



## Review of the genus *Boundarus* Li & Wang (Hemiptera: Cicadellidae: Evacanthinae) from China, with description of two new species

YALIN ZHANG, XINMIN ZHANG, CONG WEI<sup>1</sup>

Key Laboratory of Plant Protection Resources and Pest Management, Ministry of Education, Entomological Museum, College of Plant Protection, Northwest A&F University, Yangling, Shaanxi 712100, China

<sup>1</sup>Corresponding author. E-mail: Congwei@nwsuaf.edu.cn

### Abstract

Three species of the genus *Boundarus* Li & Wang, including two new species, *B. ancinatus* sp. nov. and *B. nigronotus* sp. nov., from China are recognized, and the genus is reviewed. The three species are described and illustrated in detail, and the female genitalia are described for the first time. A key to all species of the genus is provided.

**Key words:** Homoptera, Auchenorrhyncha, leafhopper, taxonomy, morphology, Oriental, China

### Introduction

Li & Wang (1998) established the evacanthine leafhopper genus *Boundarus* from China, with *B. trimaculatus* Li & Wang as its type species. In the present paper we redescribe the genus based on the discovery of two new species also from China. All three species of the genus are photographed or illustrated in detail. A key to all species of the *Boundarus* is given.

Material examined is deposited in the following institutions abbreviated in the text as follows:

NWAFU	The Entomological Museum, Northwest A&F University, Yangling, China
NKU	Nankai University, Tianjin, China
IZAS	The Institute of Zoology, Chinese Academy of Sciences, Beijing, China

All the measurements in this paper are in millimeters (mm).

### Taxonomy

#### *Boundarus* Li & Wang

*Boundarus* Li & Wang, 1998: 198.

Type species: *Boundarus trimaculatus* Li & Wang.

Head (Fig. 19) rounded anteriorly, shorter than pronotum and scutellum together; crown with median longitudinal carina distinct, not extending to apex of head, disc concave, lateral margins poorly delimited; submarginal carina mesad of ocelli on crown. Face including eyes (Figs 3, 6, 9, 12, 15, 18) longer than wide; frontoclypeus with median longitudinal carina and oblique striae laterally; clypellus broad, swollen basally, narrowed apically; lora large, flat, reaching apex of clypellus; gena strongly declivous laterally. Pronotum (Figs 1, 4, 7, 10, 13, 16, 19) broad, slightly wider than head. Scutellum (Figs 1, 4, 7, 10, 13, 16, 19) triangular, shorter than pronotum; transverse depression distinct. Forewing (Figs 1, 4, 7, 10, 13, 16, 19) yellowish brown

with dark black patches, or generally black; claval veins separate throughout length; four apical cells present, appendix broad. Hind femoral spinulation 2+1+1.

Male pygofer (Figs 21, 26, 31) tapered apically in lateral view, without ventral process. Subgenital plate (Figs 25, 30, 35) elongate, with hair-like setae or macrosetae arranged in rows. Style (Figs 24, 29, 34) with basal articulating arm short, apophysis well developed, foot-like apical process with several setae and elongate lateral angle; connective (Figs 24, 29, 34) Y-shaped, stem very long. Aedeagus (Figs 22–23, 27–28, 32–33) in lateral view curved dorsad, with pair of apical processes and pair of well developed processes on dorsal part of atrium, respectively; gonopore apical.

Female slightly longer than male, with abdomen extending beyond apex of forewing (Fig. 4). First valvula (Figs 38–39, 42–43, 46–47) with longitudinal striations extending over distal one third and attaining dorsal margin; second valvula with dorsal sclerotised and hyaline area present, dorsal margin with rounded teeth on distal third (Figs 36–37, 40–41, 44–45).

**Remarks:** The genus *Boundarus* is similar to *Evacanthus* Le Peletier & Serville and *Onukia* Ishihara, but it can be easily distinguished from the latter two genera by: 1) lateral margins of crown poorly delimited; 2) veins R<sub>1a</sub> and C in forewing fused and forming an acute angle (not right angle as in the other two genera); 3) male genitalia with pair of anterior processes near middle of aedeagus (see table 1 for details).

