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Research article

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Five new species of the genus *Andes* Stål, 1866 from China (Hemiptera, Fulgoromorpha, Cixiidae)

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Abstract. Five new species of the genus *Andes* Stål, 1866, *A. balteiformis* Wang, Zhi & Chen sp. nov., *A. bifidus* Wang, Zhi & Chen sp. nov., *A. furcutus* Wang, Zhang & Chen sp. nov., *A. latanalus* Wang & Chen sp. nov. and *A. pallidus* Wang & Chen sp. nov. from China, are described and illustrated. A key to the species of *Andes* in China is provided.

Keywords. Fulgoroidea, Andini, male genitalia, morphology, taxonomy.

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Introduction

Cixiidae Spinola, 1839 is a family within Fulgoromorpha including approximately 2589 species in 247 genera from all over the world (Bourgoin 2022). Cixiidae is often considered the most primitive family of Fulgoromorpha, as it retains a series of primitive morphological features and is distributed worldwide with a high diversity, especially in the tropics (O'Brien & Wilson 1985; Emeljanov 2002). Three subfamilies are recognized: Borystheninae Emeljanov, 1989, Bothriocerinae Muir, 1923 and Cixiinae Spinola, 1839. Cixiinae is divided into 15 tribes (Emeljanov 2002), and the new species described in this paper belong to the tribe Andini Emeljanov, 2002. Currently Andini includes 124 species in three genera (*Parandes* Muir, 1925, *Andes* Stål, 1866 and *Andixius* Emeljanov & Hayashi, 2007), of which only the latter two genera and 13 species occur in China. Among Andini, *Andes* is the most species-rich genus, worldwide accounting for about 94% of Andini species (Wang *et al.* 2020; Bourgoin 2022).

The planthopper genus *Andes* was first described by Stål in 1866, but no species was consigned to it until *A. undulatus* Stål, 1870 was described. Muir (1925) recognized *Leirioessa* Kirkaldy, 1907 as a

junior synonym of *Andes*. Major contributors to the knowledge of the genus were Fennah, Muir, Synave and Van Stalle. Fennah (1956, 1958, 1978) described 12 new species and provided illustrations of male genitalia. Muir (1921, 1922, 1923, 1925, 1926) described 49 species in total and provided most of the illustrations of male genitalia, including for 33 new species, 15 new combinations, and for the first time described the male genitalia of the type species. Synave (1953, 1955, 1959, 1960, 1963, 1967), Van Stalle (1982, 1983, 1984a, 1984b, 1985, 1986) and Van Stalle & Synave (1984) studied the African fauna of the genus, describing a total of 40 new species. Other scholars have conducted morphological or taxonomic studies on this genus, identifying the main morphological characteristics or providing male genitalia illustrations and keys for the identification of known species (Walker 1851, 1857, 1858, 1870; Uhler 1896; Distant 1907, 1911; Kirkaldy 1907; Matsumura 1914; Schmidt 1926; Ishihara 1957, 1961; Linnavuori 1973; Tsaur *et al.* 1991; Emeljanov 2001; Löcker 2007).

Four species, *A. lachesis*, *A. noctua*, *A. othrepte* and *A. uncinatus*, were originally described by Fennah (1956) from southern China. Later, Zhou *et al.* (1985) recorded *A. marmoratus* (Uhler, 1896) for the first time from China. Tsaur *et al.* (1991) described a new species, *A. notatus*, and transferred *Brixia formosanus* Matsumura, 1914 and *B. ocellatus* Matsumura, 1914 to *Andes*. At the same time, *A. ocellatus* (Matsumura, 1914) was renamed as *A. luzonensis* Tsaur & Hsu, 1991, because it was a homonym of *A. ocellatus* Muir, 1925. Therefore, previously, the Chinese fauna of *Andes* included eight known species (Bourgoin 2022).

In this paper five new species, *A. balteiformis* Wang, Zhi & Chen sp. nov., *A. bifidus* Wang, Zhi & Chen sp. nov., *A. furcutus* Wang, Zhang & Chen sp. nov., *A. latanalus* Wang & Chen sp. nov. and *A. pallidus* Wang & Chen sp. nov., are described and illustrated from China. Hence, the number of species of *Andes* known from China is raised to thirteen.

