



Contribution to the genus *Phlugiolopsis* (Tettigoniidae: Meconematinae) from China

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Abstract

This paper reports four new species from Yunnan, Hunan and Guangdong in China, i.e. *Phlugiolopsis procera* **sp. nov.**, *Phlugiolopsis clavata* **sp. nov.**, *Phlugiolopsis nanlingensis* **sp. nov.** and *Phlugiolopsis spina* **sp. nov.** While the females of *Phlugiolopsis bispinata* Bian & Shi, 2018 and *Phlugiolopsis breviproceris* Zheng, Shi & Chang, 2023 are described for the first time. All specimens are deposited in the Museum of Hebei University.

Key words: Tettigoniidae, Meconematinae, *Phlugiolopsis*, new species, China

Introduction

The genus *Phlugiolopsis* was established by Zeuner (1940) for type species *Phlugiolopsis henryi* Zeuner, 1940 from a tropical fern greenhouse in England. It is brachypterous, which has small somatotype and inhabits a typical tropical environment. Species of *Phlugiolopsis* are fond of tropical mixed deciduous forests which are dominated by evergreen woody plants where they live in the rich and dense undergrowth layer (Helfert & Sanger, 2002).

China combines both tropical and subtropical climates with multiple mountains and valleys. Local recruitment may have been accelerated by adaptive differentiation across disparate habitats (forest versus alpine) over short geographic distances which have been facilitated by habitat fragmentation and elevational gradients, these can be caused by active orogeny and climate change-induced landscape modifications (Ye *et al.*, 2019; Ding *et al.*, 2020; Ding *et al.*, 2023). Nanling Mountain is located in the border of 4 provinces of China with significant climatic variations. Numerous related researches about insects have been reported for the past few years includes our laboratory (Li *et al.*, 2019; Xin *et al.*, 2020; Zhang & Yin, 2022; Zhang & Yin, 2023). This paper records the new species of *Phlugiolopsis* collected from Nanling Region for the first time. Hengduan Mountain has abundant animal and plant resources, and many new species descriptions have been made in recent years (Wang *et al.*, 2023; Yang & Peng, 2023; Zheng *et al.*, 2023; Yu & Wang, 2024), this paper reports new material of *Phlugiolopsis* from Hengduan Mountain.

Material and methods

Specimens are preserved in 95% ethanol, some are dried and pinned specimens and which were measured under a Nikon-SMZ-800 stereomicroscope. Morphological structures were examined using a Leica M205A stereo microscope and a Leica DFC450 digital imaging system was used to acquire morphological images. Image editing was accomplished using Adobe Photoshop CC 2019. All specimens are stored in the Museum of Hebei University (HBU).

The following conventions were adopted for the specimen measurements: body length: distance from apex of fastigium verticis to posterior margin of tenth abdominal tergite in the midline; pronotum length: distance from

anterior to posterior margins of pronotum in the midline; tegmen length: distance from base to apex of tegmen in lateral view on exposing area; hind femur length: distance from base of hind femur to apex of genicular lobe; ovipositor length: distance from base of subgenital plate to apex of ovipositor.

***Phlugiolopsis procera* sp. nov.**, Chinese name 突板吟螽
(Fig. 1)

Description. Male. Body small. Fastigium verticis conical, apex rounded, furrowed dorsally. Eyes subglobose, prominent forward and outward. Apical segment of maxillary palpus slightly longer than subapical one, apical area lightly swelled.

Pronotum elongate backwards, anterior margin slightly prominent, posterior margin rounded; lateral lobe longer than deep, without humeral sinus. Tegmina short, apices slightly surpassing posterior margin of pronotum, reaching middle area of second abdominal tergite, apices rounded. Hind wings absent.

All femora unarmed on ventral surfaces. Fore coxa with 1 spine; fore tibia with tympana open and oval on both sides, with 5 outer and 4 inner spines on ventral surface. Middle tibia with 3 spines on inner margin and 5 spines on outer margin on ventral surface. Genicular lobes of hind femur with apices rounded; hind tibia with 21–23 spines on both sides of dorsal surface separately, bearing 1 pair of dorsal apical spurs and 2 pairs of ventral apical spurs.

Tenth abdominal tergite with posterior margin feebly concave. Cercus expanded inwards on dorsal surface of basal half; interno-ventral surface with a stubby conical process near basal area, apex rounded; apical third of cercus cylindrical, almost rectangularly incurved, its interno-dorsal surface with a small tooth, tip acute; apex of cercus slightly acute. Subgenital plate with base broad, apical area narrowing; basal margin feebly concave, apical area triangularly protruding backwards, terminal slightly rounded; styli conical, apices rounded, inserted on apical third of subgenital plate on lateral margins.

Female. Lateral surfaces of eighth abdominal tergite on apical area with a digital projection separately. Tenth abdominal tergite short, posterior margin lightly concave. Cercus conical, apex acute. Ovipositor short, slightly upcurved; dorsal valvula with apex acute, apex of ventral valvula with a feeble hook. Subgenital plate broader than long, approximately rectangular; basal margin relatively straight, apical area angularly protruding backwards, apex rounded.

