

# Proposal of *Caryanda nigrospina* species group (Orthoptera: Acrididae) with description of two new species from China

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**Abstract:** Two new species, *Caryanda caesinota* Mao & Li sp. nov. and *Caryanda heterochromia* Mao & Huang sp. nov., are described and illustrated. The concept of the *Caryanda nigrospina* species group is proposed to contain *C. nigrospina* Mao, Ren & Ou, 2011 and the above two species. A key to the known species of this *C. nigrospina* species group is provided.

**Key words:** Caelifera; Caryandinae; taxonomy; key

## 黑刺卵翅蝗种团的提议暨二新种记述（直翅目：蝗科）

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**摘要：**详细描述了黑刺卵翅蝗 *Caryanda nigrospina* Mao, Ren & Ou, 2011 的雄性外生殖器结构，并记述 2 新种：蓝背卵翅蝗 *C. caesinota* Mao & Li sp. nov. 及异色卵翅蝗 *C. heterochromia* Mao & Huang sp. nov.；提出黑刺卵翅蝗种团建议包含上述 3 种；文章还给出了该种团已知种的分种检索表。

**关键词：**蝗亚目；卵翅蝗亚科；分类；检索表

## Introduction

The genus *Caryanda* Stål, 1878 was established with *Acridium spurium* Stål, 1860 as the type species. 83 species in this genus have been reported in the world so far, of which 67 species have been recorded in China with 23 species of these species found in Yunnan (Eades *et al.* 2016; Li & Xia 2006; Mao & Li 2015; Mao *et al.* 2003, 2011, 2015a, 2015b). To clarify the phylogenetic positions among them, Mao & Li (2015) and Mao *et al.* (2015a, 2015b) attempted to propose the concept of a *C. dentata* species group, a *C. viridis* species group and a *C. amplexicerca* species group.

While examining unidentified materials collected from Yunnan, two new species, *C. caesinota* Mao & Li sp. nov. and *C. heterochromia* Mao & Huang sp. nov., were recognized. They are extremely similar to *C. nigrospina* Mao, Ren & Ou, 2011 in general features, especially in the transversally expanded apex of the apical penis valves. Therefore, we propose

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in this paper the concept of a *Caryanda nigrospina* species group to contain these three allied species in the genus *Caryanda*.

In this paper, all materials used are pinned specimens and deposited in the Biological Science Museum, Dali University (BMDU), Yunnan Province, China. In this work, the Vickery's classification system (1997) is adopted and terminology is based on the work by Dirsh (1975) and Ingrisch (1989). The pinned specimens together with a rule were photographed by a digital camera (Canon EOS 60D). The line drawings were made with a stereomicroscope (Olympus SZX7) equipped with drawing apparatus and a micrometer. The line drawings and color figures are post corrected using Adobe Photoshop® CS2 software.

Abbreviations. an—ancora; cv—valves of cingulum; ilo—inner lophus; olo—outer lophus; pv—apical valves of penis.

## Taxonomy

### *Caryanda nigrospina* species group

Diagnosis. The *Caryanda nigrospina* species group shares the following diagnostic characters in the male: supra-anal plate nearly pentagonal; cerci conical; apical penis valves of phallic complex upcurved with expanded and oval apex with inner margin folded retrad in lateral view.

This species group is endemic to Yunnan with three known species so far.

#### Key to the species of *Caryanda nigrospina* species group

1. Lateral lobes of pronotum entirely yellow below postocular bands except inferior margins black, hind femora green in both sexes (Figs. 1, 2); female subgenital plate with posterior margin roundly projecting in middle (Fig. 14)..... *C. nigrospina* Mao, Ren & Ou
- Lateral lobes of pronotum black with two yellow maculae on median area in both sexes, sometimes pronotum entirely brown in female..... 2
2. Dorsum of body blue green in male or green in female, hind femora yellow in male or green yellow in female (Figs. 3, 4); female subgenital plate with posterior margin roundly angulated (Fig. 22)..... *C. caesinota* Mao & Li **sp. nov.**
- Dorsum of body green in male or brown in female, hind femora red but basal fifth yellow in male or entirely brown in female (Figs. 5, 6); female subgenital plate with posterior margin medially projecting and with 2–3 blunt teeth (Fig. 30)..... *C. heterochromia* Mao & Huang **sp. nov.**