Material and methods

The morphological terminology and measurements follow Bourgoin (1987) and Bourgoin *et al.* (2015), except the terminology for female genitalia, which follows Bourgoin (1993). Dry specimens were used for the descriptions and illustrations. Body length was measured from apex of vertex to tip of forewing; vertex length is the median length of vertex (from apical transverse carina to tip of basal emargination). Drawings of external morphology were done with the aid of a Leica MZ 12.5 stereo microscope. Photographs of the types were taken with the Keyence VHX-6000 system. Illustrations were scanned with a CanoScan LiDE 200 and imported into Adobe Photoshop CS7 for labelling and plate composition. The dissected male genitalia are preserved in glycerine in genitalia vials pinned together with the specimens.

The type specimens examined are deposited in the Institute of Entomology, Guizhou University, Guiyang, Guizhou Province, China (GUGC).

Results

Class Insecta Linnaeus, 1758
Order Hemiptera Linnaeus, 1758
Infraorder Fulgoromorpha Evans, 1946
Family Cixiidae Spinola, 1839
Subfamily Cixiinae Spinola, 1839
Tribe Andini Emeljanov, 2002

Genus *Andes* Stål, 1866

Andes Stål, 1866: 166.

Leirioessa Kirkaldy, 1907: 112 (synonymized in Muir 1925: 201).

Andes – Muir 1925: 201. — Zhou *et al.* 1985: 23. — Tsauro *et al.* 1991: 67.

Type species

Andes undulatus Stål, 1870 (subsequent designation in Muir 1925).

Diagnosis (modified from Tsauro *et al.* 1991)

Vertex narrowest and transverse at apex, widening to base, with U- or V-shaped basal emargination; lateral carinae strongly elevated; median carina absent. Forewing in resting position steeply tectiform; ScP + RA, RP and MP arising separately from a common point on basal cell or forming a minute common stem. Fore coxa with outer margin straight, subparallel with inner margin, not produced. Hind tibiae without or with several very small lateral spines. Chaetotaxy of hindtarsi 7–9/7–8.

Distribution

Palearctic Region, Oriental Region, Australian Region and Afrotropical Region.

Checklist and distribution of Chinese species of *Andes* Stål, 1866

- A. balteiformis* Wang, Zhi & Chen sp. nov.; China (Guizhou, Guangxi, Fujian).
A. bifidus Wang, Zhi & Chen sp. nov.; China (Yunnan).
A. formosanus (Matsumura, 1914); China (Taiwan).
A. furcutus Wang, Zhang & Chen sp. nov.; China (Guizhou).
A. lachesis Fennah, 1956; China (Zhejiang).
A. latanalus Wang & Chen sp. nov.; China (Guangxi).
A. luzonensis Tsauro & Hsu, 1991; China (Taiwan).
A. marmoratus (Uhler, 1896); China (Beijing), Japan (Hokkaido, Honshu, Kyushu and Shikoku).
A. noctua Fennah, 1956; China (Hubei).
A. notatus Tsauro & Hsu, 1991; China (Taiwan).
A. othrepte Fennah, 1956; China (Hongkong).
A. pallidus Wang & Chen sp. nov.; China (Guizhou).
A. uncinatus Fennah, 1956; China (Guangdong).

Key to males of Chinese species of *Andes* Stål, 1866

1. Forewing with two eye-like spots of different sizes (Tsauro *et al.* 1991: fig. 36a)
 *A. luzonensis* Tsauro & Hsu, 1991
 – Forewing without such markings2
2. Frons and lateral margin of vertex with alternating transverse stripes3
 – Frons and lateral margin of vertex without alternating transverse stripes5
3. Tegmen with clavus smoky brown at base; tegminal apex near apical angle distinctly dark brown (Ishihara 1957: fig. 1t)*A. marmoratus* (Uhler, 1896)
 – Tegmen without above spots4
4. Medioventral process of pygofer triangular; periandrium with a long, strongly sinuate spine, directed cephalad (Fennah 1956: fig. 1h)*A. noctua* Fennah, 1956
 – Medioventral process of pygofer semicircular; periandrium with a long, slender, C-shaped spine, directed ventrad; female with reduced wax secreting plates (Tsauro *et al.* 1991: fig. 34g–i, l)
 *A. formosanus* (Matsumura, 1914)
5. Periandrium with a long, slender, S-shaped spine with its tip directed dorsad (Tsauro *et al.* 1991: fig. 35h–i)*A. notatus* Tsauro & Hsu, 1991
 – Periandrium without such a spine6