Coloration. Body yellowish brown. Eyes dark brown. Dorsum of head with 4 longitudinal dark brown stripes. Flagellum of antenna with sparse annulate brown stripes, lamellar uplift on inner margin of antennal scrobe dark brown. Disc of pronotum with a broad longitudinal brown stripe, anterior two thirds black on lateral margins, its posterior half pale and slightly widened. Genicular lobes black; tarsi black.

Material examined. Holotype: ♂, Fenshuiling, Jinping, Yunnan, 21 September, 2023, coll. Hao Xu. Paratypes: 1♂2♀, Fenshuiling, Jinping, Yunnan, 19 September, 2023, coll. Hao Xu and Yueting Duan. Other material: 1♂, Fenshuiling, Jinping, Yunnan, 22 September, 2023, coll. Yueting Duan; 2♀, Fenshuiling, Jinping, Yunnan, 19 September, 2023, coll. Hao Xu.

Measurements (mm). Body: ♂8.6–9.2, ♀9.8–10.2; pronotum: ♂3.4–3.5, ♀3.7–3.9; tegmen: ♂1.2–1.3, ♀1.7–1.8; hind femur: ♂7.6–8.2, ♀9.1–9.6; ovipositor: 6.5–6.7.

Discussion. The new species is similar to *Phlugiolopsis yunnanensis* Shi & Ou, 2005, but it can be distinguished by near basal area of male cercus with a stubby conical process on interno-ventral surface, apex rounded; subgenital plate triangularly protruding on apical area, terminal rounded; female subgenital plate broader than long, approximately rectangular.

Etymology. The name of the new species refers to male subgenital plate protruding backwards on apical area, Latin “*procer-*” means protruding.

Distribution. China (Yunnan).

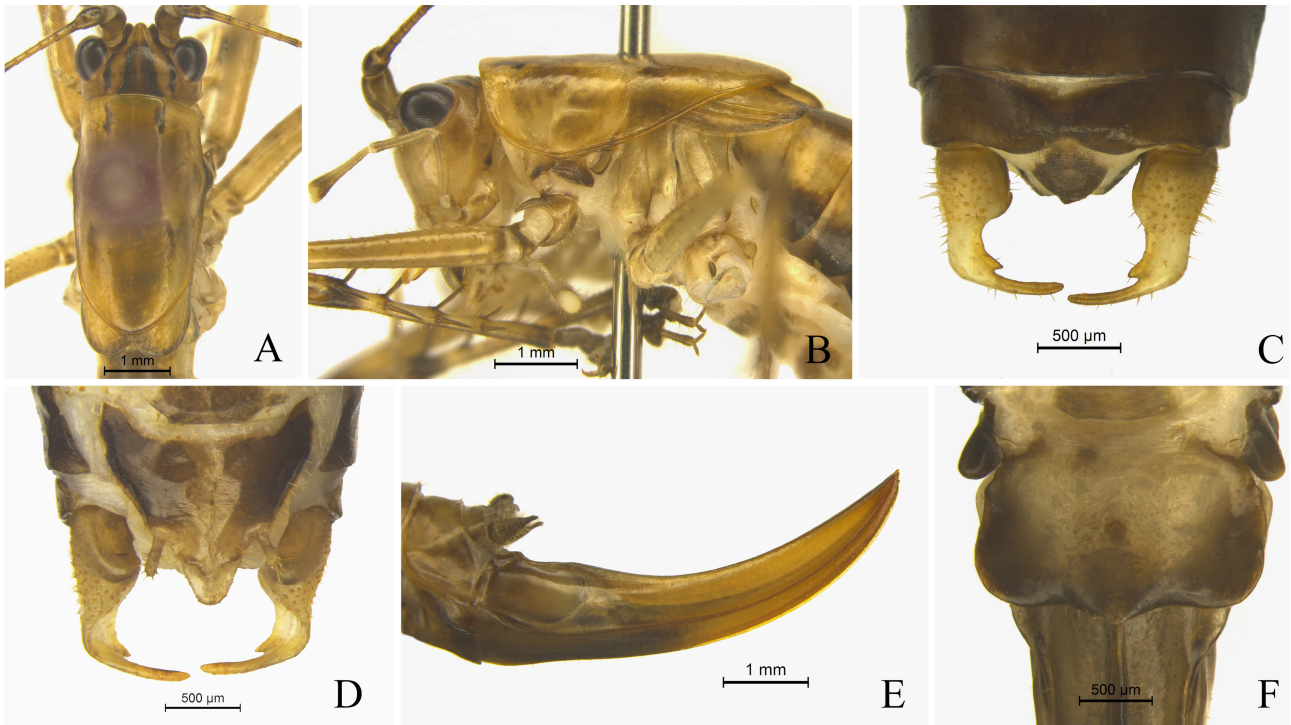


FIGURE 1. *Phlugiolopsis procera* sp. nov., male: **A–B.** head and pronotum: **A.** dorsal view; **B.** lateral view; **C–D.** apex of abdomen: **C.** dorsal view; **D.** ventral view; female: **E.** ovipositor in lateral view; **F.** apex of abdomen in ventral view.

