Spittlebug genus *Kanozata* Matsumura (Hemiptera, Cercopoidea: Cercopidae) with a new distribution record of *K. contermina* (Distant) to China

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Wang, X.-Y., Yang, N.-N. & Ren-Huai Dai, R.-H. 2018: Spittlebug genus *Kanozata* Matsumura (Hemiptera, Cercopoidea: Cercopidae) with a new distribution record of *K. contermina* (Distant) to China. — Entomol. Fennica 29: 191–200

Male and female genitalia of species in the spittlebug genus *Kanozata* Matsumura, 1940 are described and illustrated. *Kanozata contermina* (Distant, 1916) is reported from China for the first time. Keys to species and a distribution map are provided.

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Received 25 January 2018, accepted 23 May 2018

1. Introduction

The genus *Kanozata* Matsumura, 1940 (Hemiptera: Cercopoidea; Cercopidae) was established by monotypy with the description of *K. arisana* Matsumura, 1940. Liang and Webb (2002) revised the genus and proposed three new combinations: *K. choui* (Yuan & Wu, 1992), previously in *Stenaulophrys* Jacobi, 1921, *K. shillongana* (Distant, 1916) and *K. contermina* (Distant, 1916), both originally described in *Aufidus* Stål, 1863. Accordingly, four species are actually known for this genus, three of which are present in China. The genus *Kanozata* is distributed mainly in the Oriental zoogeographical region. This genus can be distinguished from other genera largely by the following combination of characteristics: the central region of postclypeus is longitudinally sulcate, the pygofer lobe is elongate and strongly recurved, the aedeagal shaft is elongate and caliper-like and the subgenital plates are lanceolate with a narrow base and a membranous outer margin.

In this paper, all species of the genus are examined and illustrated, including female genital characteristics. Until now, geographical distribution data and the female genital characteristics of the genus are incomplete. Although all species have been described, some illustrations are missing or simple. Therefore, further descriptions and illustration of the species are provided here. Male and female external morphology are compared for the first time. Accordingly, this study provides a basis for the species identification of females. Females are bigger than males but with similar external features. The female genitalia of the four species are similar except for the 1st ovipositor valvula with some differences in the lobe and the ventral hyaline area (VHA). Identification keys of the four species are given but structured differently from that of Liang and Webb (2002), e.g. provided separately for females and males. In ad-

