarsal claws (Figure 1D) toothed on all legs. Male seventh and eighth tergites both reduced to one strongly sclerotized and linear band. Male genitalia (Figure 2A): Gonocoxite strong, not having distal lobe, and having mediobasal lobe undeveloped just with several setae; gonostylus long and stout, at least straight from the base to the middle, having a ventral lobe protruding to the distal with the other parts normally shaped; cerci with a deeper depression forming two lobes; hypoproct emarginated with a wider depression forming two lobes; aedeagus gradually tapered to apex. Female ovipositor unknown.

3.2. Loborrhizomyia phaneroectata sp. nov.  
   http://zoobank.org/urn:lsid:zoobank.org:act:12E4A1A5-ABEF-4999-89D0-AAE6B223B074

   **Type material:** Holotype: Male, China, Yunnan: Pu’er (the original city name as Simao), Caiyang River Nature Reserve (22.48°N, 100.58°E), 17.V.2000, Wen-Jun Bu leg., altitude 1500 m, Malaise trap, NKUCecid. No. BAN001. Paratypes: 3 males, same data as holotype, NKUCecid. No. BAN002-004. All type specimens deposited in NKUM.

   **Etymology:** The specific name phaneroectata means the male gonostylus having a ventral lobe distinctly protruding outwardly both from the dorsal and ventral views.

   **Diagnosis:** The new species Loborrhizomyia phaneroectata sp. nov. is characterized by the unique gonostylus having a ventral lobe distinctly protruding outwardly with the distal part not completely hidden by
the distal half of gonostylus from the dorsal view.

**Description**: Body color yellow brown. Body length: 1.20–1.25 mm (n = 4). Wing length (measured from the base): 1.40–1.45 mm (n = 4). Wing width: 0.60–0.65 mm (n = 4).

Head (Figures 1A, 1B): Eye bridge 7 facets long in the middle of vertex. 3rd male flagellomere (Figure 1B) with the node 2.10–2.20 times as long as wide and the neck 5.40–5.50 times as long as wide, 0.96–0.97 times length of node.

Thorax (Figures 1C, 1D): Wing (Figure 1C) hyaline, 2.27–2.28 times as long as wide. Sc with one pore at basal 1/3; R, with one pore at basal 1/3. Tarsal claws (Figure 1D) toothed on all legs; empodium a little shorter than tarsal claw; pulvillus cylindrical, a little shorter than 1/2 length of claw.

Abdomen: Each tergite and sternite densely covered uniformly with scales. First through sixth tergites developed and strip-shaped, with an irregular but mostly single, posterior row of setae, with several pairs of lateral

*Figure 1. Loborrhizomyia phaneroectata sp. nov.* holotype (male): (A) Palpus (lateral view). (B) Third flagellomere (ventral view). (C) Wing (dorsal view). (D) Fore tarsal claw (lateral view). Scale bars: 0.1 mm for A and B, 0.5 mm for C, 0.05 mm for D.
setae, and with one anterior of trichoid sensilla; first tergite much shorter than second tergite; seventh and eighth tergites both reduced to one strongly sclerotized, latitudinal and linear band with several scattered setae; second through eighth sternites with one anterior pair of closely set trichoid sensilla; second sternite divided latitudinally into two bands, respectively, with one single, anterior row of setae and one single, posterior row of setae; third through sixth sternites subrectangular with an irregular but mostly single, posterior row of setae, and covered with several scattered anterior, lateral, and central setae; seventh sternite narrower than sixth, with an irregular but mostly single, posterior row of setae, and covered with relatively denser lateral and central setae; eighth sternite much shorter and much narrower than seventh, and reduced to subobtuse isosceles triangle shape, covered with an irregular but mostly single, posterior row of setae and several anterior setae.

Male genitalia (Figures 2A, 2B): Gonocoxite stout, having mediobasal lobes reduced to two sclerotized, glabrous and clustered setae, both inserted in a lower pie-shaped prominence; gonostylus strong, almost straight from the base to the middle, gradually arched from the middle to the distal, approximately 4/5 length of gonocoxite, covered with a few setae and dense microtrichia, with one short seta located apically on the inner side, and with a strong tooth apically, also having a ventral lobe distinctly protruding out of the gonostylus from the dorsal view; cerci deeply separated with a U-shaped depression forming two rounded lobes with a few long apical setae; hypoproct a little longer than cerci, emarginated with a wider and deeper depression forming two digitiform lobes, entirely with many dense short setae; aedeagus a little shorter than gonocoxite, gradually tapered from the base to subapex and distinctly constricted from subapex to apex, with the apex pointed. Female ovipositor unknown.

Distribution: China (Yunnan Province).

3.3. Loborrhizomyia aphanata sp. nov.


Type material: Holotype: Male, China, Yunnan: Pu’er (originally Simao), Caiyang River Nature Reserve (22.48°N, 100.58°E), 17.V.2000, Wen-Jun Bu leg., altitude 1500 m, Malaise trap, NKUCecid. No. BAO001. Paratype: male, same data as holotype, NKUCecid. No. BAO002. All type specimens deposited in NKUM.

Etymology: The specific name aphanata means the male gonostylus having a ventral lobe with the distal part completely hidden by the distal half of gonostylus from the dorsal view.