***Phlugiolopsis clavata* sp. nov., Chinese name 棒尾吟蝨**

(Fig. 2)

Description. Male. Body small. Fastigium verticis conical, apex rounded, with longitudinal sulcus on dorsum. Eyes oval, protruding forwards. Apical and subapical segments of maxillary palpus almost equal in length, apical area broadened.

Pronotum slightly elongate backwards, anterior margin relatively straight, posterior margin rounded; lateral lobe longer than deep, posterior margin tapering, humeral sinus absent. Tegmina short, apices slightly surpassing posterior margin of pronotum, reaching middle area of second abdominal tergite, apices rounded. Hind wings absent.

All femora without spines on ventral surfaces. Fore coxa with 1 spine; fore and middle tibiae each with 4 spines on inner side and 5 spines on outer side on ventral surfaces respectively; fore tibial tympana open and oval on both sides. Genicular lobes of hind femur with apices rounded; hind tibia with 27–32 internal spines and 33–36 external spines on dorsal surface, bearing 1 pair of dorsal apical spurs and 2 pairs of ventral apical spurs.

Tenth abdominal tergite with a broad and shallow concavity on posterior margin. Cercus short, slightly curved inwards; basal area with a conic process, apex faintly rounded; near basal area with a digital projection on interno-ventral surface, curved forwards; apical half of cercus clavate, slightly robust, apex rounded. Subgenital plate roughly trapezoid, basal margin concave, posterior margin slightly concave; styli conical, inserted on lateral margins of apical area of subgenital plate.