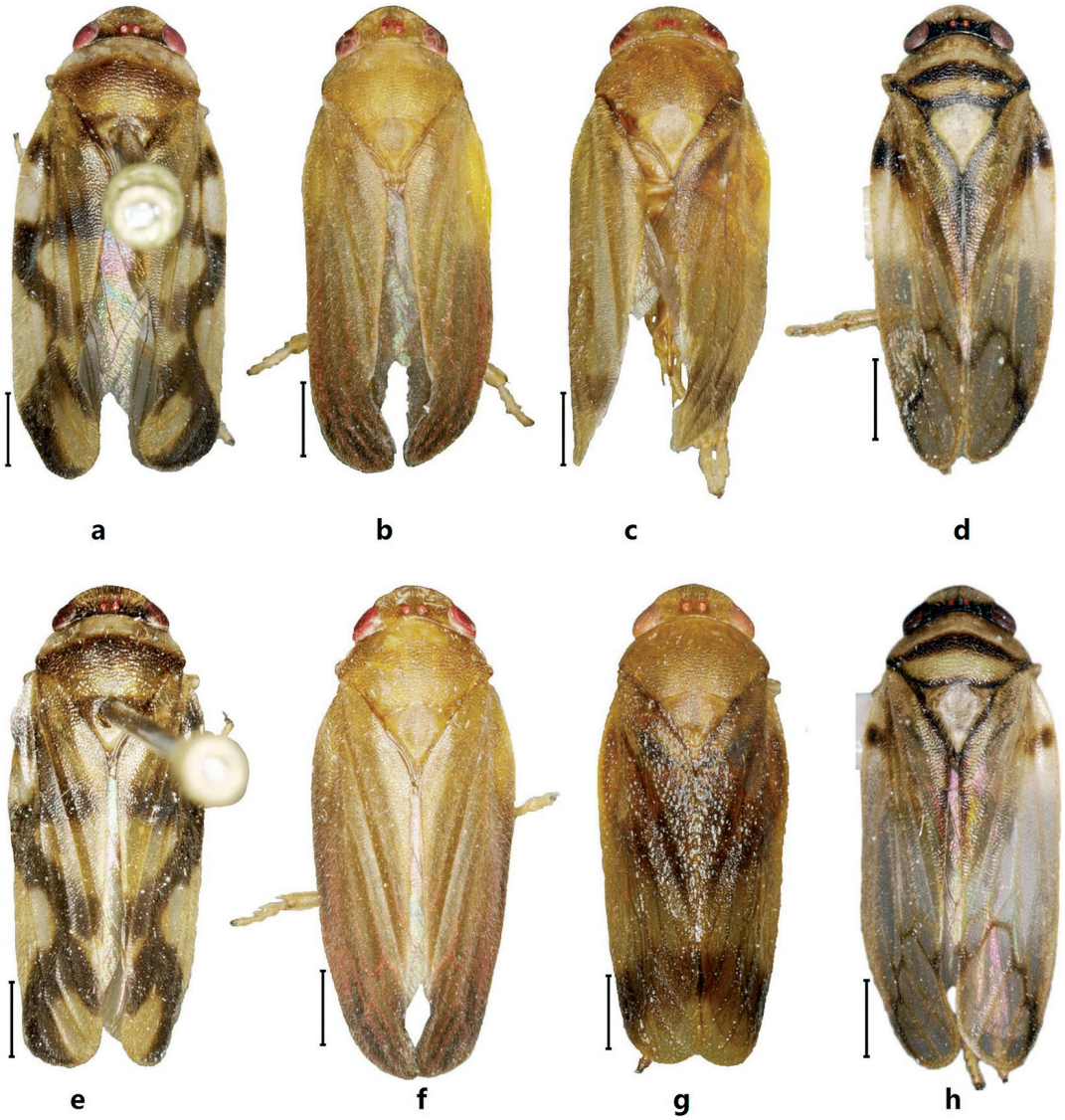

Fig. 1. Adult dorsal view of *Kanozata* species, male (a–d) and female (e–h). – a, e. *K. arisana* Matsumura, 1940. – b, f. *K. choui* (Yuan & Wu, 1992). – c, g. *K. contermina* (Distant, 1916). – d, h. *K. shillongana* (Distant, 1916). Scale bars 1.0 mm.

dition, a geographical map showing the distribution of the species is provided. *Kanozata contermina* is reported for the first time from China, Yunnan Province.

2. Materials and methods

All the specimens in this study were collected using sweep nets, preserved in test tubes (10×100 mm), and air-dried and mounted for subsequent study. The habitus photographs were taken using a KEYENCE VHX-1000 system.

The male and female abdomens of *Kanozata* were removed from adult specimens, then placed in boiling 8–10% NaOH solution for 2–3 min. They were then washed 4 or 5 times in distilled water and finally placed on a microscope slide with a drop of glycerin for observation. Dissections and observations of the genitalia were made under an Olympus SZX7 stereomicroscope. After the examination, the structures of genitalia

Fig. 2. Lateral habitus of *Kanozata* species, male (a–d) and female (e–h). – a, e. *K. arisana* Matsumura, 1940. – b, f. *K. choui* (Yuan & Wu, 1992). – c, g. *K. contermina* (Distant, 1916). – d, h. *K. shillongana* (Distant, 1916). Scale bars 1.0 mm.

were stored in micro vials with glycerin for permanent preservation. The specimens examined are deposited in the Institute of Entomology, Guizhou University, China (GUGC).

Morphological terminologies and higher classification follow Liang and Webb (2002). The abbreviation VHA is used for ventral hyaline area.

The distribution data are according to the available literatures by Distant (1916), Matsumura (1940), Chou and Wu (1988), Yuan

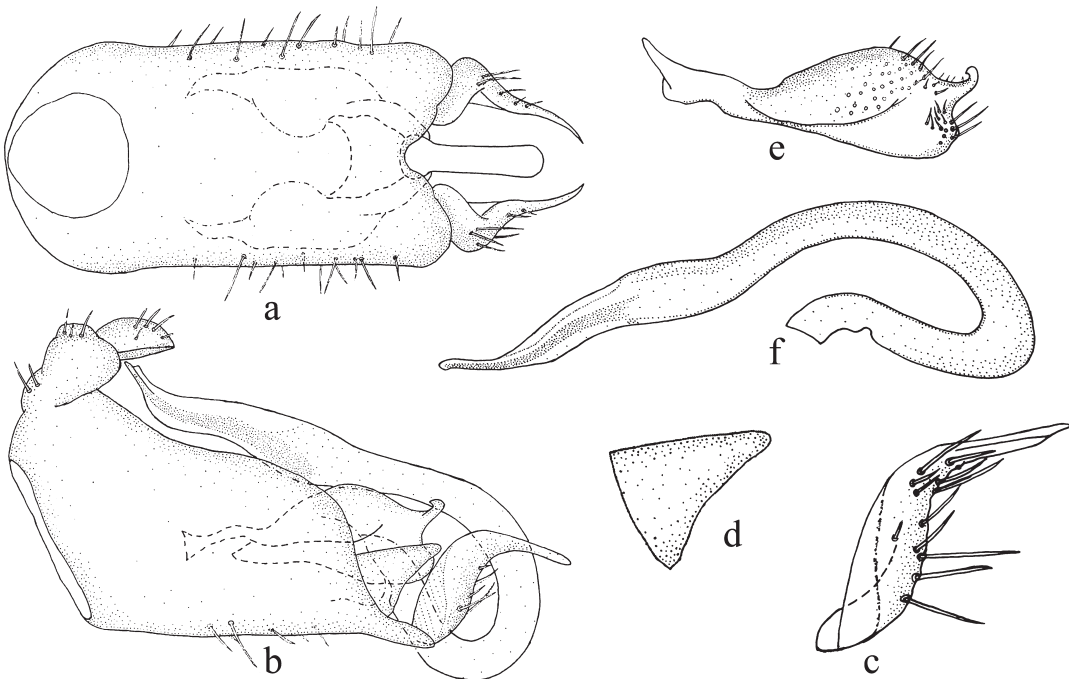

Fig. 3. *Kanozata arisana* Matsumura, 1940. – a. Male pygofer, ventral view. – b. Male pygofer, lateral view. – c. Sub-genital plate, lateral view. – d. Lateral plate, lateral view. – e. Style, lateral view. – f. Aedeagus, lateral view.

and Wu (1992), Liang (1999, 2003) and Liang and Webb (2002). The geographical distribution map was prepared by the software Arcview 3.3. Zoogeography used in this work follows Elton (1953).