6. Medioventral process of pygofer at base with a short spine on each side
.....*A. uncinatus* Fennah, 1956
– Medioventral process of pygofer without spine7
7. Apical margin of gonostyli deeply emarginate, forming two processes (Fig. 3G, I)
.....*A. bifidus* Wang, Zhi & Chen sp. nov.
– Gonostyli not forming two processes8
8. Periandrium on left laterally with a sclerotized, belt-shaped process arising ventrally near
apex (Fig. 1J–M)*A. balteiformis* Wang, Zhi & Chen sp. nov.
– Periandrium without a belt-shaped process9
9. Anal segment wider than long in dorsal view (Fig. 7H)*A. latanalus* Wang & Chen sp. nov.
– Anal segment longer than wide in dorsal view10
10. Ventral margin of periandrium apically with a bifurcated spinose process (Fig. 9J–M)
.....*A. pallidus* Wang & Chen sp. nov.
– Periandrium without a bifurcate process11
11. Dorsal margin of periandrium with a short laminal process at about midlength, basal part wide
and apical margin bifurcated (Fig. 5J–M)*A. furcutus* Wang, Zhang & Chen sp. nov.
– Periandrium without such a process12
12. Endosoma of aedeagus basally with two spinose processes (Fennah 1956: fig. 1e)
.....*A. othrepte* Fennah, 1956
– Endosoma of aedeagus basally without spinose processes; endosoma coarsely shagreen or sub-
fimbriate (Fennah 1956: fig. 2m)*A. lachesis* Fennah, 1956

Andes balteiformis Wang, Zhi & Chen sp. nov.

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Figs 1–2

Diagnosis

The salient features of this new species include: left side of ventral margin of periandrium with a belt-shaped process in apical third (Fig. 1K); dorsal margin of endosoma with multiple small teeth (Fig. 1L); basal left side of endosoma with a long spinose process (Fig. 1J); apex of endosoma with two spinose processes (Fig. 1J–L).

Etymology

The specific name is derived from the Latin adjective ‘*balteiformis*’, referring to the belt-shaped process arising from the ventral margin of the periandrium.

Type material

Holotype

CHINA • ♂; Guizhou Province, Rongjiang County, Jihua Town; 25.8° N, 108.3° E; 24 Jul. 2016; Ying-Jian Wang leg.; GUGC.

Paratypes

CHINA • 13 ♂♂, 22 ♀♀; Guangxi Province, Liongsheng County, Huaping National Natural Reserve; 25.3° N, 110.2° E; 7–8 Aug. 2019; Yong-Jin Sui, Zhi-Cheng Zhou, Xiao-Ya Wang and Jing Wang leg.;

GUGC • 6 ♂♂, 8 ♀♀; Fujian Province, Jianou City, Jianou Forest Protection Region; 27.0° N, 118.1° E; 27 Aug. 2019; Yong-Jin Sui, Zhi-Cheng Zhou, Xiao-Ya Wang and Jing Wang leg.; GUGC.

Description

MEASUREMENTS. Body length: male 5.9–6.7 mm (N = 20), female 6.6–8.3 mm (N = 30).

COLORATION. General color yellowish brown (Fig. 1A–B). Eyes blackish brown, ocelli faint yellow, semi-translucent. Antenna, vertex, face and rostrum generally yellowish brown. Pronotum and mesonotum brown. Forewing semi-translucent, costal vein with spots, resembling a U-shape, lateral areas slightly darker; slightly anterior to stigma, posterior to stigma and near fork $MP_{1+2} + MP_{3+4}$ with an irregular puce spot, respectively; apical half of wing with brown patches. Stigma yellowish brown. Veins yellowish brown. Tubercles brown. Hind tibiae yellowish brown. Ventral abdomen blackish brown.