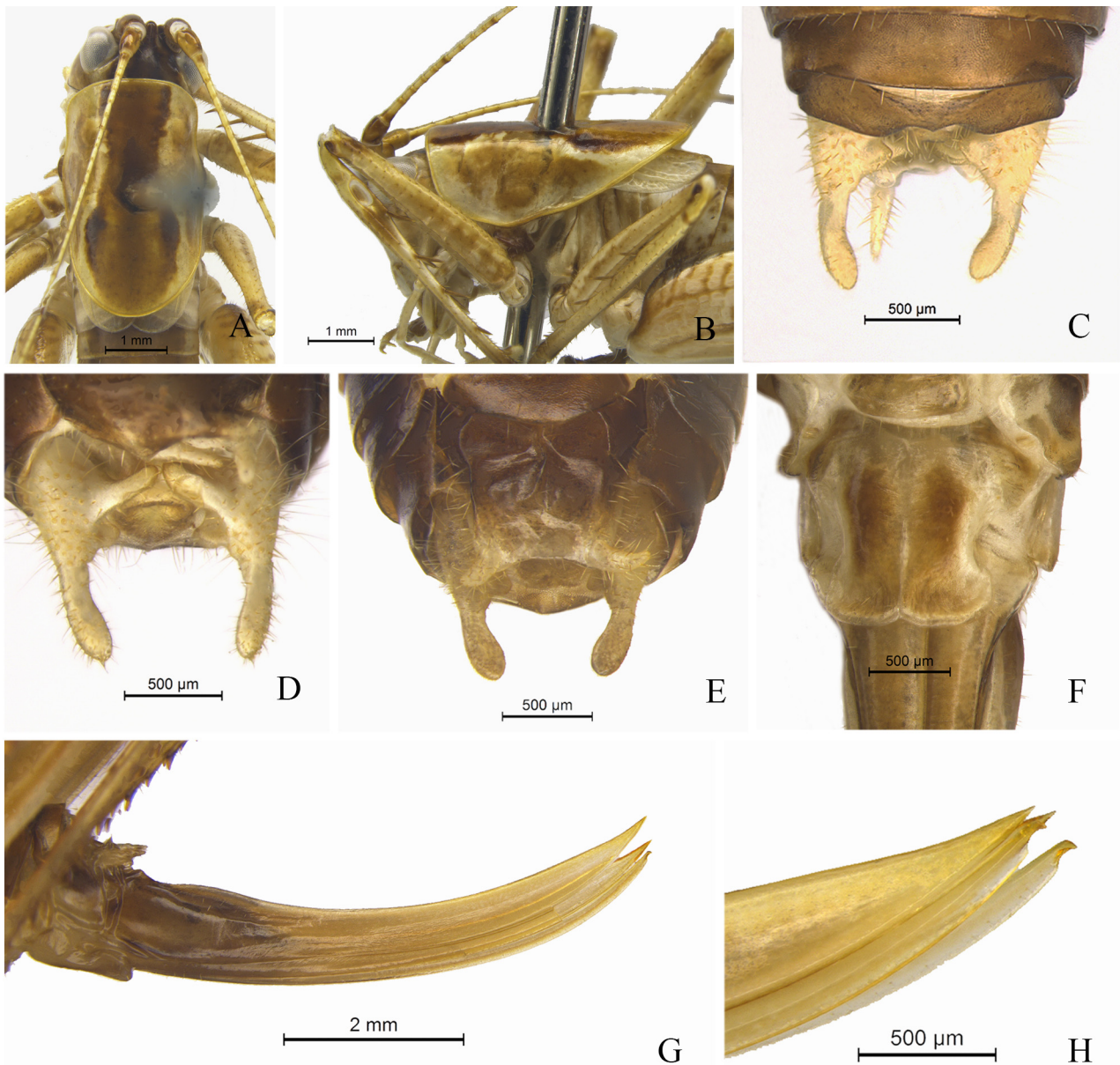


FIGURE 2. *Phlugiolopsis clavata* sp. nov., male: **A–B.** head and pronotum: **A.** dorsal view; **B.** lateral view; **C–E.** apex of abdomen: **C.** dorsal view; **D, E.** ventral view; female: **F.** subgenital plate in ventral view; **G.** ovipositor in lateral view; **H.** apex of ovipositor in lateral view.

Female. Tenth abdominal tergite short. Cercus conical, apex acute. Ovipositor comparatively long, slightly curved dorsad; apex of dorsal valvula acute, ventral valvula with apex hook-shaped. Subgenital plate liguliform with basal margin roughly straight, near middle area obviously concave on lateral margins; the median carina distinct on apical half, posterior margin weakly concave.

Coloration. Body yellowish brown. Eyes dark brown. Dorsal area of head with 4 longitudinal dark brown stripes. Flagellum of antenna with sparse annulate brown stripes, lamellar uplift on internal margin of antennal scrobe dark brown. Pronotal disc with a broad longitudinal brown stripe, two thirds anterior area of longitudinal stripe dark brown on lateral margins, posterior half slightly widened. Genicular lobes black; tarsi dark brown.

Material examined. Holotype: ♂, Daxueshan, Yongde, Yunnan, 24 August, 2020, coll. Peng Cui. Paratypes: 2♂2♀, other data same as holotype. Other material: 4♂6♀, other data same as holotype; 2♀, Daxueshan, Yongde, Yunnan, 23 August, 2020, coll. Peng Cui.

Measurements (mm). Body: ♂7.5–8.5, ♀8.4–8.5; pronotum: ♂3.5–4.0, ♀3.5–3.9; tegmen: ♂1.0–1.2, ♀0.8–1.1; hind femur: ♂8.5–9.5, ♀8.4–9.5; ovipositor: 6.4–6.6.

Discussion. This species resembles *Phlugiolopsis breviproceris* Zheng, Shi & Chang, 2023, it can be distinguished by male cercus with a conic process on dorsal surface of base, apex slightly rounded; apical half of cercus clavate, comparatively robust, apex rounded.

Etymology. The new species name is derived from apical half of male cercus being clavate, Latin “*clava*” means clavate.

Distribution. China (Yunnan).

***Phlugiolopsis nanlingensis* sp. nov., Chinese name 南岭吟螽**
(Fig. 3)

Description. Male. Body small. Fastigium verticis conical, apex rounded, with median sulcus on dorsum. Eyes nearly globular, slightly protruding forward. Apical segment of maxillary palpus roughly equal to subapical one in length, apical area inflated, apex truncate.

Pronotum longer, anterior margin approximately straight, posterior margin rounded; lateral lobe longer than high, humeral sinus absent. Tegmina short, terminals slightly surpassing posterior margin of pronotum, reaching posterior margin of second abdominal tergite, apices rounded. Hind wings absent.

All femora unarmed on ventral surfaces. Fore coxa with 1 spine; fore tibia with 5 internal spines and 6 external spines on ventral surface; both sides of tympana open and oval. Middle tibia with 6 external spines and 4 internal spines on ventral surface. Hind femur with apices of genicular lobes rounded; hind tibia with 24–27 spines on both inner and outer sides on dorsal surface, with 2 pairs of ventral apical spurs and 1 pair of dorsal apical spurs.

Tenth abdominal tergite with posterior margin concave. Cercus with a semicircular expansion on dorsal surface of basal third; near middle area with an irregular process on interno-ventral surface, which broader on basal half and narrow on apical half; apical third of cercus cylindrical, obviously incurved, apex acute. Subgenital plate subtrapezoidal, basal margin with a V-shaped membranous area, posterior margin feebly concave; styli comparatively long, inserted on ventral surface of apical third of subgenital plate near lateral margins.

Female. Tenth abdominal tergite short, posterior margin concave. Cercus conical, apex acute. Ovipositor short, slightly curved upwards; apex of dorsal valvula acute, apex of ventral valvula hook-shaped. Subgenital plate rectangular on basal half, apical half narrowing; basal margin comparatively straight, which concave on lateral margins; posterior margin faintly concave.

Coloration. Body yellowish brown. Eyes reddish brown. Dorsal area of head with 4 longitudinal dark brown stripes. Flagellum of antenna with sparse annulate brown stripes, lamellar uplift on inner margin of antennal scrobe dark brown. Disc of pronotum with a broad longitudinal brown stripe, the longitudinal stripe widened on posterior area, lateral margins dark brown on anterior two thirds. Genicular lobes black; tarsi dark brown.

