



## A review of the genus *Abrus* Dai & Zhang (Hemiptera: Cicadellidae, Deltocephalinae) from China with description of one new species

WU DAI & YALIN ZHANG<sup>1</sup>

Key Laboratory of Plant Protection Resources and Pest Management, Ministry of Education, Entomological Museum, Northwest A&F University, Yangling, Shaanxi 712100. E-mail: daiwu@nwsuaf.edu.cn; yalinzh@nwsuaf.edu.cn

<sup>1</sup>Corresponding author

### Abstract

All nine species of the genus *Abrus* Dai and Zhang from China are reviewed, and one new species, *A. breviolus* sp. nov. is described. A key is given to separate all species and a detailed morphological description and illustrations are provided.

**Key words:** Homoptera, leafhopper, morphology, distribution, taxonomy

### Introduction

The Chinese athysanine leafhopper genus *Abrus* (Cicadellidae: Deltocephalinae) was established by Dai and Zhang (2002), who included six new species and provided a key for their separation. Recently, Li and Wang (2006) described two new species.

During our ongoing study of the Chinese Deltocephalinae, we found another new species, which is described in this paper. A key is provided to distinguish all nine species and illustrations are given.

### Material and methods

External morphology was observed and illustrated under a Leica ZOOM2000 stereomicroscope and OLYMPUS PM-10AD microscope. The male and female terminalia were dissected out, treated with 10% KOH solution at approximately 80°C for several minutes, and observed in a droplet of glycerol under the compound light microscope.

The morphological terminology used in the descriptions mainly follows Zhang (1990). Absolute measurements, in millimeters (mm), are used for body.

The following abbreviations are used for the depositories of material used in this study.

- BMNH The Natural History Museum, London, United Kingdom  
EM Entomological Museum of Northwest A&F University, Yangling, Shaanxi, China  
GZU Guizhou University, Guiyang, China  
IZAS The Institute of Zoology, Chinese Academy of Sciences, Beijing, China  
NKU Nankai University, Tianjin, China  
SHEM The Shanghai Entomological Museum, Chinese Academy of Sciences, Shanghai, China  
ZSU Zhongshan University, Guangzhou, China

## **Abrus Dai and Zhang, 2002**

*Abrus* Dai and Zhang, 2002: 304. Type species: *Abrus hengshanensis* Dai and Zhang, 2002, by original designation.

**Description.** Orange to brownish-yellow, crown with two pairs of similar black spots on anterior margin, pronotum with pair of black markings on anterior part. Inner and central anteapical cells at apex, third and fourth apical cells at base each often with a black spot.

Body elongate, robust. Head including eyes narrower than pronotum. Crown longer medially than next to eyes but shorter than width between eyes; anterior margin roundly produced anteriorly in dorsal view; disc somewhat flat; anterior margin with four dark markings. Transition of vertex and frontoclypeus rounded. Eyes fairly large. Ocelli situated on frontal margin of crown next to eye, separated from eye by distance equal to or less than their own diameter. Frontoclypeus narrow, longer than width between eyes. Clypellus slightly expanded apically. Pronotum with its anterior margin roundly produced and posterior margin slightly concave. Scutellum almost as long as one and one half times length of head, with transverse suture straight and depressed. Forewing exceeding abdomen, with wide appendix, three subapical and 4 apical cells, inner subapical cell open. Sc and R in hind wing separate distinctly. Fore femur with several basal ventral macrosetae and several fine intercalary setae. Fore tibia with two rows of macrosetae from base to apex at dorsal margin (6+7), and two rows of short to moderately long setae at ventral margin. Hind femur very slightly broadened distally, before expanded apex, the latter with formula 2+2+1. Hind tibia nearly straight, armed with following stout setae (following Davis, 1975): R1 20±1, R2 12±1, R3 15±1.

Male pygophore narrowing to apex or with posterior margin blunt, with or without dorsal/ventral process; several macrosetae posteriorly and some at mid-ventral margin; with a membranous process from inner apex, covered with minute setae. Subgenital plate short to long with several irregularly arranged macrosetae laterally. Connective Y-shaped, shaft robust and arms well developed. Style with basal half wide, narrowing to midlength with apical half narrow. Aedeagus with basal apodeme well developed, produced dorsally; shaft long, curved dorsad with well-developed dorsal projection at base and paired appendages apically, gonopore at or near apex.

Female with abdominal sternum VII subequal in length to length of abdominal sternum VI, its caudal margin concave, v-shaped; first pair of gonapophyses tapered from base to apex, with submarginal cell-like sculpture dorsally, without teeth; second pair of gonapophyses lanceolate, with scalelike sculpture dorsally.

**Remarks.** This genus resembles *Matsumurella* Ishihara in general appearance, but differs in having the clypellus expanded apically, the male pygophore with a long membranous process from its inner apex and the aedeagus with a well-developed basal projection dorsally. This genus is also very similar to *Thamnotettix* Zetterstedt but in addition to the above characters it differs in having several irregularly arranged setae laterally on the subgenital plate rather than a single row.

**Distribution.** China (Gansu, Hunan, Fujian, Guizhou, Guangxi, Guangdong).

### **Key to species of the genus *Abrus***

1. Basal projection of aedeagal shaft shorter than half length of shaft (Fig. 53) ..... *A. breviolus* sp. nov.  
Basal projection of aedeagal shaft equal to or longer than half length of shaft (Figs. 8, 15, 22, 28, 35, 42, 48, 53, 57) .....2
2. Aedeagal shaft about half length of basal projection, apical appendages extended posterad (Fig. 15) .....  
.....*A. brevis*  
Aedeagal shaft as long as or longer than basal projection, apical appendages extended basolaterad (Figs. 8, 22, 28, 35, 42, 48, 53, 57) .....3

3. Pygophore with pair of long processes at posterodorsal margin (Fig. 24) ..... *A. wuyiensis*  
 Pygophore without process at posterodorsal margin .....4
4. Apical appendages of aedeagus branched at apex, with small process at base .....5  
 Apical appendages of aedeagus not branched at apex, without process at base.....7
5. . Pygophore with long process at posteroventral corner (Fig. 37); basal projection of aedeagus short, about half length of shaft (Figs. 42, 43) ..... *A. coneus*  
 Pygophore without long process at posteroventral corner, basal projection of aedeagus as long as shaft.. 6
6. Basal projection of aedeagus with pair of triangular appendages laterally at midlength, aedeagal shaft without ventral flange at apex (Figs. 35, 36) ..... *A. bifurcatus*  
 Basal projection of aedeagus without appendage laterally at midlength, aedeagal shaft with ventral triangular flange at apex (Figs. 48, 49) ..... *A. concavelus*
7. Pygophore without process at ventral margin (Fig. 54); apical appendages of aedeagus short and directed dorsally, basal projection of aedeagus without lateral appendages in ventral view (Figs. 57, 58) .....  
 ..... *A. leigongshanensis*  
 Pygophore with process at ventral margin, apical appendages of aedeagus long and directed lateroventrally .....8
8. Pygophore with process at caudoventral margin (Figs. 17, 18); basal projection of aedeagus dentate along ventral margin and with lateral appendages directed ventrally in ventral view (Figs. 22, 23) ..... *A. huangi*  
 Pygophore with digitate process in the middle of ventral margin (Fig. 3); basal projection of aedeagus with a long process subapically and lateral appendages directed dorsally in ventral view (Figs. 8, 9) .....  
 ..... *A. hengshanensis*

***Abrus hengshanensis* Dai and Zhang, 2002**

Figs. 1–9, 74

*Abrus hengshanensis* Dai and Zhang, 2002: 305, fig. 1, A–I.

**Material examined.** China: Holotype ♂, Hunan: Hengshan Mountain, 10 Aug. 1985, coll. Zhang Yalin and Chai Yonghui (EM); paratype 1♂, 1♀, same data as holotype (EM).

**Diagnosis.** This species is similar to *A. huangi* Dai and Zhang, but can be distinguished from the latter by: 1) pygophore with digitate process in the middle of ventral margin; 2) basal projection of aedeagus with long process subapically and lateral appendages directed dorsally in ventral view.