3. Taxonomy

3.1. Descriptions of species of *Kanozata*

3.1.1. *Kanozata arisana* Matsumura, 1940

Kanozata arisana Matsumura, 1940: 67; Liang & Webb 2002, 36: 741.

Material examined. 1 ♂, China, Guizhou Province, Leigongshan, Lianhuaping, 13–14.IV.2005, Zhonghui Zhou leg.; 1 ♂, China, Guangxi Province, Damingshan, 14.V.2012, Hu Li leg.; 2 ♀♀, China, Guizhou Province, Fanjingshan, 22.IV. 2011, Weibin Zheng & Zhimin Chang leg.; 2 ♂♂, China, Hubei Province, Shennongjia, Yazikou, 11.VIII.1997, Maofa Yang leg.; 2 ♀♀, China, Guizhou Province, Fanjingshan, 20–22.IX.2010, Zhihua Fan & Zhimin Chang leg.; 2 ♀♀, China, Guizhou Province, Leigongshan, Lianhuaping, 13–14.IX.2005, Yi Tang leg.; 4 ♀♀, China, Guizhou Province, Leigongshan, Lianhuaping, 17–18.IX.2005, Deyan Ge & Zaihua Yang leg.; 7 ♀♀, China, Guizhou Province, Leigongshan, 3–16.VII.2011, Zhimin Chang & Weibin Zheng leg.; 6 ♂♂, 5 ♀♀, China, Guizhou Province, Leigongshan, Xiaodanjiang, 17–18.IX.2005, Zizhong Li & Bin Zhang leg.

Description. Body length. (including tegmina): ♂, 6.40–6.50 mm, ♀, 7.65–7.80 mm. General colour black or brown, pronotum, crown and scutellum (Figs 1g, 2g) with black bands, forewings (Figs 1a, 2a) pale yellow with dark brown bands, zigzag-shaped.

Genitalia. Male. Genitalia with subgenital plates (Fig. 3a–c) caliper-like, without seta, middle part with long setae, apex with about 5–6 setae, with narrow base and membranous outer margin, elongate, and lateral margin with about 10–14 setae. Lateral plates (Fig. 3d) triangular in lateral view, ventral margin curved, with many fine setae. Style (Fig. 3e) well developed, slender near base, middle-upper part expanded, with many progressively larger setae, apex with