Material examined. Holotype: ♂, Nanling, Ruyuan, Guangdong, 27 August, 2020, coll. Lidan Zhang. Paratypes: 1♂, Mangshan, Yizhang, Hunan, 30 August, 2020, coll. Lidan Zhang; 1♀, Mangshan, Yizhang, Hunan, 24 July, 2023, coll. Chun Chen. Other material: 1♂, Mangshan, Yizhang, Hunan, 24 July, 2023, coll. Chun Chen.

Measurements (mm). Body: ♂6.3–8.3, ♀6.7; pronotum: ♂3.3–4.0, ♀3.5; tegmen: ♂1.1–1.3, ♀1.0; hind femur: ♂7.2–7.9, ♀8.1; ovipositor: 5.6.

Discussion. This new species is really similar to *Phlugiolopsis damingshanis* Bian, Shi & Chang, 2012, but differs from the latter in male cercus semicircular expanded inwards on basal area; ventral surface with an irregular process, which broader on basal half and narrow on apical half. Yet for *Phlugiolopsis damingshanis* Bian, Shi & Chang, 2012 male cercus expanded inwards on dorsal surface of base, apex roundly triangular; ventral surface with a compressed process, apex rounded.

Etymology. The new species name is derived from its type locality Nanling.

Distribution. China (Hunan, Guangdong).

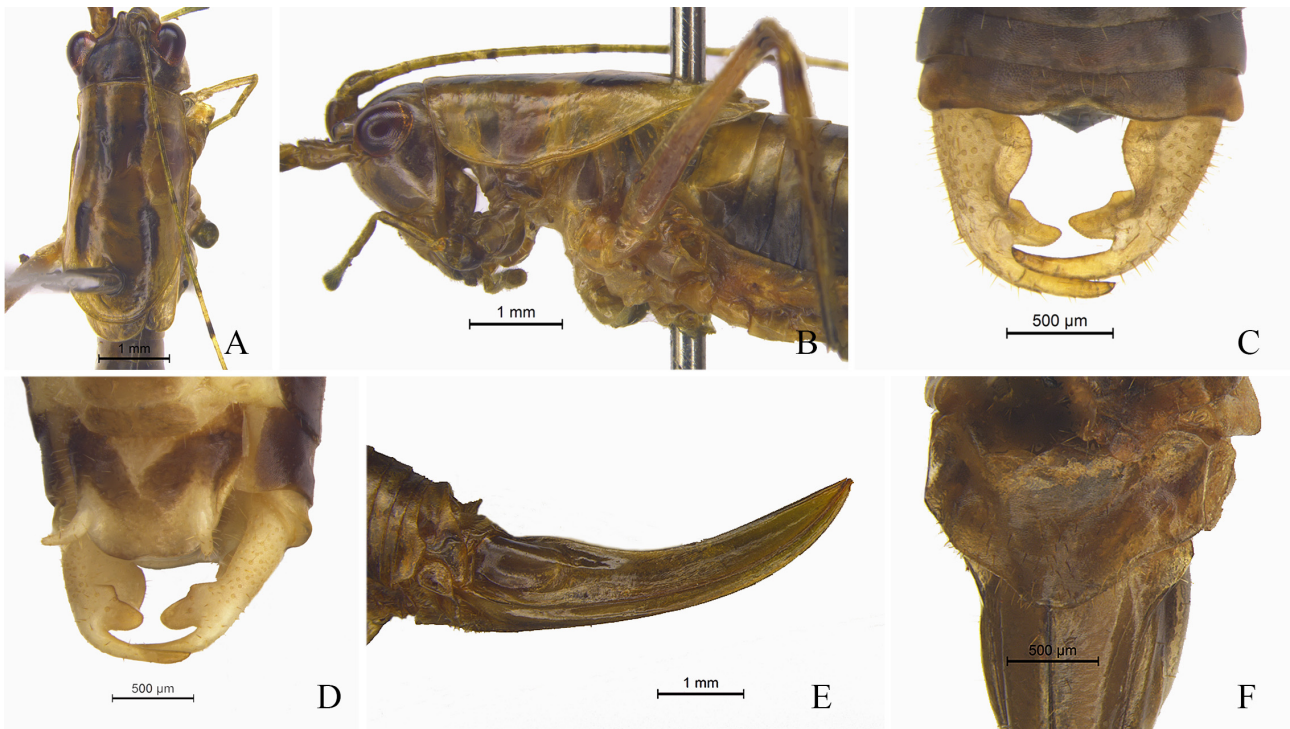


FIGURE 3. *Phlugiolopsis nanlingensis* sp. nov., male: A–B. head and pronotum: A. dorsal view; B. lateral view; C–D. apex of abdomen: C. dorsal view; D. ventral view; female: E. ovipositor in lateral view; F. subgenital plate in ventral view.

***Phlugiolopsis spina* sp. nov., Chinese name 刺板吟蝽**

(Fig. 4)

Description. Male. Body small. Fastigium verticis conical, apex rounded, with longitudinal sulcus on dorsal area. Apical segment of maxillary palpus subequal to subapical one in length, apical area inflated. Eyes globular, protruding forwards.