**TABLE 1.** Comparison of diagnostic characteristics for *Boundarus* and allied genera.

Taxa	characteristics	rugae on crown	lateral margins of crown	forewing angle formed by vein R <sub>1a</sub> and vein C	ventral process of male pygofer	paired anterior processes near middle of aedeagal shaft
<i>Onukia</i>	present	distinct	right angle	absent	absent	
<i>Evacanthus</i>	absent	distinct	right angle	present	absent	
<i>Boundarus</i>	absent	vague	acute angle	absent	present	

### Key to *Boundarus* species (male)

1. Forewing generally black; apical processes of aedeagus short, about one fourth length of aedeagal shaft.....*B. nigronotus* sp. nov.
- . Forewing generally yellowish brown with black patches; apical processes of aedeagus long, exceeding one fourth length of aedeagal shaft..... 2
2. Aedeagus with anterior processes near middle of shaft not hook-like in lateral view; apical processes about half length of the shaft..... *B. trimaculatus*
- . Aedeagus with anterior processes near middle of aedeagus hook-like in lateral view; apical processes one third length of the shaft ..... *B. ancinatus* sp. nov.

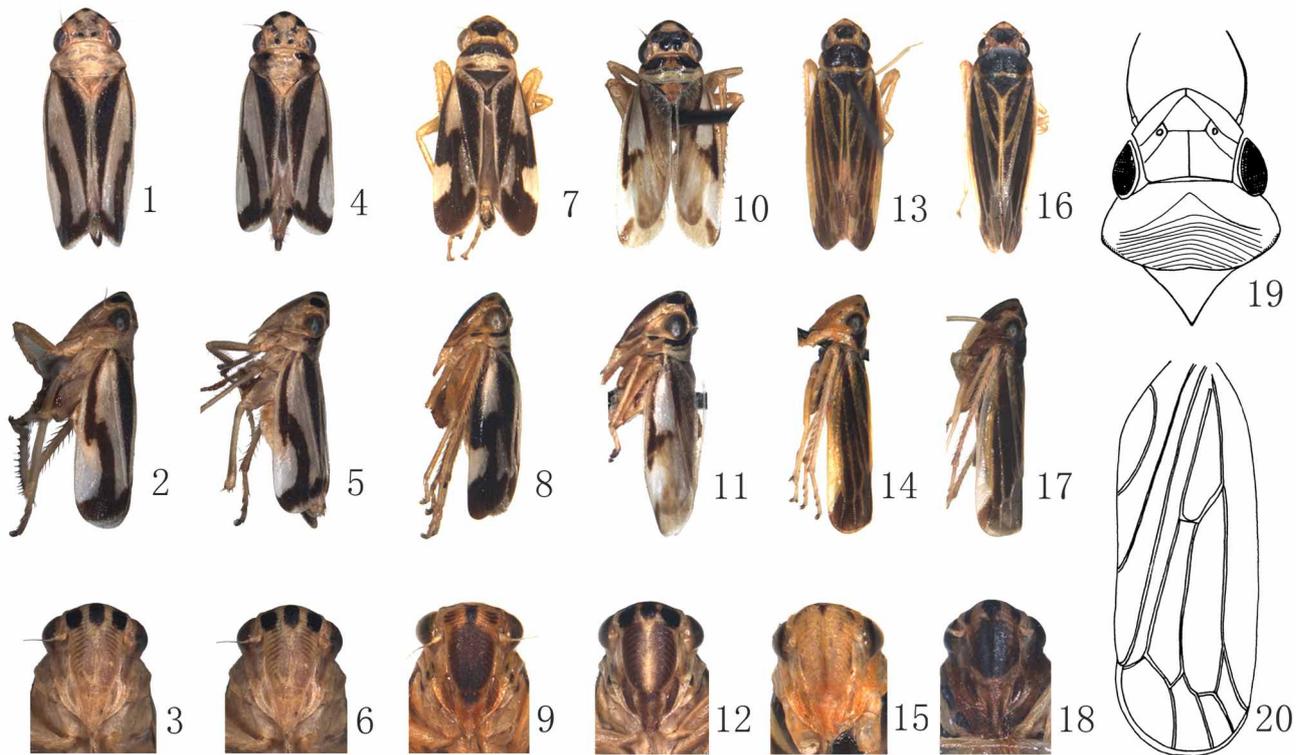
### *Boundarus trimaculatus* Li & Wang

(Figs 1–6, 21–25, 36–39)