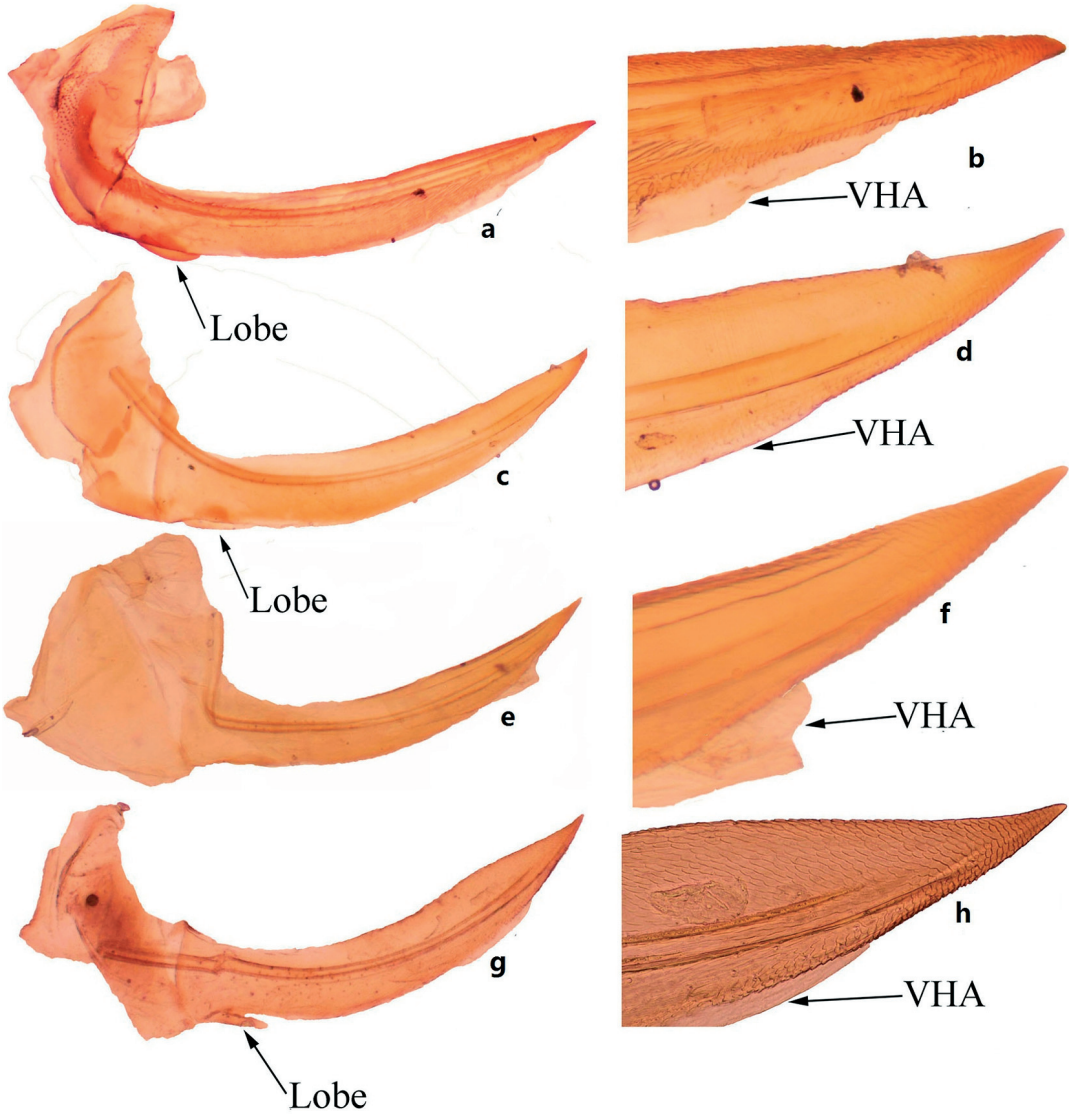

Fig. 4. Valvulae I of ovipositor of *Kanozata* species. – a, b. *K. arisana* Matsumura, 1940. – c, d. *K. choui* (Yuan & Wu, 1992). – e, f. *K. contermina* (Distant, 1916). – g, h. *K. shillongana* (Distant, 1916). VHA=ventral hyaline area.

densely stout setae, apical process curved, and with many fine setae. In lateral view, aedeagal shaft (Fig. 3f) elongate, concave near base, quarter strongly recurved, narrow basally to broad sub-apically and then tapered to apex, apex recurved.

Female. In lateral view, 1st valvulae (Figs. 4a–b) of ovipositor slightly twisted dorsad, tapering, tip sharpened, base of shaft slightly expanded, dorsal sculptured area formed by dense scale-like processes. VHA (Fig. 4b) visible near apex. Sub-basal lobe (Fig. 4a) rounded ventrally and touching its ventral surface.

Distribution. China (Taiwan, Hubei, Guangxi, Fujian, Sichuan, Yunnan, Guizhou).

Remarks. This species is similar to *K. shillongana* (Distant 1916), but can be distinguished by the following: (1) This species has lateral plates (Fig. 3d) triangular in lateral view. (2) Female 1st valvulae (Fig. 4a–b) of the ovipositor are slightly twisted, sub-basal lobe (Fig. 4a) rounded ventrally and touching its ventral surface.

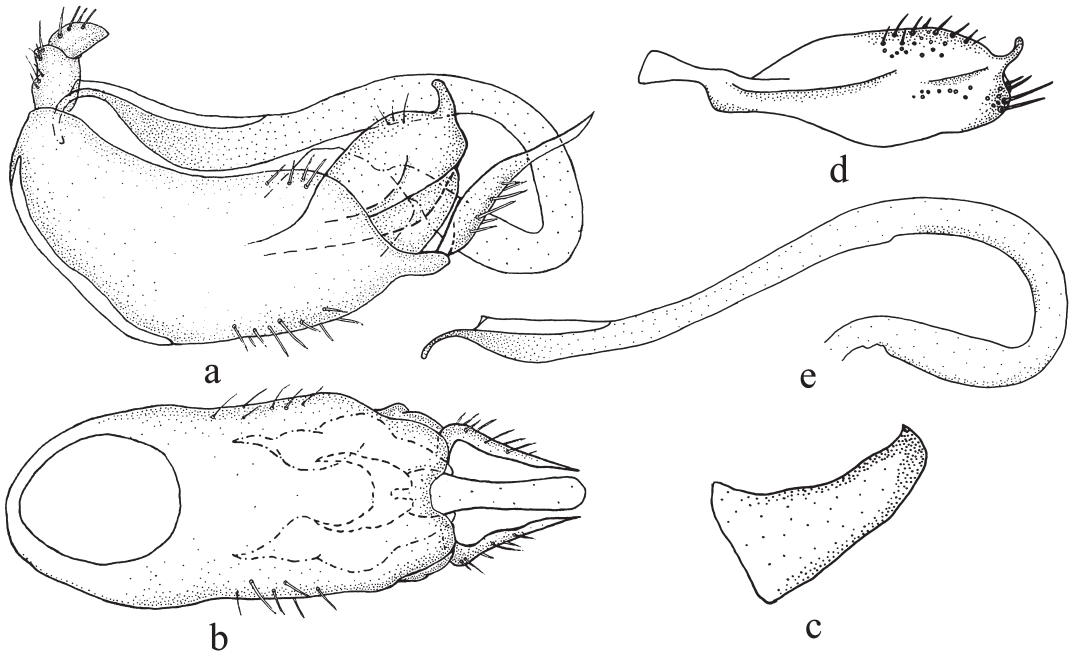

Fig. 5. *Kanozata choui* (Yuan & Wu, 1992). – a. Male pygofer, lateral view. – b. Male pygofer, ventral view. – c. Lateral plate, lateral view. – d. Style, lateral view. – e. Aedeagus, lateral view.