Pronotum moderately elongate backwards, anterior margin slightly prominent, posterior margin rounded; lateral lobe longer than deep, humeral sinus absent. Tegmina short, apices slightly surpassing posterior margin of pronotum, reaching middle area of third abdominal tergite, apices rounded. Hind wings absent.

All femora without spines on ventral surfaces. Fore coxa with 1 spine; fore tibia with 5 inner spines and 6 outer spines on ventral surface; tibial tympana open and ovoid on both sides. Middle tibia with 5 inner spines and 5–6 outer spines on ventral surface. Genicular lobes of hind femur with apices rounded; hind tibia with 3 spines on inner side and 7 spines on outer side on ventral surface as well as 22–25 inner spines and 26–29 outer spines on dorsal surface, bearing 2 pairs of ventral apical spurs and 1 pair of dorsal apical spurs.

Tenth abdominal tergite short, posterior margin concave. Cercus slightly curved inwards, basal area stout, apical area narrowing; base with a lobate projection on interno-dorsal surface, apex rounded; subbasal area with a digital process on ventral surface, which curved forwards near middle area, apical area slightly thin, apex rounded; apical half of cercus cylindrical, apex rounded. Subgenital plate triangular with base broad and apex narrow; basal margin roughly straight, posterior margin rounded; styli conical and positioned on apical third of ventral surface.

Female. Tenth abdominal tergite short. Epiproct triangular, apex rounded. Cercus conical, apex acute. Ovipositor short, weakly curved dorsally; apex of dorsal valvula acute, ventral valvula with a terminal hook. Subgenital plate with basal margin relatively straight, lateral margins obviously concave, which bulged in the middle; basal third with a stubby spine on lateral margins respectively; posterior margin concave, apices of lateral lobes rounded.

Coloration. Body yellowish brown. Eyes reddish brown. Dorsal area of head with 4 longitudinal dark brown stripes. Scape and pedicel of antenna dark brown, lamellar uplift on inner margin of antennal scrobe dark brown. Disc of pronotum with a broad longitudinal brown stripe, which slightly widened on posterior area, lateral margins dark brown. Genicular lobes black; spines on tibia black; tarsi dark brown.