**Distribution.** China (Hunan).

***Abrus brevis* Dai and Zhang, 2002**

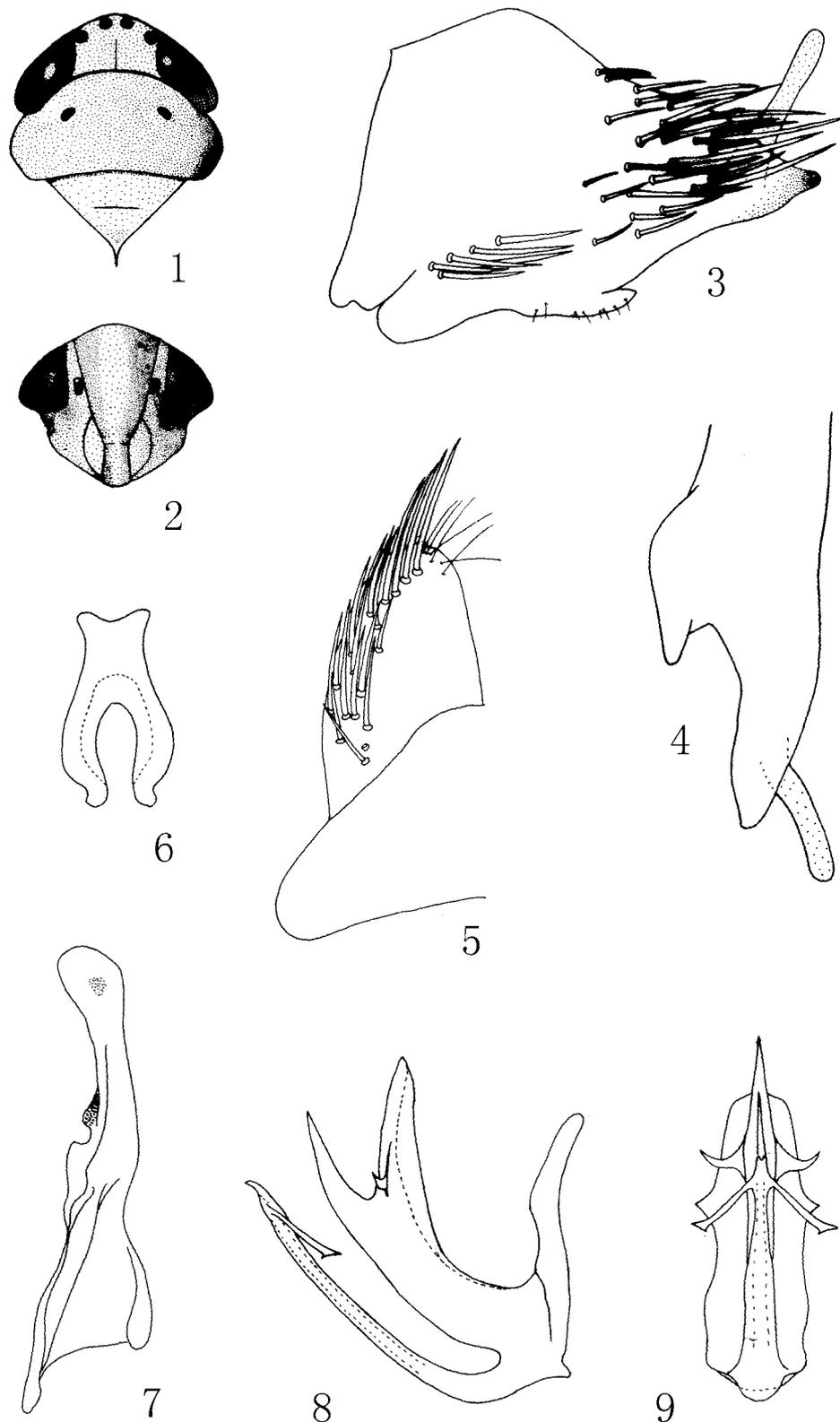
Figs. 10–16

*Abrus brevis* Dai and Zhang, 2002: 306, fig. 2, A–G.

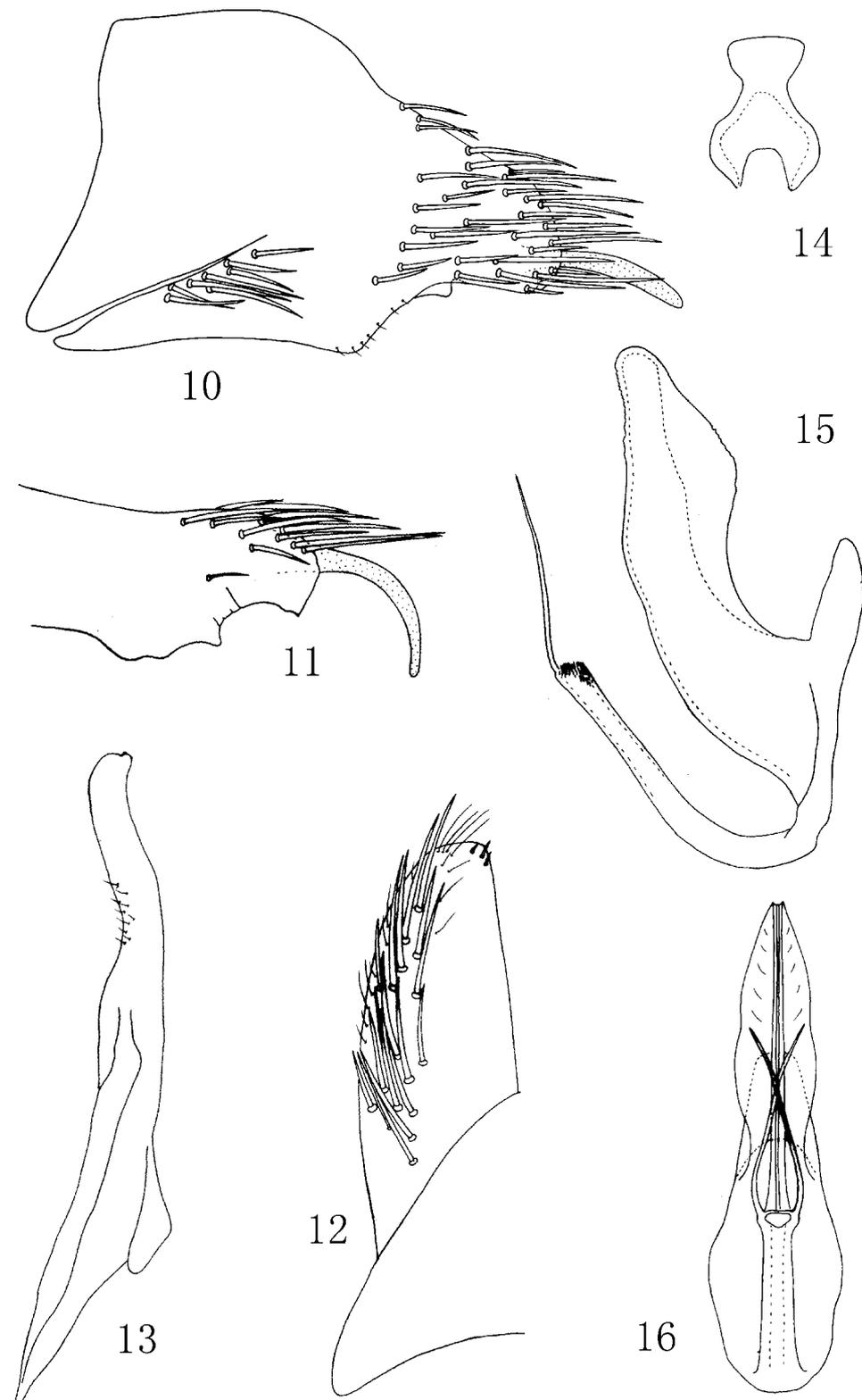
**Material examined.** China: Holotype ♂, Guangxi; Napo, Defu, 1350m, 18 June 2000, coll. Chen Jun (IZAS).