3.1.2. *Kanozata choui* (Yuan & Wu, 1992)

Stenaulophrys Choui Yuan & Wu, 1992: 227–228.

Kanozata choui (Yuan & Wu 1992), Liang & Webb 2002, 36: 741.

Material examined. 1 ♂, China, Yunnan Province, Longling County, Xiaoheishan, 25.VII.2002, Maofa Yang leg.; 1 ♂, 2 ♀♀, China, Tibet, Bome County, Tongmai, 29.VIII.2011, Ye Liu leg.; 1 ♂, 1 ♀, China, Yunnan Province, Lushui County, Pianma, 17.VIII.2000, Zizhong Li leg.; 1 ♂, China, Lushui County, Lanben, 12.VIII.2000, Unkown leg.; 1 ♂, China, Song County, Baiyunshan, 3.VII.2002, Xiangsheng Chen leg.; 1 ♂, China, Guizhou Province, Daozhen County, Xiannvdong, 25–27.V.2004, Zhang Bin & Pian Xu leg.; 1 ♂, 1 ♀, China, Guangxi Province, Wuming County, Damingshan, 5–10.VIII.2011, Zaihua Yang leg.; 4 ♂♂, 23 ♀♀, China, Shaanxi Province, Zhouzhi County, Heihe, 9–12.VIII. 2010, Yanli Zheng & Pei Zhang, leg.; 1 ♀, China, Guizhou Province, Leigongshan, Lianhuaping, 9–14.IX.2005, Yi Tang leg.; 2 ♀♀, China, Hubei Province, Shennongjia, Yazikou, 11.VIII.1997, Maofa Yang leg.; 2 ♀♀, China, Sichuan Province, An County, Chaping, 20–22.VII.2010, Kebin Li leg.; 3 ♀♀, China, Yunnan Province, Tengchong County, Gaoligongshan, 17–19.VII. 2002, Renhuai Dai leg.; 5 ♂♂, 1 ♀, China, Henan Province, Baiyunshan, 3.VIII.2010, Coll. Hu Li & Zhihua Fan leg.; 2 ♂♂, China, Henan Province, Xixia County, Taiping Town, 31.VII.2010, Hu Li & Zhihua Fan leg.; 1 ♂, 1 ♀, China, Yunnan Province, Mengyang, 20.VII.2008, Xiaohong Jiang leg.

Description. Body length (including tegmina): ♂, 5.90–6.05 mm, ♀, 6.50–6.60 mm. Overall colouration yellow, apical area of forewings (Figs 1b, f, 2b, f) black or brown, marked with reddish.

Genitalia. Male. Pygofer lobe (Fig. 5a–b) yellowish-brown, base with several fine setae, subapex with about 15–18 setae. Subgenital plates (Fig. 5a–b) lanceolate, apex sparsely with lateral setae (Fig. 5c), horn-like in lateral view, apex slightly recurved. Style (Fig. 5d) well-developed, expanded near base, middle part with many fine setae, apex with longer setae than in base, apical process with fine setae, slightly curved. Aedeagal shaft (Fig. 5e) slender, near base expanded, strongly recurved, apex wide and flat, then

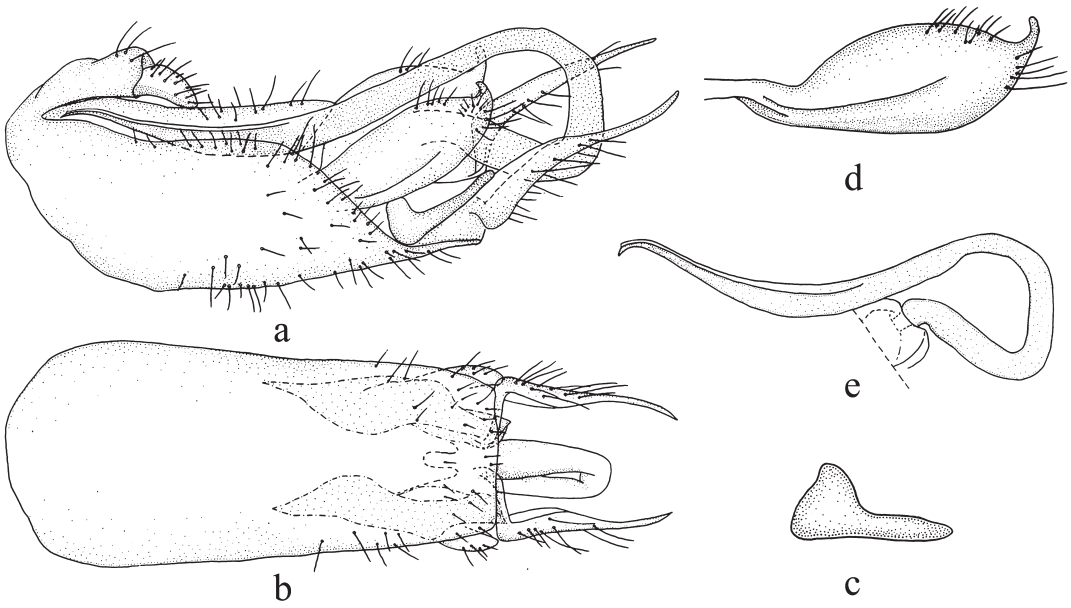

Fig. 6. *Kanozata contermina* (Distant, 1916). – a. Male pygofer, lateral view. – b. Male pygofer, ventral view. – c. Lateral plate, lateral view. – d. Style, lateral view. – e. Aedeagus, lateral view.

spoon-shaped to apex, apex blunt in lateral view, margins curved ventrally, with membranous upper surface.