**Measurements:** ♂: body length: 5.0–5.5; head width (incl. eyes): 1.7–1.9; head length: 0.9–1.1. ♀: body length: 6.0–7.5; head width (incl. eyes): 1.8–2.0; head length: 1.0–1.2.

Head with seven black patches in dorsal view and three big black patches in anterior view. Forewing generally yellowish brown with black patches; claval area black (Figs 1–6).

Male pygofer with macrosetae dorsally, subgenital plate extended to apex of pygofer in lateral view, distinctly narrowed apically in ventral view (Figs 21, 25). Aedeagus with atrial processes rounded dorsally with 90° posteroventral angle; shaft with apical processes long, about half length of shaft in lateral view (Fig. 22).



**FIGURES 1–20.** Habitus, face and forewing. 1–6: *B. trimaculatus*; 7–12: *B. ancinatus* sp. nov.; 13–18: *B. nigronotus* sp. nov.; 1–3, 7–9, 13–15 male; 4–6, 10–12, 16–18 female; 19–20: head and forewing of *B. trimaculatus*, respectively.

**Material examined:** 1♂ (Holotype, NWAUFU), China: Shaanxi Prov., Ningshan County, Huoditang, 15–June-1985, coll. Li Jinfang; 10♂♂, 10♀♀ (NWAUFU), China: Shaanxi Prov., Ningshan County, Huoditang, 8–30-June-1995, coll. Li Jinfang; 3♀♀ (NWAUFU), China: Shaanxi Prov., Mt. Huashan, July-1979, coll. Tian Chou & Chen Tong; 1♂ (NWAUFU), China: Shaanxi Prov., Huxian County, Huashuping, 27-June-2007, coll. Zhou Shun; 4♂♂, 5♀♀ (NWAUFU), China: Henan Prov., Songxian County, Mt. Baiyunshan, 1400m, 15-July-1996, coll. Zhang Wenzhu; 10♂♂, 10♀♀ (NWAUFU), China: Henan Prov., Luanchuan County, Longyuwan, 12-July-1996, coll. Zhang Wenzhu; 1♀ (NWAUFU), China: Sichuan Prov., Ya’an County, 12-July-1939, coll. Chou Io, Zheng Fengying & Hao Tianhe.

**Distribution:** China (Shaanxi, Henan, Sichuan).

**Remarks:** This species, the type species of the genus *Boundarus* Li & Wang, can be easily distinguished from the other two species of the genus by the seven black patches on the head in dorsal view and the much longer apical aedeagal processes, which are about half the length of the shaft.

***Boundarus ancinatus* sp. nov.**

(Figs 7–12, 26–30, 40–43)

**Measurements:** ♂: body length: 4.5–5.0; head width (incl. eyes): 1.3–1.5; head length: 0.7–0.9. ♀: body length: 5.0–6.0; head width (incl. eyes): 1.4–1.6; head length: 0.8–0.9.

Disk of head black. Pronotum black anteriorly. Forewing generally yellowish brown with black patches, claval area black (Figs 7–12).

Male pygofer with macrosetae subapically; subgenital plate slightly shorter than pygofer in lateral view (Figs 26, 30). Aedeagus with atrial processes hook-like in lateral view; apical processes about one third length of shaft (Figs 27–28).

**Etymology:** The species name refers to the hook-like anterior processes of the aedeagus.

**Material examined:** HOLOTYPE: ♂ (NKU), China: Sichuan Prov., Baoxing County, 2700m, 27-June-1963, coll. Zou Huangang; PARATYPES: 1 ♂, 2 ♀ (NKU), same data as holotype.

**Remarks:** This species is similar to *B. trimaculatus* Li & Wang, but can be distinguished from the latter by the pattern of black patch on the vertex, the shorter apical aedeagal processes, and the hook-like anterior processes near the middle of the aedeagus.