**Remarks.** This species is very similar to *A. hengshanensis* Dai and Zhang in general appearance, but can be distinguished from the latter by the shorter aedeagal shaft (about half length of basal projection), with a pair of long apical appendages and the basal projection without processes.

**Distribution.** China (Guangxi).



**FIGURES 1–9.** *Abrus hengshanensis* Dai and Zhang, 2002. 1. Head and thorax, dorsal view; 2. Face; 3. Male pygophore, lateral view; 4. Male pygophore, ventral view; 5. Left genital valve and subgenital plate, ventral view; 6. Connective, dorsal view; 7. Left style, dorsal view; 8. Aedeagus, lateral view; 9. Aedeagus, ventral view.



**FIGURES 10–16.** *Abrus brevis* Dai and Zhang, 2002. 10. Male pygophore, lateral view; 11. Male pygophore, ventral view; 12. Left genital valve and subgenital plate, ventral view; 13. Left style, dorsal view; 14. Connective, dorsal view; 15. Aedeagus, lateral view; 16. Aedeagus, ventral view.

***Abrus huangi* Dai and Zhang, 2002**

Figs. 17–23, 75

*Abrus huangi* Dai and Zhang, 2002: 307, fig. 3, A–G.

**Material examined.** China: Holotype ♂, Guangxi; Jinxiu, Shengtang Mountain, 900m, 18 May 1999, coll. Huang Fusheng (IZAS); paratypes 2♀, same data as holotype (IZAS).

**Remarks.** This species is very similar to *A. hengshanensis* Dai and Zhang, but can be distinguished from the latter by: 1) pygophore with process at caudoventral margin; 2) basal projection of aedeagus dentate subapically on ventral margin and lateral appendages directed basally in ventral view.

**Distribution.** China (Guangxi).

***Abrus wuyiensis* Dai and Zhang, 2002**

Figs. 24–29, 59–67, 69–72, 77

*Abrus wuyiensis* Dai and Zhang, 2002: 309, fig. 4, A–F.

**Material examined.** China: Holotype ♂, Fujian: Chong'an, Guadun, 7 Aug. 1982, coll. Zou Huanguang (NKU). Additional material: China: 1♂, Fujian: Wuyishan Mt. Guadun, 23 July 2003, coll. Duan Yani; 1♂, Zhejiang, Baishanzu, 26 Aug. 2000, coll. Dai Wu and Wei Cong; 1♂, 3♀, Zhejiang, Tianmushan, Dashigu, 9 Aug. 2007, coll. Zhang Xinmin.

**Remarks.** This species was described from the Fujian, China, based on 1 male and 4 female specimens. Recently, 2 male and 2 female specimens were collected from Zhejiang. A comparison of all material, indicates that the paratypes are *Abrus concaveus* Li and Wang, 2006.

The species is very similar to *A. bifurcatus* Dai and Zhang, but can be distinguished from the latter by: 1) pygophore with posterior margin straight and armed with pair of long processes; 2) apical aedeagal appendages without process at base. The Fujian population has the aedeagus very similar to that of the Zhejiang population in that the basal projection of the aedeagus lacks the lateral appendages found in the Zhejiang population. However, we feel that this is within variation expected in a widely distributed species.

**Distribution.** China (Fujian).

***Abrus bifurcatus* Dai and Zhang, 2002**

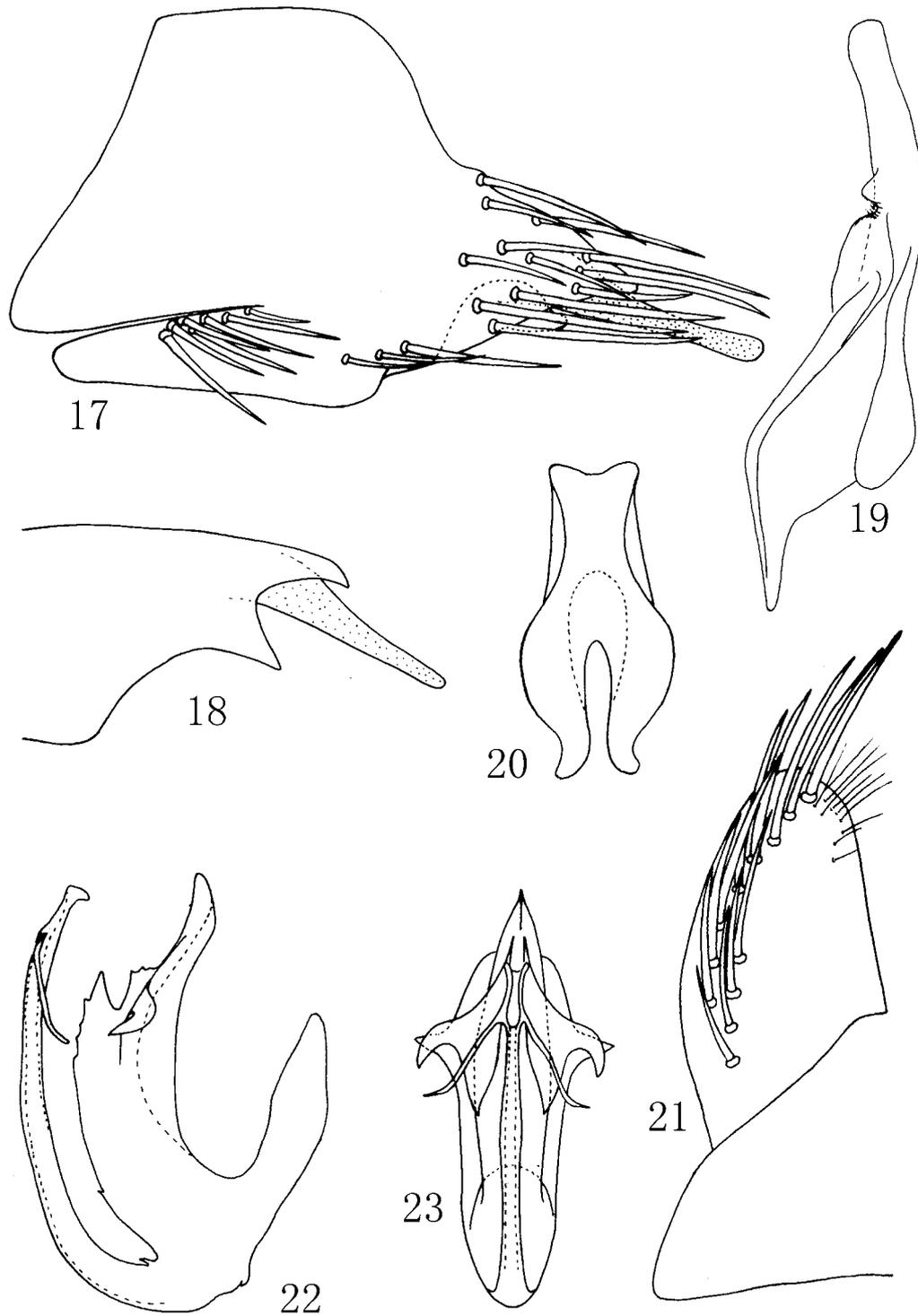
Figs. 30–36

*Abrus bifurcatus* Dai and Zhang, 2002: 310, fig. 5, A–G.