Female. Shaft of 1st valvulae (Fig. 4c–d) extremely twisted dorsad, base slightly expanded, ventral area of ovipositor slightly sculptured in lateral view, with a triangle-shaped process in dorsad, VHA (Fig. 4d) narrow, with small lobe on ventral surface. Other characteristics similar as in *K. contermina* (Distant, 1916).

Distribution. Northeastern India, northern Thailand, northern Vietnam, China (Shaanxi, Yunnan, Tibet, Henan, Guizhou, Guangxi, Sichuan, Hubei).

Remarks. This species is similar to *K. contermina*, but can be distinguished by the following: (1) This species has the lateral plates (Fig. 5c) horn-like in lateral view. (2) Female 1st valvulae (Figs. 4c–d) are with a small lobe.

3.1.3. *Kanozata contermina* (Distant, 1916) **rec. nov.**

Aufidus conterminus Distant, 1916: 205.
Kanozata contermina (Distant, 1916), Liang & Webb 2002, 36: 741.

Material examined. 1 ♂, China, Yunnan Province, Longling County, Xiaoheishan, 25.VII.2002, Renhuai Dai leg.; 2 ♂♂, 1 ♀, China, Yunnan Province, Yingjiang County, Tongbiguan, 21.VII. 2002, Zizhong Li leg.; 2 ♀♀, China, Yunnan Province, Yingjiang County, Tongbiguan, 2.VII. 2011, Yujian Li leg.

Description. Body length (including tegmina): ♂, 6.05–6.15 mm, ♀, 6.30–6.45 mm. General colour yellow, male without stripe. In female, forewing with two black bands.

Genitalia. Male. Pygofer lobe with subgenital plates (Fig. 6a–b) slender, with many slender setae, middle part slightly expanded. Lateral plates (Fig. 6c) boot-like in lateral view. Styles (Fig. 6d) well-developed, base slightly expanded, middle part with about 10–12 fine setae, and with an apical process. In lateral view, aedeagal shaft (Fig. 6e) elongate, strongly recurved, constricted sub-basally, evenly tapered from near mid-length to blunt apex with membranous upper surface.

Female. Base of 1st valvulae (Fig. 4e) extremely expanded, ovipositor without basal lobe on ventral margin, apex acute, not concave and without process. VHA (Fig. 4f) with indented margin. Other characteristics as in *K. choui*.

Distribution. Northeastern India, Bhutan, northern Thailand, Nepal, China (Yunnan).

Remarks. This species is similar to *K. choui*, but can be distinguished by the following: (1)

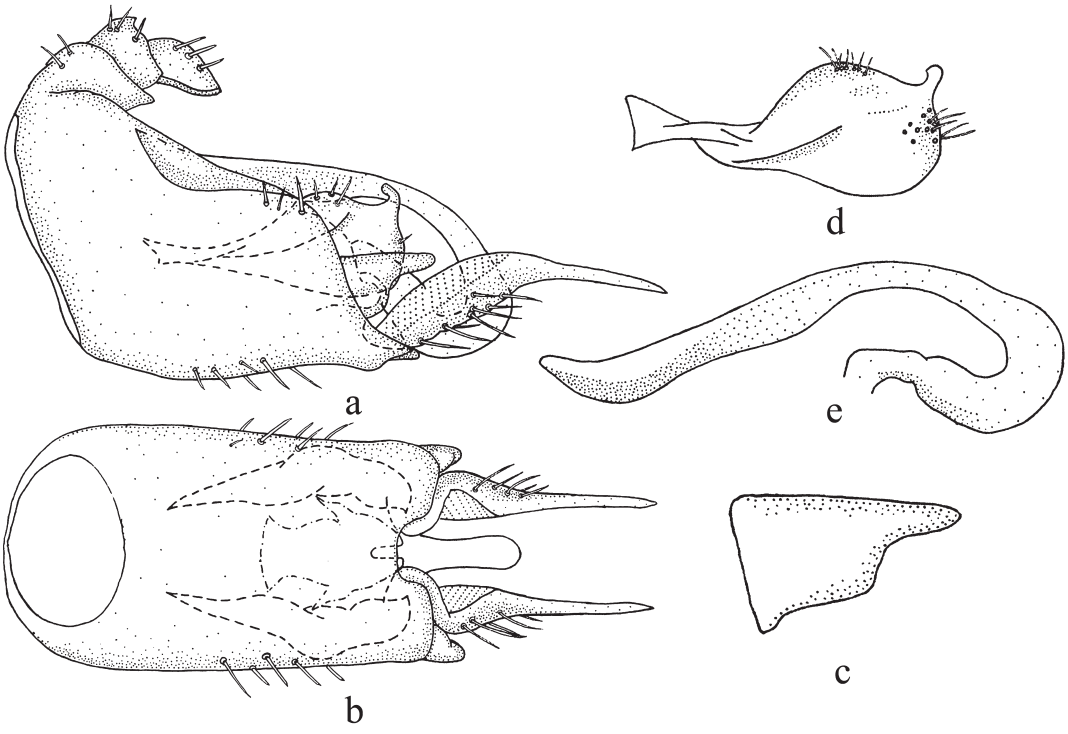

Fig. 7. *Kanozata shillongana* (Distant, 1916). – a. Male pygofer, lateral view. – b. Male pygofer, ventral view. – c. Lateral plate, lateral view. – d. Style, lateral view. – e. Aedeagus, lateral view.