HEAD AND THORAX. Vertex (Fig. 1A, C) $1.6\times$ as long as wide; lateral carinae strongly elevated, median carina absent. Frons (Fig. 1D) $3.5\times$ as long as wide. Pronotum (Fig. 1A, C) $1.7\times$ as long as vertex; posterior margin forming a right angle. Mesonotum $1.2\times$ as long as pronotum and vertex combined. Forewing (Fig. 1B, E) $2.3\times$ as long as wide, with thirteen apical cells and seven subapical cells; RP with 4 branches; MP with 5 branches (MP_{11} , MP_{12} , MP_2 , MP_3 and MP_4); fork $MP_1 + MP_2$ basad of fork $MP_3 + MP_4$. Metatibiotarsal formula 8/8, second segment of hind tarsus with three platellae.

MALE GENITALIA. Pygofer (Fig. 1F–G) in ventral view symmetrical; in lateral view, lateral lobes arcuate and extended caudally. Medioventral process triangular in ventral view, apical margin pointed. Anal segment (Fig. 1F, H) flat, tubular, dorsal margin almost straight, ventral margin strongly curved at base in lateral view; asymmetrical, basal right lobe larger than left lobe, $1.6\times$ as long as wide in dorsal view; anal style strap-shaped, not extending beyond anal segment. Gonostyli (Fig. 1G, I) symmetrical ventrally; in inner lateral view, dorsal margin concave in middle, apical margin slightly enlarged, bending inwards at an acute angle. Aedeagus (Fig. 1J–M) with five processes. Basal ventral margin of periandrium with a short spinose process, directed ventrad; left side of ventral margin of periandrium with a belt-shaped process on apical third, apex of process with small teeth. Endosoma broad, generally curved dorsad and cephalad, dorsal margin with multiple small teeth; left side of base with a long spinose process, directed cephalad; apex with two spinose processes, one short and small, directed ventrocephalad, the other slightly longer, directed ventrad.

FEMALE GENITALIA. Tergite IX (Fig. 2A–B, D) moderately sclerotized, with a large, nearly quadrate wax plate. Anal segment (Fig. 2C) rectangular, $1.9\times$ as long as wide in dorsal view, anal style linguiform. Gonapophysis VIII (Fig. 2E) elongate and slightly curved upwards. Gonapophysis IX (Fig. 2F) with two middle teeth, distance ratio between middle tooth to apex and length of denticulate portion 2.1. Gonoplac (Fig. 2G) rod-like, $4.8\times$ as long as wide in lateral view. Posterior vagina pattern as shown in Fig. 2H.

Distribution

China (Guizhou, Guangxi, Fujian).

Remarks

This species is similar to *Andes maculifrons* Muir, 1925 in appearance, but differs in: (1) ventral margin of periandrium with a belt-shaped process on apical third (ventral margin of periandrium with a triangular process on apical half in *A. maculifrons*); (2) endosoma broad, apical margin with two spinose processes (apical margin of endosoma with only one spinose process in *A. maculifrons*); (3) left side of periandrium without a spinose process (base of left side of periandrium with a tiny spinose process in *A. maculifrons*).