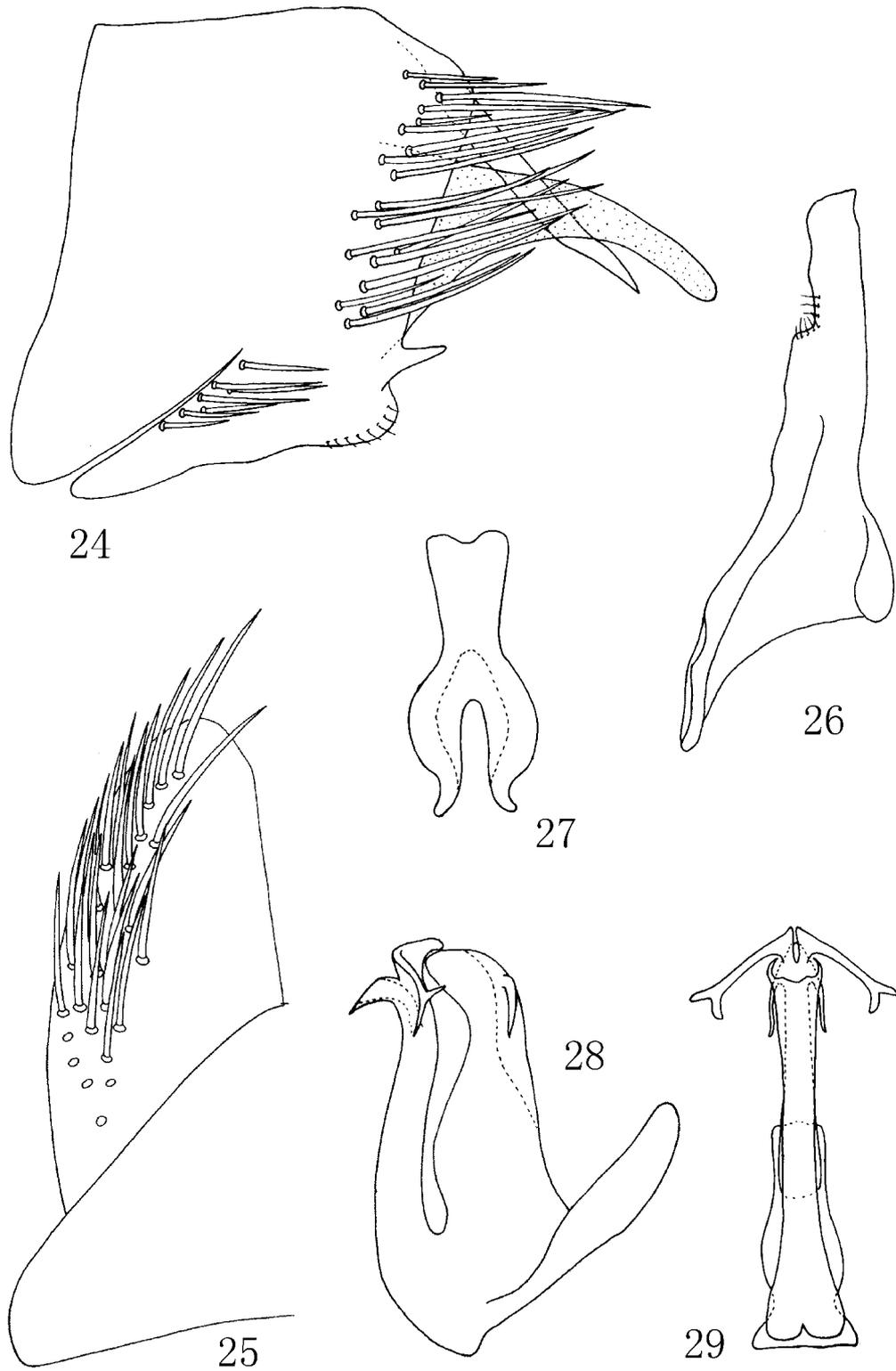
**Material examined.** China: Holotype ♂, Guangdong: Lianxian, Dadongshan Mountain, 5 Nov. 1992, coll. Cheng Hao (ZSU).

**Remarks.** This species is very similar to *A. coneus* Dai and Zhang, but can be distinguished from the latter by: 1) pygophore with short process at ventral posterior margin; 2) basal projection of aedeagus as long as shaft, with pair of triangular-shaped appendages laterally in the middle.

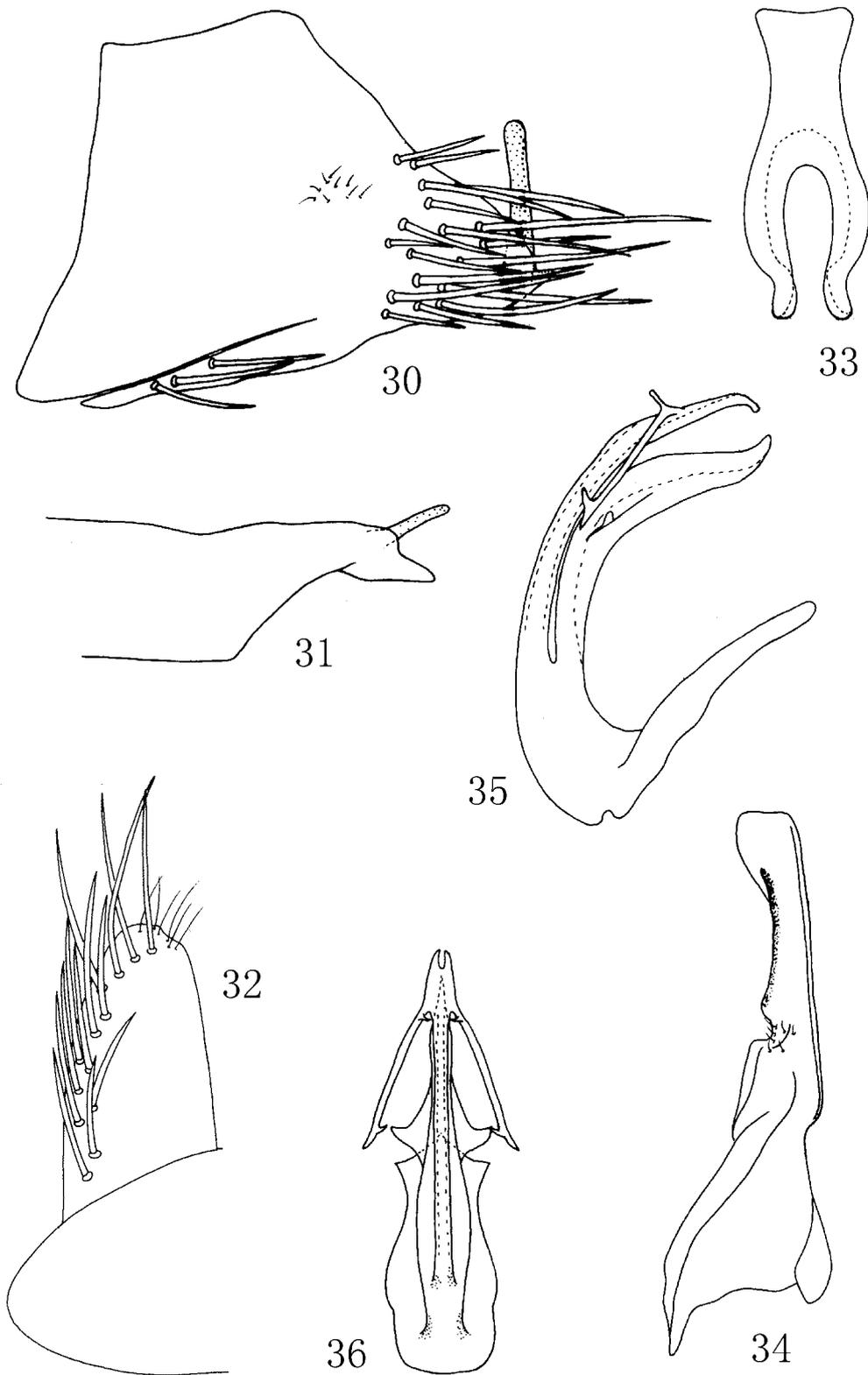
**Distribution.** China (Guangdong).



**FIGURES 17–23.** *Abrus huangi* Dai and Zhang, 2002. 17. Male pygophore, lateral view; 18. Male pygophore, ventral view; 19. Left style, dorsal view; 20. Connective, dorsal view; 21. Left genital valve and subgenital plate, ventral view; 22. Aedeagus, lateral view; 23. Aedeagus, ventral view.



**FIGURES 24–29.** *Abrus wuyiensis* Dai and Zhang, 2002. 24. Male pygophore, lateral view; 25. Left genital valve and subgenital plate, ventral view; 26. Left style, dorsal view; 27. Connective, dorsal view; 28. Aedeagus, lateral view; 29. Aedeagus, ventral view.