This species has lateral plates (Fig. 6c) boot-like in lateral view. (2) Female 1st valvulae (Fig. 4e) are without a lobe.

3.1.4. *Kanozata shillongana* (Distant, 1916)

Aufidus shillonganus Distant, 1916: 204.
Stenaulophrys shillonganus (Distant, 1916), Chou 1988, 137.
Kanozata shillongana (Distant, 1916), Liang & Webb 2002, 36: 741.

Material examined. 8 ♂♂, 11 ♀♀, China, Guangdong Province, Nanling, 4–12.VIII.2006, Zhonghui Zhou & Zaihua Yang leg.; 1 ♂, China, Yunnan Province, Longling County, Longxin, 10–11.VI.2010, Yujian Li leg.; 2 ♂♂, China, Yunnan Province, Lushui County, Pianma, 17.VI.2011, Yujian Li leg.; 2 ♂♂, 4 ♀♀, China, Yunnan Province, Tengchong County, Gaoligongshan, Baihualing, 13–14.VI.2011, Yujian Li & Jiankun Long leg.; 6 ♂♂, 7 ♀♀, China, Yunnan Province, Yingjiang County, Tongbiguan, 3.VI.2010, Jiankun Long leg.; 1 ♀, China, Yunnan Province, Dali, 21.VI.2010, Yujian Li leg.; 5 ♀♀, China, Yunnan Province, Longling County, Xiaoheishan, 25.VII.2002, Renhuai Dai & Maofa Yang leg.; 1 ♀, China, Hainan Province, Bawangling, 27.IV.2009, Xiaohong Jiang leg.; 1 ♀, China, Hainan Province, Polu, 23.IV.2009, Xiaohong Jiang leg.; 1 ♀, China, Guangdong Province, Nanling, 11–13.VIII.2006, Zhonghui Zhou leg.

Description. Body length (including tegmina): ♂, 5.60–5.75 mm, ♀, 6.40–6.55 mm. General colour pale yellow; forewings (Figs 1h, 2h) subhyaline, oblique, with transverse bands on subclaval areas.

Genitalia. Male. Pygofer (Fig. 7a–b) relatively strong, middle-part with many slender setae. Subgenital plates (Fig. 7a–b) caliper-like with narrow base and membranous outer margin. Lateral plates (Fig. 7c) with indented margin in lateral view. Styles (Fig. 7d) well developed, with apical middle-part of process clearly expanded, thin near apex and slightly curved. Aedeagal shaft (Fig. 7e) elongate, strongly recurved, basally broad, middle part narrow and broad to near

apex, thereafter tapered to apex and with membranous upper surface.

Female. 1st valvulae (Fig. 4g–h) of ovipositor deeply sculptured. Apex of sub-basal lobe spiny shaped whose apex is not touching its ventral surface (Fig. 4g). VHA (Fig. 4h) flake-like. Other characteristics similar as in *K. arisana.*

Distribution. Northeastern India, Northern Thailand, Laos, China (Yunnan, Sichuan, Guangxi, Hainan, Fujian, Tibet, Guangdong).

Remarks. This species is similar to *K. arisana*, but can be distinguished by the following: (1) This species has lateral plates (Fig. 7c) step-like in lateral view. (2) Female 1st valvulae of ovipositor are deeply sculptured, the sub-basal lobe is spiny shaped and its apex is not touching its ventral surface (Fig. 4g).

3.2. Key to species of *Kanozata*

3.2.1. Males

1. Head, pronotum, scutellum and most of forewings bright yellow (Fig. 1b, c) 2
– Not as above (Fig. 1a, d) 3
2. Apical area of forewings black or brown and reddish along nervation (Figs 1b, 2b). Terminalia in lateral view with lateral plates triangular (Fig. 5c) and margins of aedeagal shaft parallel (Fig. 5e)
K. choui (Yuan & Wu, 1992)
– Apical area of forewings with a black transverse band (Figs 1c, 2c). Terminalia in lateral view with lateral plates boot-shaped (Fig. 6c) and aedeagal shaft constricted sub-basally, tapered from midlength to apex (Fig. 3e)
K. contermina (Distant, 1916) **rec. nov.**
3. Forewings pale yellow with a dark brown band zigzag-shaped (Figs 1a, 2a). Terminalia in lateral view with lateral plates triangular (Fig. 3d) and aedeagal shaft curved dorsally anteriorly, tapered to apex (Fig. 4f)
K. arisana Matsumura, 1940
– Forewings subhyaline with an oblique band on subclaval area and dark brown transverse veins defining apical cells (Figs 1d, 2d). Terminalia in lateral view with lateral plates indented (Fig. 7c) and aedeagal shaft broad basally and subapically then tapered to apex (Fig. 7e) *K. shillongana* (Distant, 1916)