#### 1. *Caryanda nigrospina* Mao, Ren & Ou, 2011 (Figs. 1, 2, 7–14)

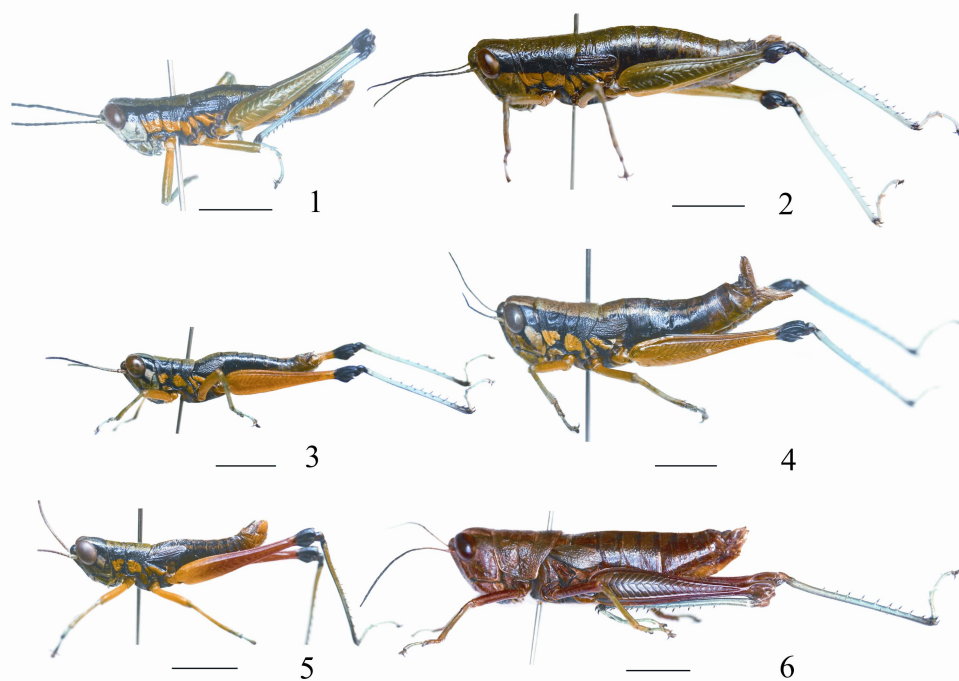
*Caryanda nigrospina* Mao, Ren & Ou, 2011: 67.

Body size small in both sexes, stouter in female.

Head. Head shorter than pronotum; fastigium roundly pentagonal in dorsal view, feebly depressed in middle. Face oblique in profile, surface thinly punctured; frontal ridge with longitudinal sulcus deep in male or shallow in female; lateral margins nearly parallel except somewhat extended around median ocellus and slightly constricted near transverse facial sulcus. Lateral facial keels thick. Antennae filiform, just reaching coxa of hind leg (♂) or just surpassing posterior margin of pronotum (♀), median segments about 2.7–3.2 (♂) or 2.1–2.3 (♀) times longer than wide. Eyes oval, longitudinal diameter about 1.4–1.5 (♂) or 1.6–1.8 (♀) times as long as horizontal diameter, and about 2.3–2.6 (♂) or 1.8–1.9 (♀) times as long as

subocular furrow.