**FIGURES 30–36.** *Abrus bifurcatus* Dai and Zhang, 2002. 30. Male pygophore, lateral view; 31. Male pygophore, ventral view; 32. Left genital valve and subgenital plate, ventral view; 33. Connective, dorsal view; 34. Left style, dorsal view; 35. Aedeagus, lateral view; 36. Aedeagus, ventral view.

***Abrus coneus* Dai and Zhang, 2002**

Figs 37–43, 73

*Abrus coneus* Dai and Zhang, 2002: 311, fig. 6, A–G.

**Material examined.** China: Holotype ♂, Gansu; Kangxian, Baiyun Mountain, 1250–1750m, 12 July 1998, coll. Chen Jun; Paratype: 1 ♀, Gansu; Kangxian, Baiyun Mountain, 1250–1750m, 12 July 1998, coll. Chen Jun (IZAS); 1 ♀ (IZAS), Gansu; Kangxian, Qinghe Forest Farm, 1400m, 12 July 1998, coll. Yao Jan.

**Remarks.** This species is very similar to *A. bifurcatus* Dai and Zhang, but can be distinguished from the latter by: 1) pygophore with long appendage at ventral posterior margin; 2) basal projection of aedeagus about half length of shaft, without lateral appendages at middle.

**Distribution.** China (Gansu).

***Abrus concavelus* Li and Wang, 2006**

Figs. 44–49, 76

*Abrus concavelus* Li and Wang, 2006:841, figs. 8–13.

Body proportions and coloration as in generic description.

**Male genitalia:** Pygophore broad, rounded posteriorly, covered with macrosetae posteriorly and some at mid-ventral margin; posterior margin with triangular membranous process on inner apex, covered with minute setae. Subgenital plate elongate, extending beyond pygophore, narrowing to rounded apex, lateral margin sinuate, with numerous macrosetae. Connective Y-shaped, shaft robust, arms well developed. Style with basal half wide, narrowing to middle, apical half narrow. Aedeagus with well-developed basal projection from dorsal margin, tapered to acute apex, deeply concave at dorsal margin; shaft about as long as basal projection, with ventral triangular flange subapically and pair of lateral appendages, apically branched and with short process near midlength, phallosome apical on ventral surface.

**Material examined.** China: Holotype ♂, Fujian Prov., Wuyi Mountain, 7 August 1998, Yang Maofa (GZU). Other material: 1 ♂, Fujian Prov., Wuyi Mountain, Xianfengling, 21 July 2003, coll. Duan Yani (EM); 4 ♀, Fujian; Wuyi, Sangang, 17 Nov. 1980, coll. Chen Tong (EM); 1 ♀, Fujian; Longdu, Wuyishan Mountain, 21 Aug. 1988, coll. Yang Zhongqi (EM).

**Remarks.** This species resembles *Abrus coneus* Dai and Zhang externally, but can be distinguished from the latter by: 1) pygophore without long appendage at ventral posterior margin; 2) aedeagal shaft about as long as basal projection, with ventral triangular flange subapically; 3) aedeagal projection tapered to acute apex and deeply concave at dorsal margin.