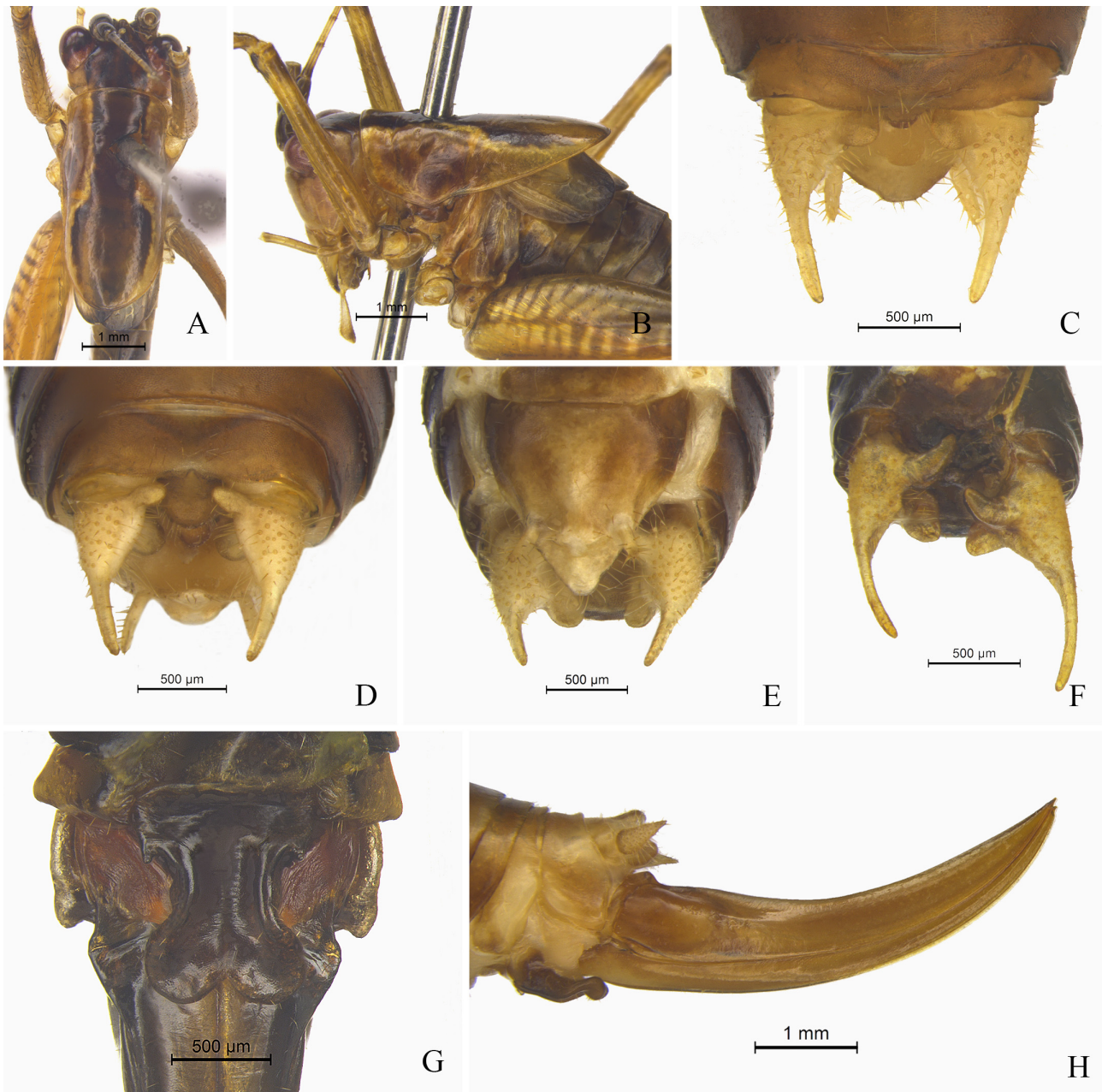


FIGURE 4. *Phlugiolopsis spina* sp. nov., male: **A–B.** head and pronotum: **A.** dorsal view; **B.** lateral view; **C–F.** apex of abdomen: **C.** dorsal view; **D.** dorso-apical view; **E, F.** ventral view; female: **G.** subgenital plate in ventral view; **H.** ovipositor in lateral view.

Material examined. Holotype: ♂, Xiaobazi, Maguan, Yunnan, 20 August, 2019, coll. Peng Cui. Paratypes: 1♂2♀, other data same as holotype. Other material: 1♀, Xiaobazi, Maguan, Yunnan, 20 August, 2019, coll. Peng Cui; 2♂, Xiaobazi, Maguan, Yunnan, 21 August, 2019, coll. Peng Cui; 1♂, Xiaobazi, Maguan, Yunnan, 6 August, 2022, coll. Mengjia Zheng; 2♂, Nanwenhe, Malipo, Yunnan, 25 August, 2019, coll. Peng Cui.

Measurements (mm). Body: ♂6.5–7.7, ♀9.5–9.6; pronotum: ♂3.5–4.1, ♀3.8–4.0; tegmen: ♂1.4–1.6, ♀1.3–1.7; hind femur: ♂7.9–9.1, ♀8.5–8.6; ovipositor: 5.3–5.8.

Etymology. The new species is named after female subgenital plate with a pair of spinous processes on basal third, Latin “*spina*” means spinose.

Discussion. This species resembles *Phlugiolopsis circolobosis* Bian, Shi & Chang, 2013, but differs from the latter in male cercus with a short lobate process at base, apex rounded; subgenital plate triangular, apex rounded; female subgenital plate with a pair of spinous processes on lateral margins of one third base.

Distribution. China (Yunnan).

***Phlugiopsis bispinata* Bian & Shi, 2018**

(Fig. 5)

Phlugiopsis (Longiloba) bispinata Bian & Shi, 2018: 345.

Holotype: male; type locality: Huanglianshan, Lvchun, Yunnan; location of type specimen: the Museum of Hebei University.

Female. Tenth abdominal tergite with posterior margin relatively straight. Cercus conical, apex acute. Ovipositor short, moderately curved dorsad; apex of dorsal valvula acute, ventral valvula with apex hook-shaped. Subgenital plate broad in middle area, apical area narrowing; basal margin roughly straight, lateral margins concave on basal half, posterior margin obtusely triangular. The previously unknown female is described for the first time.

Material examined. Holotype: ♂, Huanglianshan, Lvchun, Yunnan, 17 August, 2016, coll. Xun Bian. Other material: 1♀, Huanglianshan, Lvchun, Yunnan, 17 August, 2016, coll. Xun Bian; 2♂1♀, Wuliangshan, Jingdong, Yunnan, 9 August, 2022, coll. Yanhao Duan and Jie Su; 1♂1♀, Zhuyeping, Jingdong, Yunnan, 9 August, 2020, coll. Peng Cui; 3♂8♀, Yuanjiang, Yuxi, Yunnan, 29 September, 2009, coll. Benyong Mao.

Measurements (mm). Body: ♂6.9–7.1, ♀7.1–9.4; pronotum: ♂3.9–4.0, ♀3.9–4.0; tegmen: ♂1.7–1.8, ♀1.2–1.6; hind femur: ♂7.9–8.8, ♀8.8–9.0; ovipositor: 5.7–5.9.