Thorax. Pronotum nearly cylindrical, surface foveolate, anterior and posterior margins nearly straight, posterior margins faintly concave medially in both sexes; median carina indistinct, lateral carinae absent; three transverse sulci distinct; prozona 2.3–2.6 (♂) or 2.2–2.3 (♀) times as long as metazona; lateral lobe with posteroventral corner obtuse. Prosternal spine long conical, straight, apex acute. Mesosternal interspace about 1.6–2.0 (♂) or 1.2–1.5 (♀) times longer than minimum width; metasternal lobes with each other contiguous in male or separated in female. Tegmina narrow scale-like, 3.3–3.7 (♂) or 3.3–4.4 (♀) times longer than maximum width, apex reaching or just surpassing posterior margin of 1st abdominal tergite. Hind femora with upper carina smooth and terminating in an acute angle; lower genicular lobes spined. Hind tibiae with apical half nearly cylindrical, with 8–9 external and 9–10 internal spines on dorsal side; external apical spine small. Tympanum opened distinctly, oval.



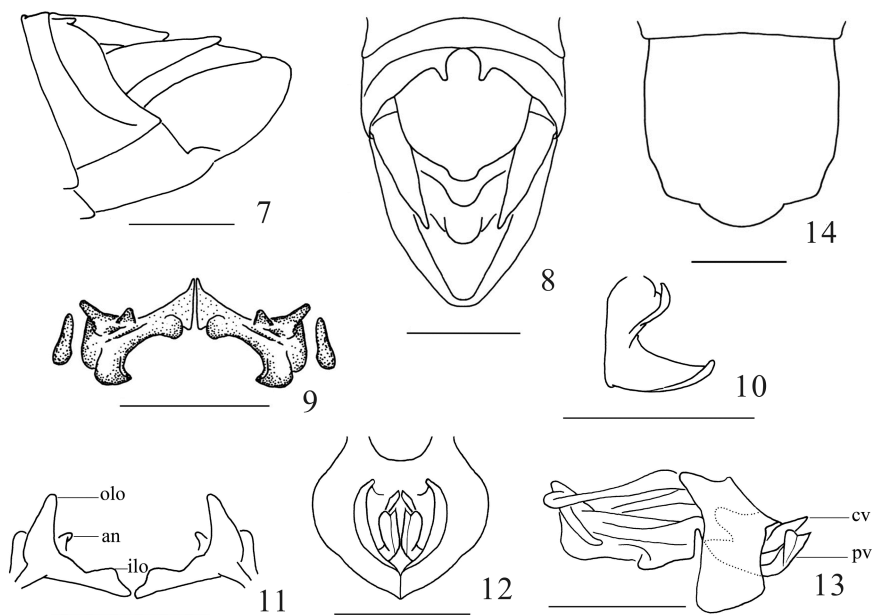
Figures 1–6. 1, 2. *Caryanda nigrospina* Mao, Ren & Ou, 2011; 3, 4. *C. caesinota* Mao & Li sp. nov.; 5, 6. *C. heterochromia* Mao & Huang sp. nov. 1, 3, 5. ♂; 2, 4, 6. ♀. Habitus of adults, lateral view. Scale bars = 5 mm.

Abdomen. Male genitalia (Figs. 7, 8). Tenth abdominal tergite broadly divided in middle, with small furculae on posterior margin. Supra-anal plate nearly pentagonal; width at base equal to length; basal half with broad median longitudinal sulcus, lateral areas slightly concaved, posterior margin rounded and with apex roundly angulated. Cerci long conical, gradually narrowing, apex obtusely sharp. Subgenital plate short conical, apex obtuse. Epiphallus (Figs. 9, 11): outer lophi narrowly triangular in posterior view, distally tapering, pointing dorsad, rarely projecting at the base of inner margin; inner lophi triangular in dorsal view; ancorae triangular, apex ventrad rolled; anterior projections with upper margins dorsad

projecting; bridge narrow, divided in middle. Phallic complex (Figs. 12, 13): cingular valves trigonous, parallelogrammic in lateral view, fused apically; basal penis valves strongly expanded; apical penis valves upcurved in lateral view, apically expanded, oval-shaped in apical view and inner margin extremely rolled retrad as a knife-edge.

Female genitalia. Subgenital plate nearly oblong, posterior margin straight at both sides and roundly convex in middle (Fig. 14). Ventral basivalvular sclerite with inner margins always contiguous with each other. Upper and lower ovipositor valves with outer edges evenly serrated.