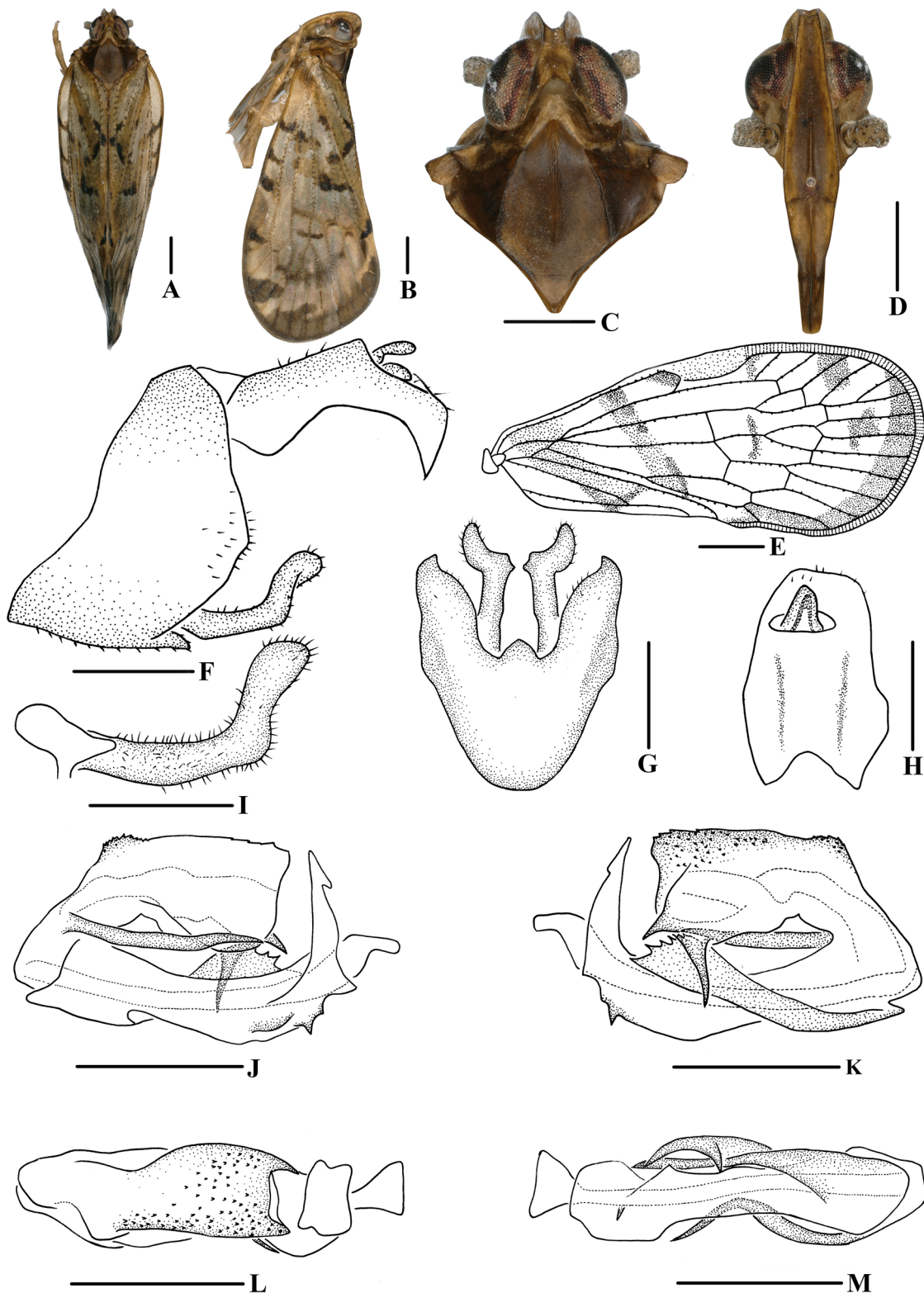


Fig. 1. *Andes balteiformis* Wang, Zhi & Chen sp. nov., ♂. **A.** Dorsal view. **B.** Lateral view. **C.** Head and thorax, dorsal view. **D.** Face, ventral view. **E.** Forewing. **F.** Genitalia, lateral view. **G.** Pygofer and gonostyli, ventral view. **H.** Anal segment, dorsal view. **I.** Gonostyli, lateral view. **J.** Aedeagus, right side. **K.** Aedeagus, left side. **L.** Aedeagus, dorsal view. **M.** Aedeagus, ventral view. Scale bars: A–D, F–M = 0.5 mm; E = 1.0 mm.