3.2.2. Females

1. Forewings without band (Figs 1f, 2f), VHA not distinct (Fig. 4d)
K. choui (Yuan & Wu, 1992)
– Forewings with bands (Figs 1e, g, h, 2e, g, h), VHA distinct (Fig. 4b, f–h) 2
2. Pronotum, crown and scutellum without black bands (Figs 1g, 2g). 1st valvulae without sub-basal lobe (Fig. 4e)
K. contermina (Distant, 1916) **rec. nov.**
– Pronotum, crown and scutellum (Figs 1e, h, 2e, h) with black bands. 1st valvulae with sub-basal lobe (Fig. 4a, g) 3
3. Forewings subhyaline with an oblique transverse band on subclaval area (Figs 1h, 2h). 1st valvulae with sub-basal lobe spiny shaped, its apex not touching its ventral surface (Fig. 4g)
K. shillongana (Distant, 1916)
– Forewings pale yellow with dark brown band zigzag-shaped (Figs 1a, 2a). 1st valvulae with apex of sub-basal lobe touching ventral surface, 1st valvulae with sub-basal lobe (Fig. 4a) rounded ventrally and touching its ventral surface
K. arisana Matsumura, 1940

4. Geographical distributions of *Kanozata* species

The geographical distribution of the genus (Fig. 8) reveals that *K. arisana*, *K. contermina* and *K. shillongana* occur in the Oriental region (China [Guizhou, Hubei, Yunnan, Guangdong, Guangxi, Hainan, Fujian, Tibet (Medog), Taiwan, Sichuan, Henan], Bhutan, India, Thailand, Nepal and Laos) (Distant 1916, Matsumura 1940, Chou *et al.* 1988, Liang 1999, 2003, Liang & Webb 2002). Of these, *K. arisana* is distributed only in China. *Kanozata choui* is widely distributed in northeastern India, northern Thailand, northern Vietnam, and in Oriental China (Shaanxi, Yunnan, Tibet, Henan, Guizhou, Guangxi, Sichuan, Hubei, Tibet (Bome, Zhangmu)) (Yuan & Wu 1992, Liang & Webb 2002, Liang 2003) as well as some Palaearctic regions of China (Shaanxi (Taibaishan)) (Yuan & Wu 1992).

Obviously, the genus has the main distribution in northeast of India, southwest and south of

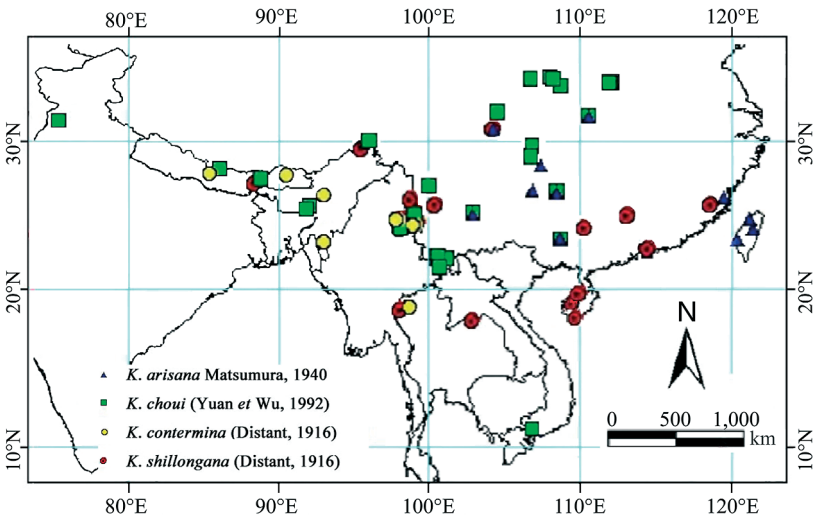

Fig. 8. Distribution map of the genus *Kanozata*.

China, but also reaching towards south and north from those areas. The distribution pattern of *Kanozata* conforms with the point that northeastern India and southern China (south of Qinling Mountains) is a sister region (nearest area of biogeographic relations) to an area including southern Yunnan, Indochina, Malay peninsula and Kepulauan Sunda Besar (Liang 1998). The distribution type of *K. arisana* agrees with the standpoint that Taiwan is a sister region to southern China (south of Qinling Mountains) (Liang 1998). Northeast of India, southwest and south of China may be treated as a key area of *Kanozata* diversity conservation.

This genus may have originated after the formation of the Oriental region. Combining the geological history of China and the surrounding regions, we think that the species of *Kanozata* there may have originated in Laurasia and Gondwanaland (Liang 1998). However, it is necessary to expand the collection range and improve the knowledge of distributions in order to confirm the origin of *Kanozata* more accurately, in which also clarifying the phylogenetic relationships of the species will be helpful.

Acknowledgements. We thank two anonymous referees for reading the manuscript and making some constructive suggestions. We also thank our colleagues and friends (GUGC) for kindly offering the materials for study. The project was supported by the special foundation of developing outstanding young science and technology talents, Guizhou Province, China (Qiankeherenzi (2011) NO. 16).

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