Coloration (Figs. 1, 2). Green in both sexes. Frons and genae blue-green. Eyes brown. Antennae with basal segments light, others dark. Postocular bands black, continuing on dorsal area of lateral lobes of pronotum and abdominal tergites. Lateral lobe of pronotum entirely yellow below postocular bands except inferior margins black. Prosternum and prosternal spine black. Mesothorax with episternum and epimeron yellow. Metathorax with episternum and epimeron yellow. Tegmina black. Hind femora green, knee black; hind tibiae blue except base black. Abdominal tergites darkish green; abdominal sternites black along sulci.



Figures 7–14. *Caryanda nigrospina* Mao, Ren & Ou, 2011. 7, 8. Male terminalia, lateral and dorsal views; 9–11. Epiphallus, dorsal, lateral and posterior views; 12, 13. Phallic complex, apical and lateral views; 14. Subgenital plate of female, ventral view. Scale bars = 1 mm.

Measurements (mm). Length of body: ♂ 15.0–16.5, ♀ 20.7–23.2. Length of pronotum: ♂ 3.1–3.4, ♀ 4.5–4.7. Length of tegmen: ♂ 2.6–3.3, ♀ 3.3–4.0. Length of hind femur: ♂ 9.9–10.5, ♀ 11.6–13.0.

**Specimens examined.** ♂ Holotype (deposited in BMDU), **China**, Yunnan, Lvchun, 23°00'N, 102°24'E, alt. 1700 m, 26-VII-2006, leg. Benyong MAO. Other specimens. 8♂3♀ (deposited in BMDU), leg. Benyong MAO & Jishan XU, other data same as holotype; 6♂3♀

(deposited in BMDU), 27-VII-2004, leg. Guohui YANG & Zizhong YANG, other data same as holotype.

Distribution. China (Yunnan).

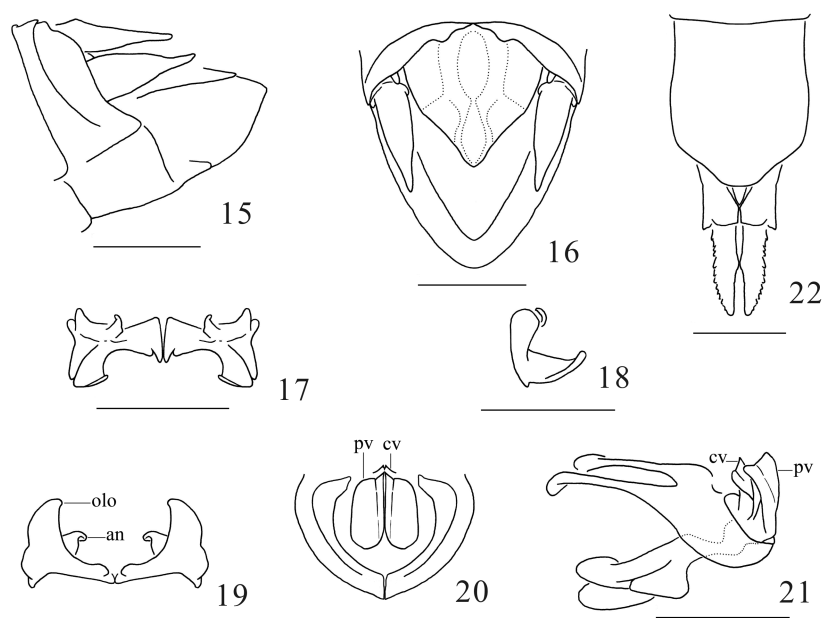
Remarks. Based on our recent research on Caryandinae, after a careful reexamination of all primary types of *C. nigrospina*, we found that those detailed features of the apical penis valve previously neglected by the original authors should be valued to distinguish between species. Therefore we redescribe the male genitalia in this paper.

## 2. *Caryanda caesinota* Mao & Li sp. nov. (Figs. 3, 4, 15–22)

Description. This new species is similar to *C. nigrospina* in general characteristics. The differences from the latter are described below.