**FIGURES 21–35.** Male genitalia. 21–25: *B. trimaculatus*; 26–30: *B. ancinctus* sp. nov. 31–35: *B. nigronotus* sp. nov.; 21, 26, 31: male pygofer, lateral view; 22, 27, 32: aedeagus, lateral view; 23, 28, 33: aedeagus, ventral view; 24, 29, 34: connective and style, dorsal view; 25, 30, 35: subgenital plate, ventral view.

***Boundarus nigronotus* sp. nov.**

(Figs 13–18, 31–35, 44–47)

**Measurements:** ♂: body length: 5.5–6.0; head width (incl. eyes): 1.3–1.5; head length: 0.8–0.9. ♀: body length: 6.0–7.0; head width (incl. eyes): 1.5–1.6; head length: 0.7–0.9.

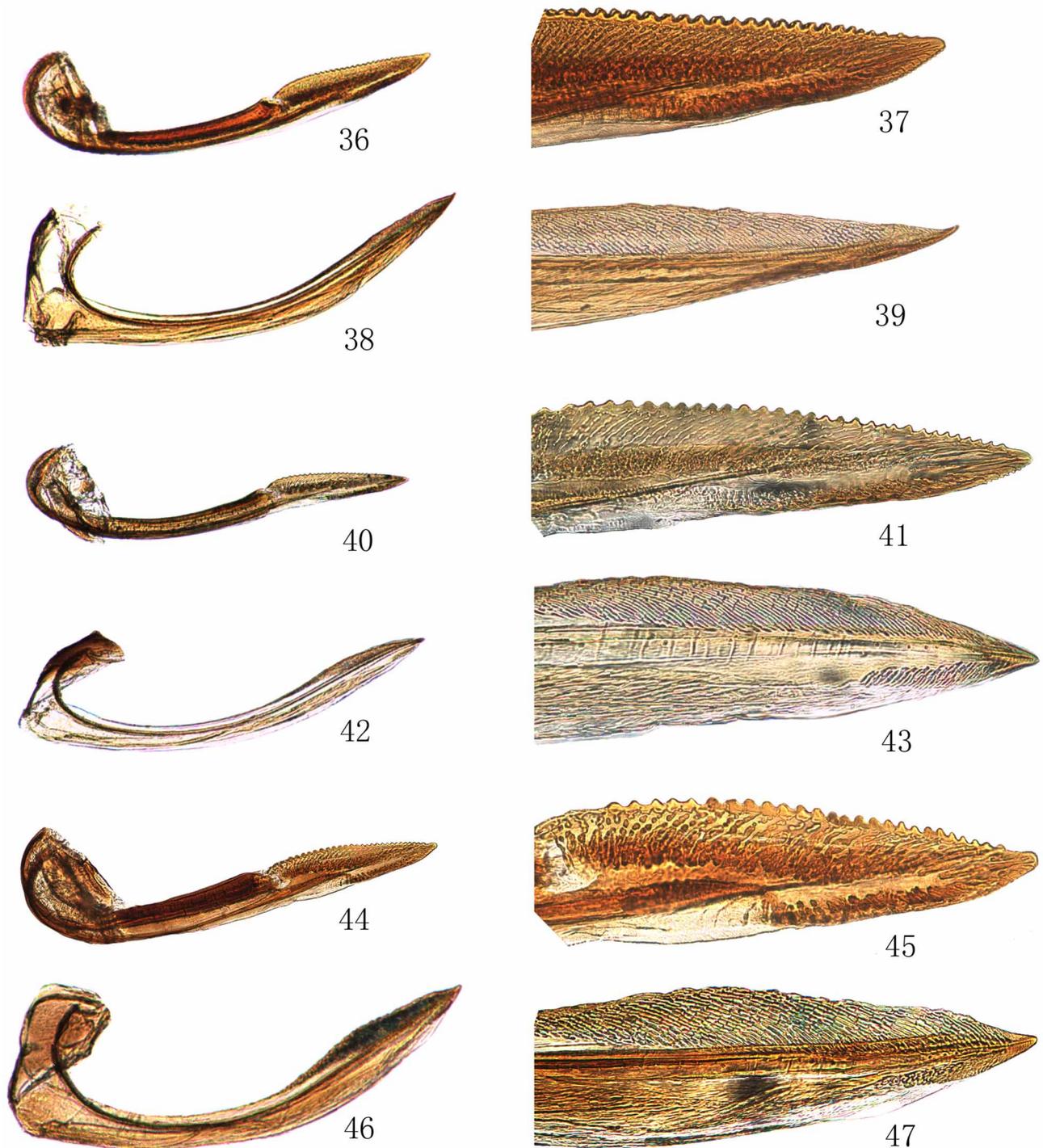
Disk of head black; pronotum and scutellum totally black; forewing generally black, with veins whitish yellow (Figs 13–18).