Diagnosis: The new species Loborrhizomyia aphanata sp. nov. is characterized by the unique gonostylus having a ventral lobe with the distal part completely hidden by the distal half of gonostylus from the dorsal view.

Description: Body color yellow brown. Body length: 1.25–1.30 mm (n = 2). Wing length (measured from the base): 1.55–1.60 mm (n = 2). Wing width: 0.65–0.70 mm (n = 2).

Head (Figures 3A, 3B): Eye bridge 8 facets long in the middle of vertex. 3rd male flagellomere (Figure 3B) with the node 1.60–1.70 times as long as wide and the neck 5.10–5.20 times as long as wide, 1.15–1.16 times length of node.

Thorax: Wing (Figure 3C) hyaline, 2.27–2.28 times as long as wide. R, with one pore at basal 1/3. The fifth tarsus including the tarsal claws on all legs missed.

Abdomen: Each tergite and sternite densely covered uniformly with scales. First through sixth tergites
developed and strip-shaped, with a single, posterior row of setae, with several pairs of lateral setae, and with one anterior of trichoid sensilla; first tergite much shorter than second tergite; seventh and eighth tergites both reduced to one strongly sclerotized, latitudinal and linear band with several scattered setae; second through eighth sternites with one anterior pair of closely set trichoid sensilla; second sternite divided latitudinally into two bands, respectively, with one irregular but mostly single anterior row of setae and one similar irregular but mostly single posterior row of setae; third through sixth sternites subrectangular with an irregular but mostly single, posterior row of setae, and covered with several scattered anterior, lateral, and central setae; seventh sternite narrower than sixth, with an irregular but mostly single, posterior row of setae, and covered with relatively denser lateral and central setae; eighth sternite distinctly much shorter and much narrower than seventh, and reduced to subobtuse isosceles triangle shape, covered with an irregular but mostly single, posterior row of setae and several anterior setae.

Male genitalia (Figures 4A, 4B): Gonocoxite strong, but relatively slenderer than *phaneroectata*, having mediobasal lobes reduced to two sclerotized, glabrous and clustered setae; gonostylus strong, almost straight from the basal to the subdistal, only arched from subdistal to the distal, approximately 2/3 length of gonocoxite, covered with a few setae and dense microtrichia, with two short setae located apically on the inner side, and with a slender tooth apically, also having a ventral lobe with the distal part completely hidden by the distal half of gonostylus from the dorsal view; cerci deeply separated with a wide depression forming two finger-shaped lobes with a few long apical setae; hypoproct a little shorter than cerci, emarginated with a wider and moderate depression forming two rounded lobes, entirely

Figure 3. *Loborrhizomyia aphanata* sp. nov. holotype (male): (A) Palpus (lateral view). (B) Third flagellomere (ventral view). (C) Wing (dorsal view). Scale bars: 0.1 mm for A and B, 0.5 mm for C.
with many dense short setae; aedeagus shorter than gonocoxite without lobes or any other modifications, and mediobasal lobe only with several setae, but the new genus is easily distinguishable from *Rhizomyia* by gonostylus having a ventral lobe protruding to the distal, while in *Rhizomyia* gonostylus is normally shaped. With the description of the new genus in the present paper, the tribe Brachineurini reveals that more and more genera are being discovered with variously modified or lobed gonostylus in males, such as *Alatostyla* Fedotova & Sidorenko, *Effusomyia* Fedotova, and *Nodalistyla* Fedotova & Sidorenko recorded in the Far East. Similar morphologic change is rare in the other tribes of the subfamily Cecidomyiinae. However, we could not suggest how the specific morphological structure in these genera above adapts to their ecology and behavioral requirements, such as courtship and mating. As for the feeding habits, considering that most Brachineurini species have been reported for their larvae associated with arthropodous remains and their adults reared from fungi and rotting wood (Mamaev and Krivosheina, 1965; Harris and Evans, 1979; Gagné and Jaschhof, 2017; Jiao et al., 2017), *Loborrhizomyia* larvae may predictably be mycophagous too.

With regard to the comparison between the two new species, *Loborrhizomyia phaneroectata* sp. nov. differs from *L. aphanata* sp. nov. by its ventral lobe on gonostylus distinctly protruding out of gonostylus from the dorsal view, while *aphanata* has ventral lobe on gonostylus completely hidden by the distal half of gonostylus from the dorsal view. As for the other parts: aedeagus of the former has a pointed apex, but that of the latter a blunt one; hypoproct of the former emarginated with a deeper depression forming two digitiform lobes, while that of the latter emarginated with a moderate depression forming two rounded lobes.

Both of the two new species belonging to this new genus are distributed in Yunnan Province of China, which is one of the world’s most well-known regions for extremely rich biodiversity, which reveals the potential cecidomyiid midge species diversity-rich areas in China, especially for the mycophagous tribe Brachineurini. Therefore, we believe that more new Brachineurini groups will be found in Yunnan and nearby regions when further surveys are done in southwestern China.

**Nomenclatural acts:** This work and the nomenclatural acts it contains have been registered in ZooBank. The ZooBank Life Science Identifier (LSID) for this publication is: http://zoobank.org/urn:lsid:zoobank.org:pub:0E69531E-6323-4545-B102-CCFA69DD0C88

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