Head. Antennae with median segments about 3.2–4.2 (♂) or 2.5–3.4 (♀) times longer than wide. Eyes with longitudinal diameter about 1.3–1.4 (♂) or 1.5 (♀) times as long as horizontal diameter, and about 2.2–2.3 (♂) or 1.7–1.9 (♀) times as long as subocular furrow.

Thorax. Pronotum with prozona 2.2–2.3 (♂) or 2.0–2.3 (♀) times as long as metazona. Mesosternal interspace about 1.9–2.3 (♂) or 1.2–1.4 (♀) times longer than minimum width. Tegmina with length 2.9–3.3 (♂) or 2.5–2.9 (♀) times longer than maximum width.



Figures 15–22. *Caryanda caesinota* Mao & Li sp. nov. 15, 16. Male terminalia, lateral and dorsal views; 17–19. Epiphallus, dorsal, lateral and posterior views; 20, 21. Phallic complex, apical and lateral views; 22. Subgenital plate and ovipositor, ventral view. Scale bars = 1 mm.

Abdomen. Male genitalia (Figs. 15, 16). Tenth abdominal tergite moderately divided in middle, with very small furculae on posterior margin. Supra-anal plate nearly pentagonal; width at base equal to length; basal half with broad median longitudinal sulcus, lateral areas a little concaved, posterior margin with apex subacute. Cerci conical,

apical fifth sharply narrowing, apex acute. Subgenital plate short, conical, apex obtuse. Epiphallus (Figs. 17–19): outer lophi trapeziform in posterior view, distal portion narrow, pointing dorsad; inner lophi rounded in dorsal view; ancorae fingerlike, apex blunt, ventrad rolled; anterior projections with upper margins finely bulging dorsad; bridge narrow, divided in middle. Phallic complex (Figs. 20, 21): cingular valves upcurved, apex transversally expanded, inner edge retrad rolled; basal penis valves strongly expanded, apical penis valves upcurved in lateral view, apex expanded as a long oval in apical view, inner edge retrad rolled.

Female genitalia (Fig. 22). Subgenital plate nearly oblong, posterior margin with apex obtusely angularly rounded. Ventral basivalvular sclerite with inner margins always contiguous with each other. Upper and lower ovipositor valves with outer edges obtusely serrated.

Coloration (Figs. 3, 4). Dorsum of body, frons and genae blue green in male or light brown in female. Eyes brown. Antennae with basal segments light, others dark. Postocular bands black, continued on dorsal area of lateral lobes of pronotum and abdominal tergites. Lateral lobes of pronotum black with two yellow maculae. Prosternum and prosternal spine yellow. Mesothorax with episternum and epimeron yellow. Metathorax with episternum yellow. Tegmina black. Hind femora yellow in male or green yellow in female, knee black; hind tibiae blue except base black. Abdominal sternites yellow.

Measurements (mm). Length of body: ♂ 19.1–19.8, ♀ 24.5–25.2. Length of pronotum: ♂ 3.3–3.5, ♀ 4.9–5.0. Length of tegmen: ♂ 2.8–3.5, ♀ 3.5–3.8. Length of hind femur: ♂ 10.5–11.5, ♀ 14.0–14.1.

**Holotype.** ♂, **China**, Yunnan, Yongde, 24°01'N, 99°43'E, alt. 862 m, 22-IX-2009, leg. Benyong MAO. **Paratypes.** 1♂, same data as holotype; 2♂, **China**, Yunnan, Menglian, 22°20'N, 99°36'E, alt. 1000 m, 22-X-2012, leg. Benyong MAO & Miao LI; 1♂1♀, **China**, Yunnan, Zhenkang, 23°46'N, 98°56'E, alt. 1065 m, 17-VIII-2010, leg. Benyong MAO; 2♂, 1♀, **China**, Yunnan, Langcang, 22°23'N, 99°55'E, alt. 1400 m, 25-IX-2012, leg. Benyong MAO & Miao LI. Type specimens are deposited in the BMDU.

Etymology. The specific epithet *caesinota* means that the dorsum of male body is caesious.