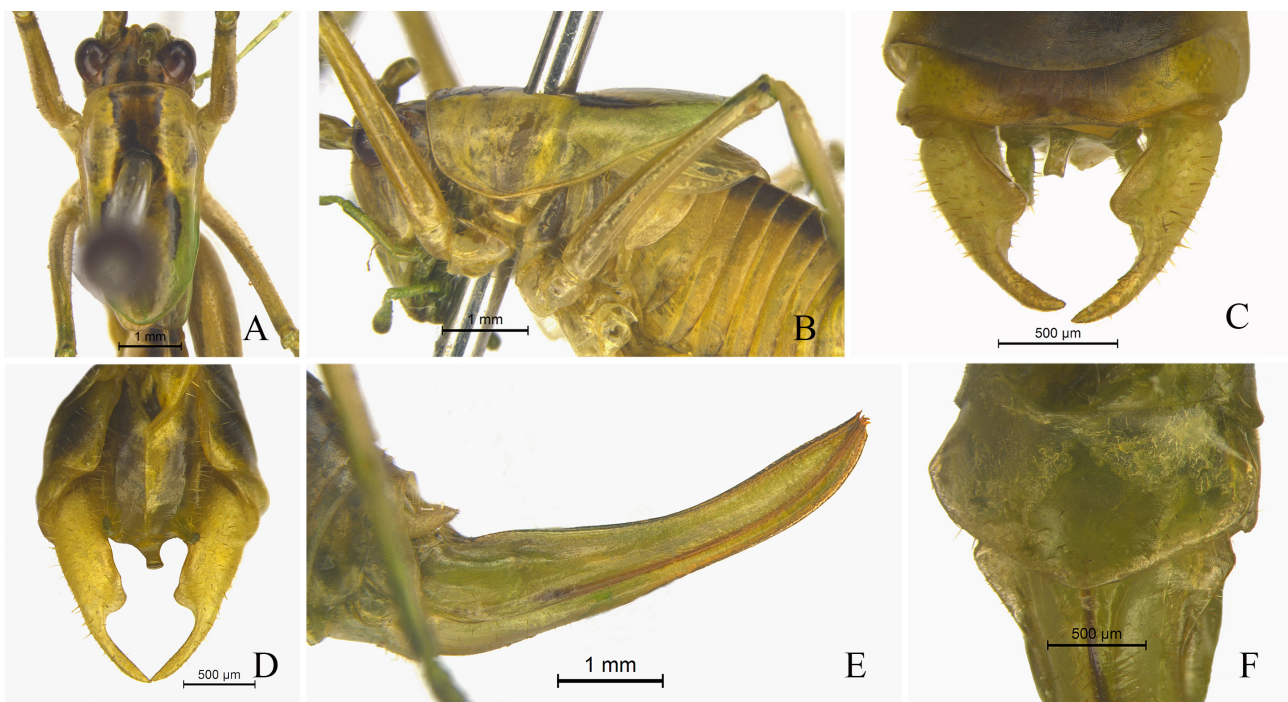


FIGURE 5. *Phlugiopsis bispinata* Bian & Shi, 2018., male: A–B. head and pronotum: A. dorsal view; B. lateral view; C–D. apex of abdomen: C. dorsal view; D. ventral view; female: E. ovipositor in lateral view; F. subgenital plate in ventral view.

Discussion. After the examination of holotype of the species and comparing the specimens collected from same and different geographical populations, we discover some differences in morphology of male subgenital plate. This is as follows: two small spines (on specimen collected from Huanglianshan) or slightly concave (specimen collected from Wuliangshan and Yuanjiang). We feel we cannot classify them as different species without examination of further material.

Distribution. China (Yunnan).

***Phlugiolopsis breviproceris* Zheng, Shi & Chang, 2023**

(Fig. 6)

Phlugiolopsis breviproceris Zheng, Shi & Chang, 2023: 70.

Holotype: male; type locality: Laoshan, Malipo, Yunnan; location of type specimen: the Museum of Hebei University.

Descriptive notes of the female. Tenth abdominal tergite lightly concave on posterior margin. Cercus conical, apex acute. Ovipositor comparatively long, feebly curved dorsad; dorsal valvula with apex acute, apex of ventral valvula hook-shaped. Subgenital plate broader than long; basal margin relatively straight, lateral margins concave near middle area, the lateral carinae distinct; posterior margin nearly truncate. This is the first description of a female of the species.

Material examined. Holotype: ♂, Laoshan, Malipo, Yunnan, 30 July, 2021, coll. Qi Guo. Other material: 3♂1♀, Laoshan, Malipo, Yunnan, 30 July, 2021, coll. Qi Guo and Yanhao Duan; 1♂, Daweishan, Pingbian, Yunnan, 8 August, 2021, coll. Qi Guo; 1♀, Bozhushan, Wenshan, Yunnan, 19 July, 2021, coll. Yanhao Duan; 1♂, Dulong, Maguan, Yunnan, 24 July, 2017, coll. Yongxia Wu; 5♂3♀, Jinchang, Maguan, Yunnan, 26 July, 2017, coll. Yongxia Wu and Yujie Dou.

Measurements (mm). Body: ♀8.3–9.7; pronotum: ♀3.4–3.6; tegmen: ♀1.2–1.7; hind femur: ♀7.9–8.4; ovipositor: 5.8–6.6.

Discussion. After the examination of the specimens collected from type locality and adjacent localities, we describe the female of *Phlugiolopsis breviproceris* Zheng, Shi & Chang, 2023 for the first time.

Distribution. China (Yunnan).



FIGURE 6. *Phlugiolopsis breviproceris* Zheng, Shi & Chang, 2023., female: **A.** ovipositor in lateral view; **B.** subgenital plate in ventral view.

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