**Distribution.** China (Fujian).

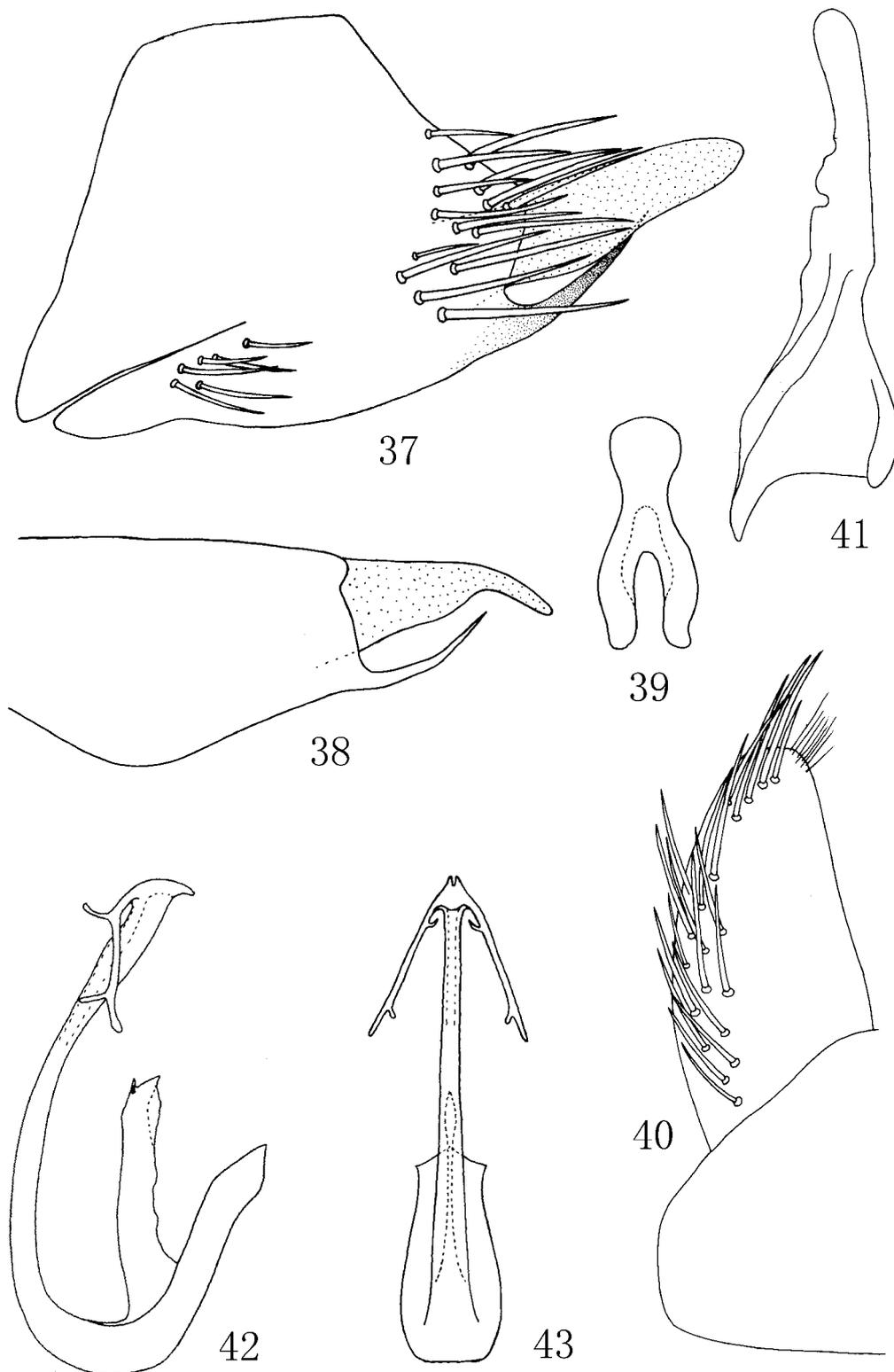
***Abrus breviolus* sp. nov.**

Figs. 50–53

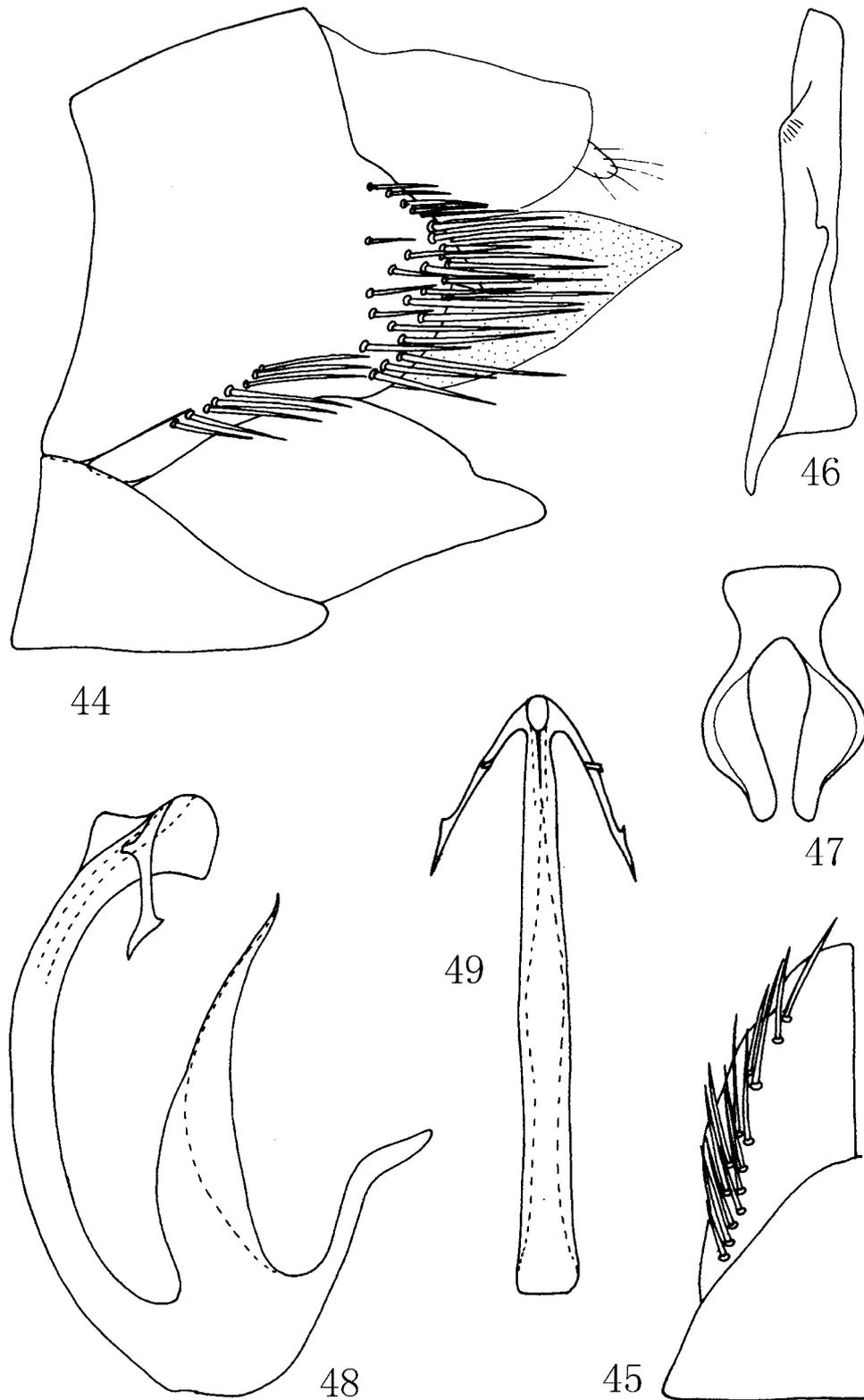
External features as in generic description.

**Male genitalia:** Pygophore quadrilateral in shape, covered with macrosetae posteriorly and some at mid-ventral margin; posterior margin truncate with process dorsally and ventrally and membranous process at inner apex, covered with tiny setae. Subgenital plate short and wide, not extending beyond pygophore, posterior margin straight, with several macrosetae. Connective Y-shaped, shaft robust, arms well developed. Style very long, extending beyond subgenital plate, region beyond lateral lobe long with apex produced medially,

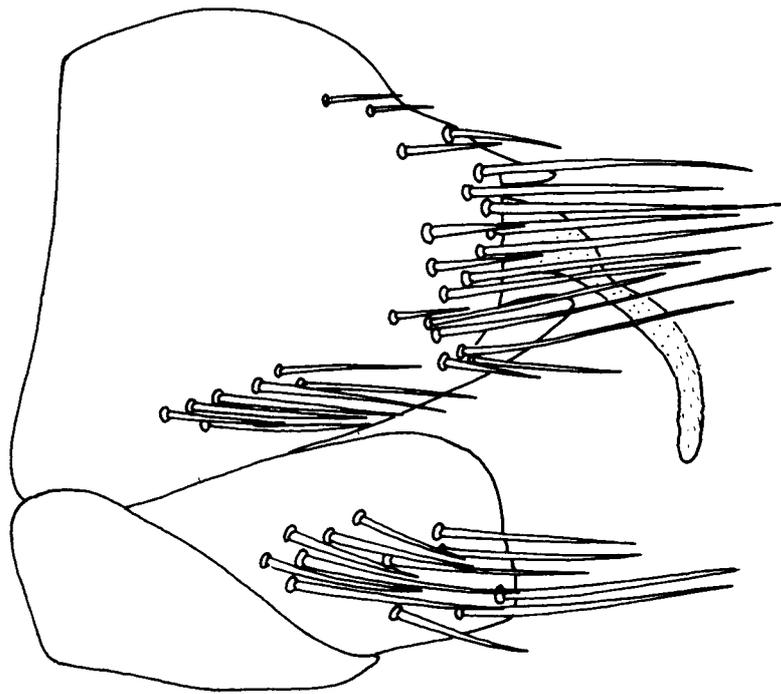
acute. Aedeagus with small basal projection dorsally; shaft relatively straight in lateral view, with pair of sub-apical appendages each with small basal tooth; phallosome apical on ventral surface.



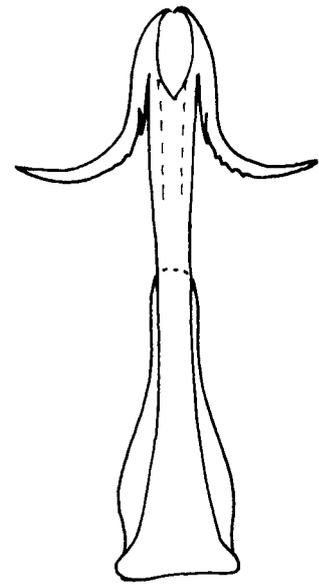
**FIGURES 37–43.** *Abrus coneus* Dai and Zhang, 2002. 37. Male pygophore, lateral view; 38. Male pygophore, ventral view; 39. Connective, dorsal view; 40. left side of genital valve and subgenital plate, ventral view; 41. Left style, dorsal view; 42. Aedeagus, lateral view; 43. Aedeagus, ventral view.



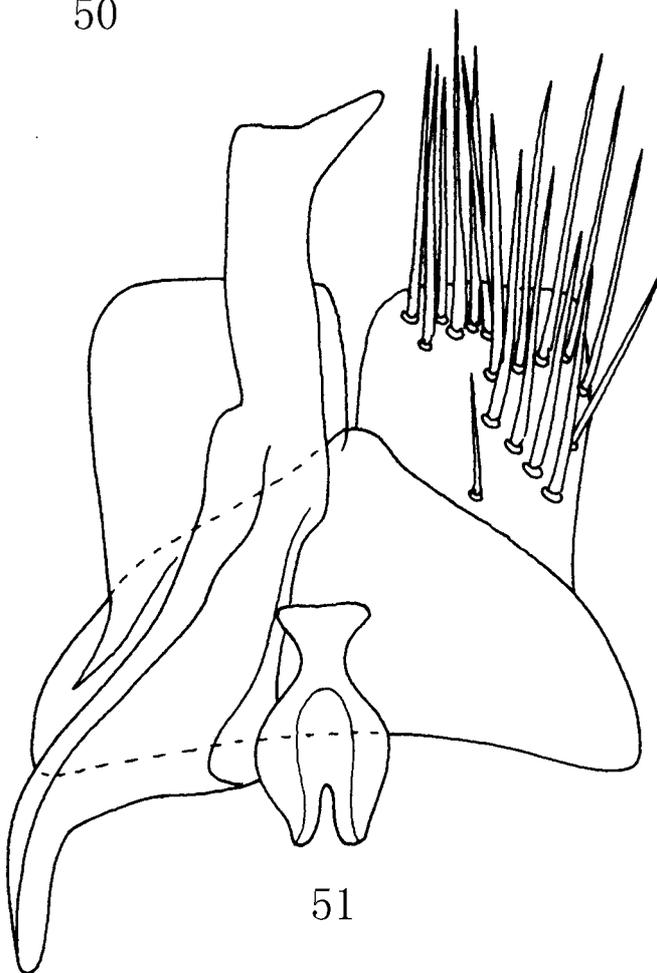
**FIGURES 44–49.** *Abrus concavelus* Li and Wang, 2006. 44. Male pygophore, lateral view; 45. Left side of genital valve and subgenital plate, ventral view; 46. Left style, dorsal view; 47. Connective, dorsal view; 48. Aedeagus, lateral view; 49. Aedeagus, ventral view.