Diagnosis. This new species is similar to *C. nigrospina* and *C. heterochromia* Mao & Huang sp. nov., but differs from the latter two by the characters listed in Table 1.

**Table 1. Comparisons among *C. nigrospina*, *C. caesinota* Mao & Li sp. nov. and *C. heterochromia* Mao & Huang sp. nov.**

<i>C. nigrospina</i> Mao, Ren & Ou, 2011	<i>C. caesinota</i> Mao & Li sp. nov.	<i>C. heterochromia</i> Mao & Huang sp. nov.
Male supra-anal plate with apex roundly angulated	Male supra-anal plate with apex subacute	Male supra-anal plate with apex subacute
In apical view, outer lophi of epiphallus triangular	In apical view, outer lophi of epiphallus narrow trapeziform	In apical view, outer lophi of epiphallus broad trapeziform
In apical view, apical penis valves oval, inner edge rolled retrad	In apical view, apical penis valves long oval, inner edge rolled retrad	In apical view, apical penis valves oval, median area ovally concave, inner edge fairly risen retrad

Continued Table 1.

<i>C. nigrospina</i> Mao, Ren & Ou, 2011	<i>C. caesinota</i> Mao & Li sp. nov.	<i>C. heterochromia</i> Mao & Huang sp. nov.
Female subgenital plate with posterior margin straight at both sides and roundly convex in middle	Female subgenital plate with apex obtusely angularly rounded	Female subgenital plate with posterior margin medially projecting and with 2–3 blunt teeth
Lateral lobes of pronotum entirely yellow below postocular bands in both sexes	Lateral lobes of pronotum black with two yellow maculae in both sexes	Lateral lobes of pronotum black with two yellow maculae in male or entirely brown in female

### 3. *Caryanda heterochromia* Mao & Huang sp. nov. (Figs. 5, 6, 23–30)

Description. Head. Antennae with median segments about 2.8–3.5 (♂) or 2.5–3.2 (♀) times longer than wide. Eyes with longitudinal diameter about 1.4 (♂) or 1.5–1.6 (♀) times as long as horizontal diameter, and about 2.2–2.5 (♂) or 1.8–2.2 (♀) times as long as subocular furrow.

Thorax. Pronotum with prozona 2.0–2.3 (♂) or 1.9–2.3 (♀) times as long as metazona. Mesosternal interspace about 1.8–2.3 (♂) or 1.4–1.8 (♀) times longer than minimum width. Tegmina with length 2.9–3.3 (♂) or 2.5–2.9 (♀) times larger than maximum width.

Abdomen. Male genitalia (Figs. 23, 24). Tenth abdominal tergite broadly divided in middle, with small furculae on posterior margin. Supra-anal plate nearly pentagonal; width at base equal to length; basal half with broad median longitudinal sulcus, lateral areas slightly concave, posterior margin with apex subacute. Cerci conical, gradually narrowing, apex acute. Subgenital plate short conical, apex obtuse. Epiphallus (Figs. 25–27): outer lophi trapeziform in posterior view, distal portion broad, pointing dorsad, usually with a small triangular process at base of inner margin; inner lophi rounded in dorsal view; ancorae fingerlike, apex blunt, ventrad rolled; anterior projections with upper margins dorsad bulging; bridge narrow, divided in middle. Phallic complex (Figs. 28, 29): cingular valves trigonous, apex obtuse, fused apically; basal penis valves strongly expanded, apical penis valves upcurved in lateral view, expanded in apical view, median area ovally concaved, inner edge fairly risen retrad.

Female genitalia (Fig. 30). Subgenital plate nearly oblong, posterior margin medially projecting and with 2–3 blunt teeth. Ventral basivalvular sclerite with inner margins always contiguous with each other. Upper and lower ovipositor valves with outer edges obtusely serrated.