Male pygofer without macrosetae; subgenital plate extended well beyond apex of pygofer, with more hair-like setae (Figs 31, 35). Aedeagus with atrial processes foliate in lateral view; apical processes short, about one fourth length of shaft in lateral view, broadened basally in posterior view (Figs 32, 33).

**Etymology:** The species name refers to the black pronotum and scutellum.

**Material examined:** HOLOTYPE: ♂ (NWFU), China: Henan Prov., Luanchuan County, Longyuwan, 2000m, 13-July-1996, coll. Cai Wangzhi; PARATYPES: 1 ♂ (IZAS), China: Sichuan Prov., Mt. Emeishan,

1000–1600m, 26-June-1955, coll. Wu Le; 2♂♂, 20♀♀ (IZAS), China: Sichuan Prov., Mt. Emeishan, 1000–1600m, 26-June-1955, coll. Wu Le & Zhu Fuxing; 1♂ (NWAUFU), China: Henan Prov., Neixiang County, Baotianman, 1300m, 11-July-1998, coll. Hu Jian; 1♂, 2♀♀ (NWAUFU), China: Henan Prov., Songxian County, Baiyunshan, 1400m, 15-July-1996, coll. Zhang Wenzhu; 1♂, 5♀♀ (NWAUFU), China: Shaanxi Prov., Ningshan County, Houditang, 17-July-1984, coll. Zhang Yalin; 4♀♀ (NWAUFU), China: Jilin Prov., Hongtushan, 2-August-1983, coll. Wu Zhengliang & Hua Baozhen; 1♀ (NWAUFU), China: Guizhou Prov., Fanjingshan, 21-July-1986, coll. Li Zizhong; 1♂ (NWAUFU), China: Hubei Prov., Wufeng, 2253m, 11-July-2006, coll. Lu Lin.



**FIGURES 36–47.** Ovipositor. 36–39: *B. trimaculatus*; 40–43: *B. ancinatus* sp. nov.; 44–47: *B. nigronotus* sp. nov.; 36–37, 40–41, 44–45: second valvula, apex of second valvulae, laterior view; 38–39, 42–43, 46–47: first valvula, apex of first valvulae, lateral view.

**Remarks:** This species is distinctly different from the other two species of the genus by its body shape and coloration, in addition to the much longer subgenital plates, and the robust apical processes of the aedeagus in ventral view. It is similar to some known species of the genus *Evacanthus* Le Peletier and Serville externally, particularly in the color pattern of the forewings, but it is closer to the other species of *Boundarus* in having the same distribution of carinae on the head, similar male genitalia and other characteristics as listed in table 1. Therefore, it is tentatively placed in the genus *Boundarus*.

### Acknowledgements

We are grateful to Prof. C.A. Virakthamath (University of Agricultural Sciences, India) for his help to examine some related specimens, and to Prof. Qiao Gexia (IZAS) and Prof. Liu Guoqing (NKU) for lending us the specimens. The project is supported by the National Natural Science Foundation of China (Grant No. 30870326) and the Fundamental Research Funds for the Central Universities (PY200908).

### References

Li, Z.Z. & Wang, L.M. (1998) A new genus and a new species of Evachanthinae from China (Homoptera: Cicadellidae) *Acta Zootaxonomica Sinica*, 23(2): 198–199.