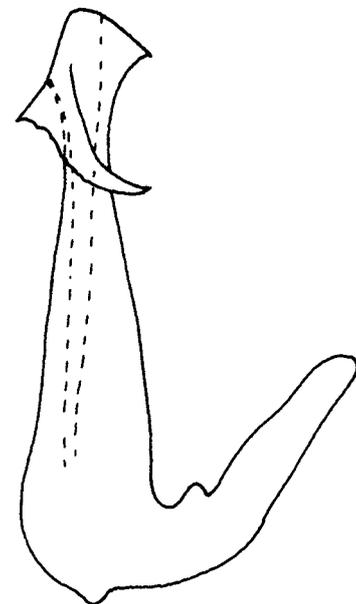
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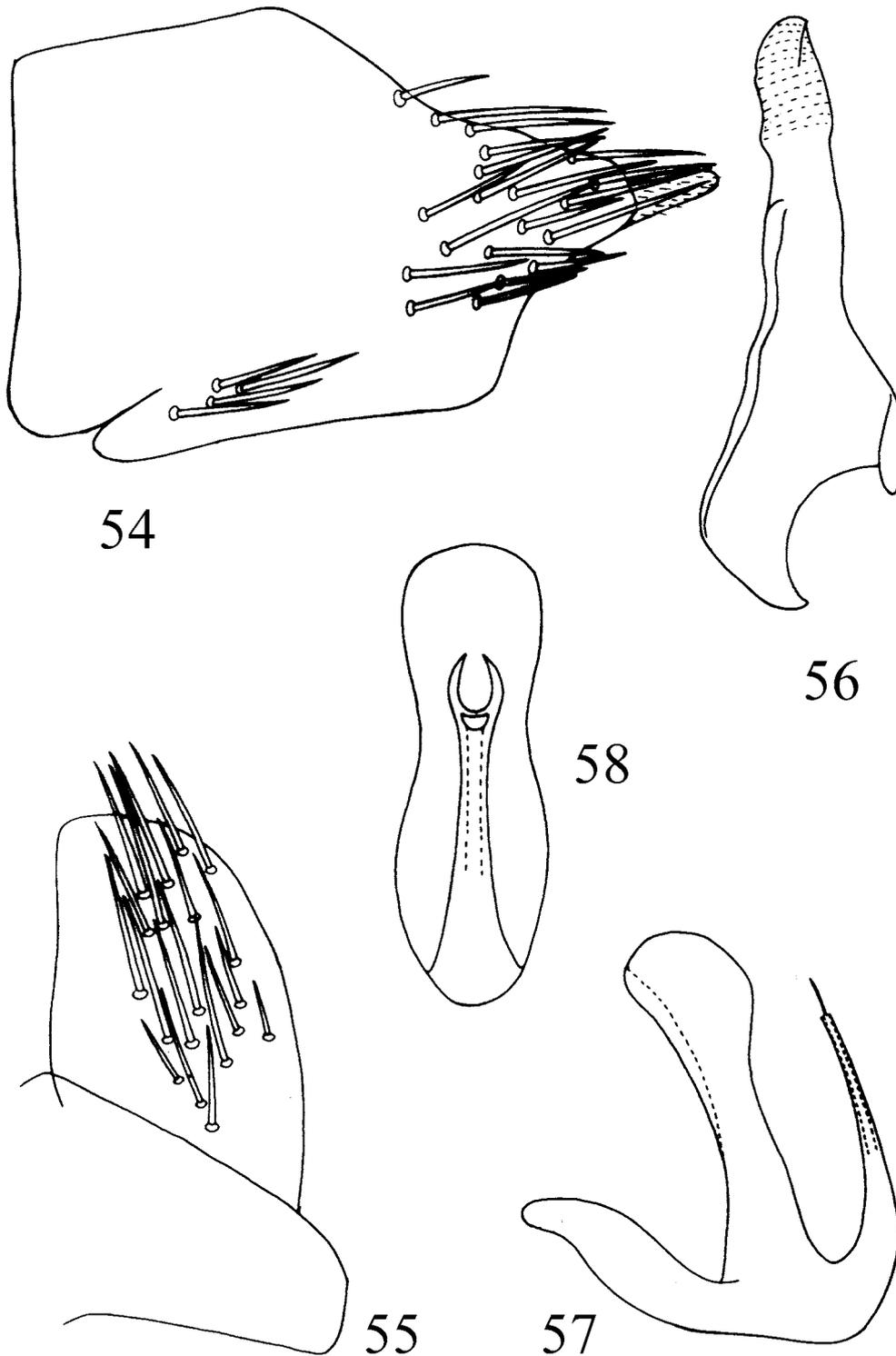


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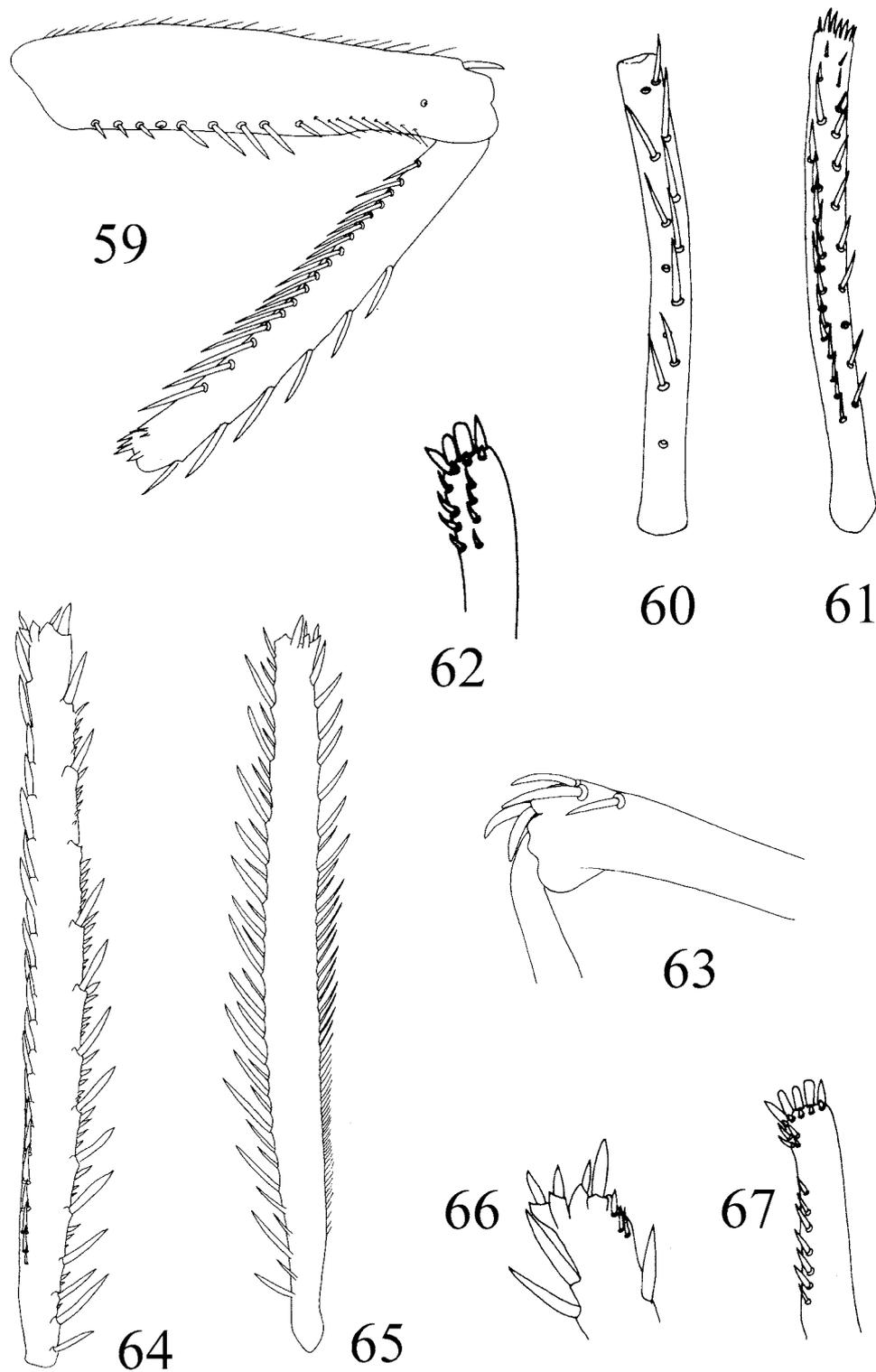