Coloration (Figs. 5, 6). Male. Dorsum of head green. Frons and genae blue-green. Eyes brown. Antennae with basal segments light, others dark. Postocular bands black, continued on dorsal area of lateral lobes of pronotum and abdominal tergites. Pronotum with disc green, lateral lobe with two yellow maculae, inferior margin black. Prosternum and prosternal spine yellow. Mesothorax with episternum and epimeron yellow. Metathorax with episternum yellow. Tegmina black. Hind femora bicolored, with basal fifth yellow and apical four-fifths red, knee black; hind tibiae blue except base black. Abdominal tergites darkish green except inferior areas yellow; abdominal sternites yellow. Female. Red brown. Eyes dark brown. Fore and middle legs with tibiae and tarsi light green. Hind femora with tibiae and tarsi light blue.

Measurements (mm). Length of body: ♂ 19.5–21.5, ♀ 26.5–27.0. Length of pronotum: ♂

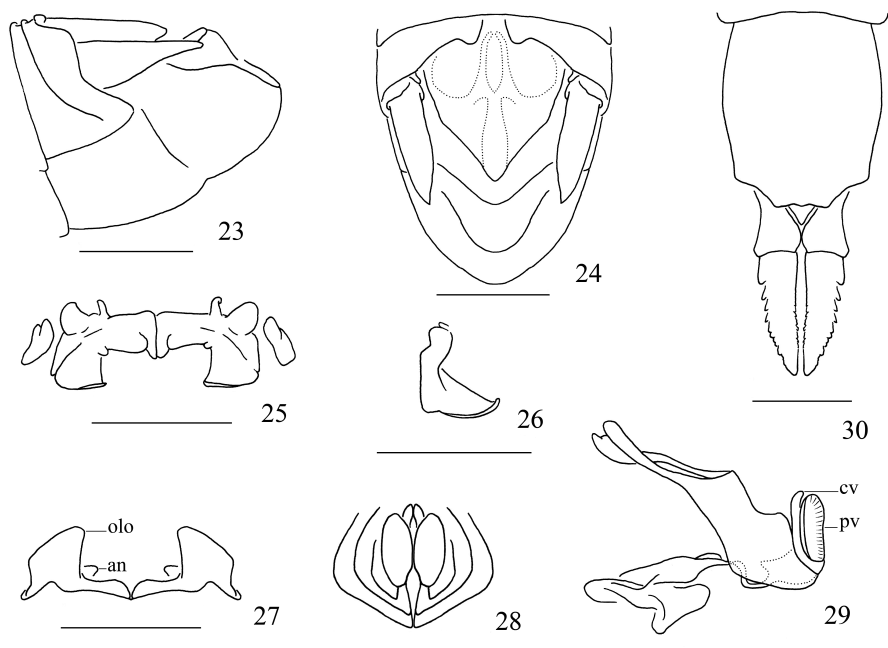
3.5–4.0, ♀ 4.8–5.3. Length of tegmen: ♂ 3.1–3.5, ♀ 3.6–4.5. Length of hind femur: ♂ 11.0–12.0, ♀ 14.3–15.0.

**Diagnosis.** This new species is similar to *C. nigrospina* and *C. caesinota* Mao & Li sp. nov., but differs from the latter two by the characters listed in Table 1.

**Holotype.** ♂, **China**, Yunnan, Mengla, Mt. Nangongshan, 21°37'N, 101°27'E, alt. 1185 m, 06-X-2013, leg. Benyong MAO & Jianhua HUANG. **Paratypes.** 3♂4♀, same data as holotype; 4♂2♀, **China**, Yunnan, Jiangcheng, 22°36'N, 101°53'E, alt. 1336 m, 01-XI-2012, leg. Benyong MAO & Miao LI. Type specimens are deposited in the BMDU.

**Etymology.** The specific epithet *heterochromia* means that both sexes have different coloration.

**Distribution.** China (Yunnan).



Figures 23–30. *Caryanda heterochromia* Mao & Huang sp. nov. 23, 24. Male terminalia, lateral and dorsal views; 25–27. Epiphallus, dorsal, lateral and posterior views; 28, 29. Phallic complex, apical and lateral views; 30. Subgenital plate and ovipositor, ventral view. Scale bars = 1 mm.

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