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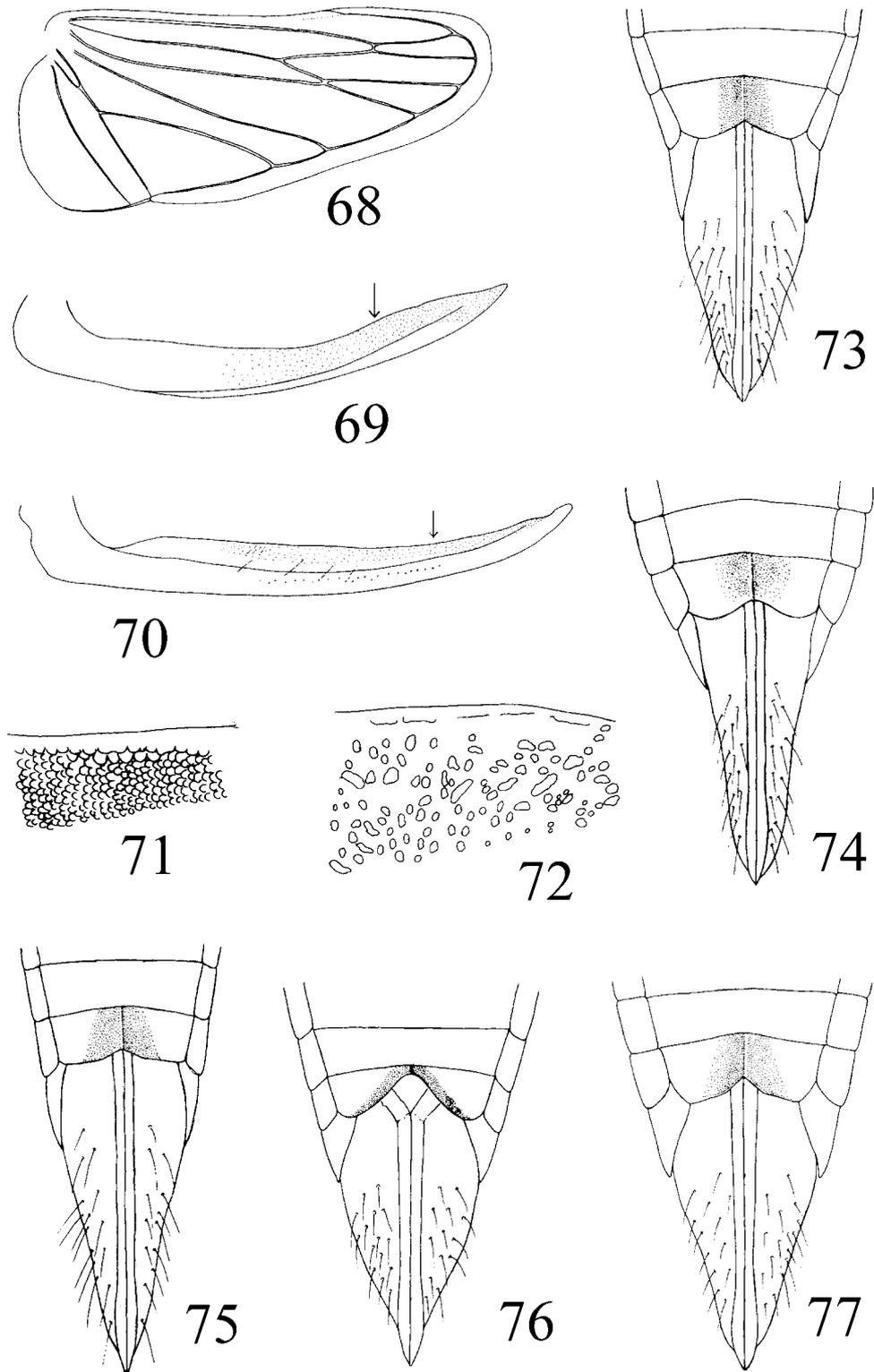
**FIGURES 50–53.** *Abrus breviolus* sp. nov. 50. Male pygophore, lateral view; 51. Genital valve and subgenital plate, dorsal and ventral view, connective and style, dorsal view; 52. Aedeagus, ventral view; 53. Aedeagus, lateral view.



**FIGURES 54–58.** *Abrus leigongshanensis* Li and Wang, 2006. 54. Male pygophore, lateral view; 55. Genital valve and subgenital plate, ventral view; 56. Left style, dorsal view; 57. Aedeagus, lateral view; 58. Aedeagus, ventral view.



**FIGURES 59–67.** *Abrus wuyiensis*: 59. fore femur and tibia, anterior surface; 60. fore tibia, dorsal view; 61. fore tibia, ventral view; 62. apex of second hind tarsomere; 63. apex of hind femur; 64. hind tibia, anterior surface; 65. hind tibia, posterior surface; 66. apex of hind tibia; 67. apex of first hind tarsomere.



**FIGURES 68–77.** Fig. 68, hindwing of *Abrus wuyiensis*; 69–77. Female genitalia of *Abrus* species. Figs 69–72. *Abrus wuyiensis*: 69. Second gonapophysis; 70. First gonapophysis; 71. Magnified view of first gonapophysis on fig. 70; 72. Magnified view of second gonapophysis on fig. 69; Figs. 73–77. Female seventh ovipositor: 73. *Abrus coneus*; 74. *Abrus hengshanensis*; 75. *Abrus huangi*; 76. *Abrus concavelus*; 77. *Abrus wuyiensis*.

**Measurement.** Male 8.8mm long (including tegmen).

**Material examined.** Holotype ♂, China: Zhejiang Prov., Tianmu Mountain, 30 July 2003, 350m, Dai Wu (EM); Paratypes : 2♂, same as holotype (EM and BMNH); 1♂, China, Zhejiang Prov., Hangzhou, Beigaofeng, 3 Aug. 2003, Dai Wu (EM); 1♂, China, Zhejiang Prov., Mogan Mountain, 21 July 1981, Yan Hengyuan (SHEM).

**Remarks.** This species is very similar to *Abrus wuyiensis* Dai and Zhang externally, but can be distinguished from the latter by: 1) subgenital plate short and wide, not extending beyond pygophore and with posterior margin truncate; 2) basal projection of aedeagus very small.

**Etymology.** This new species is named for the very short subgenital plate.

### ***Abrus leigongshanensis* Li and Wang, 2006**

Figs. 54–60

*Abrus leigongshanensis* Li and Wang, 2006:840, figs. 1–7.

**Material examined.** China: Holotype ♂, Guizhou Prov., Leigong Mountain, 14 Sept. 2005, Li Zizhong and Zhang Bin (GZU).

**Remarks.** This species resembles *Abrus hengshanensis* Dai and Zhang externally, but can be distinguished from the latter by: 1) pygophore without process at ventral margin; 2) apical appendages of aedeagus short and directed dorsally; 3) basal projection of aedeagus without lateral appendages in ventral view.

**Distribution.** China (Guizhou).

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