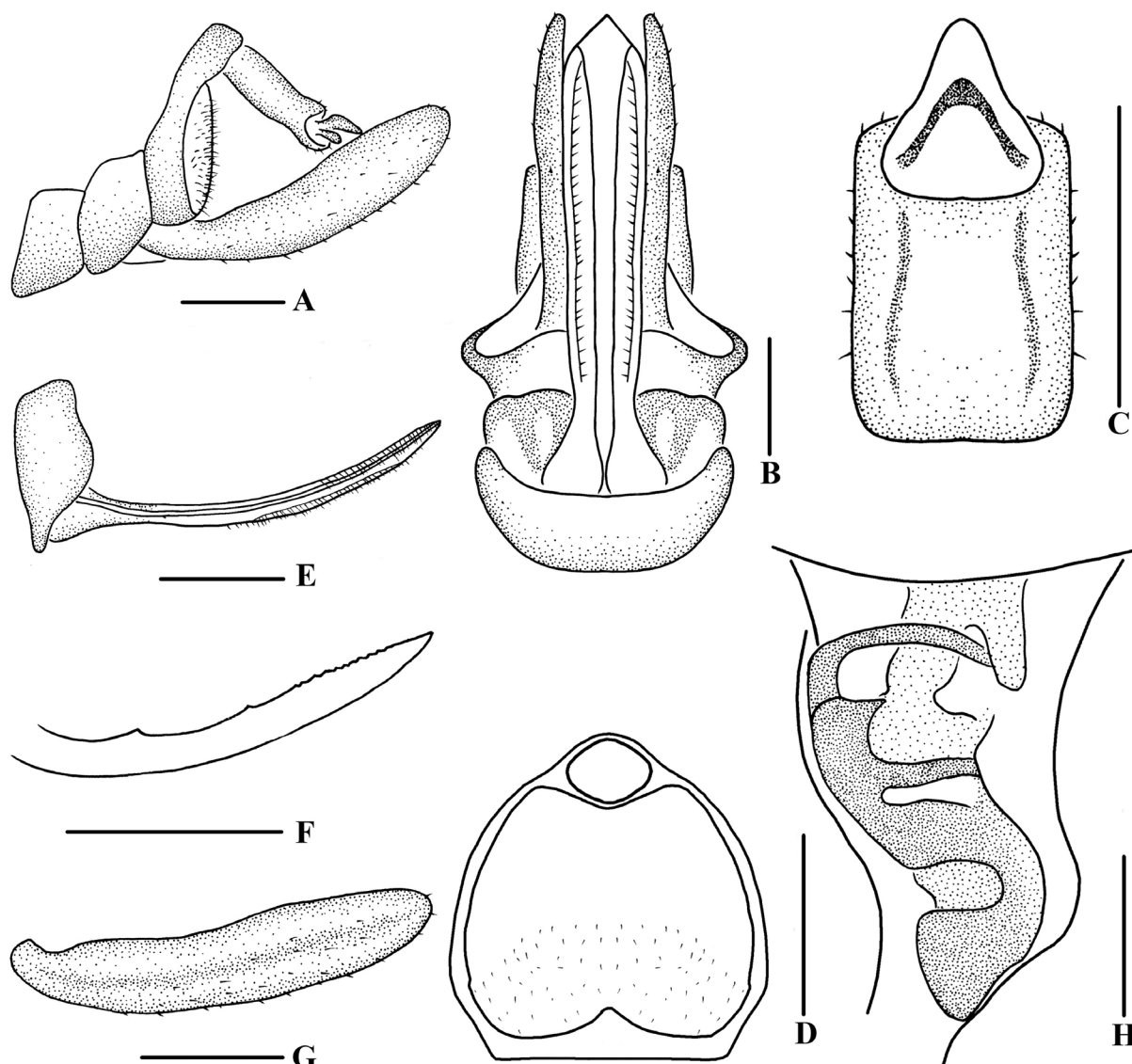


Fig. 2. *Andes balteiformis* Wang, Zhi & Chen sp. nov., ♀. **A.** Genitalia, lateral view. **B.** Genitalia, ventral view. **C.** Anal segment, dorsal view. **D.** Tergite IX, caudal view. **E.** Gonapophysis VIII and gonocoxa VIII, dorsal view. **F.** Gonapophysis IX, lateral view. **G.** Gonoplac, inner lateral view. **H.** Posterior vagina, ventral view. Scale bars: 0.5 mm.

Andes bifidus Wang, Zhi & Chen sp. nov.

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Figs 3–4

Diagnosis

The salient features of this new species include: middle part of apical margin of gonostyli deeply emarginate, forming two processes (Fig. 3G); ventral margin of periandrium with a sub-triangular process, apical left side of process with a short, small spinose process (Fig. 3K, M); basal $\frac{1}{3}$ of right side of periandrium with a horn-like spinose process (Fig. 3J).

Etymology

The specific name is derived from the Latin adjective ‘*bifidus*’, referring to the deeply emarginate (bifurcate) apex of the gonostyli.

Type material

Holotype

CHINA • ♂; Yunnan Province, Pingbian County, Dawei Mountain National Park; 22.9° N, 103.7° E; 18–20 Aug. 2017; Yan Zhi leg.; GUGC.

Paratypes

CHINA • 55 ♂♂, 19 ♀♀; same collection data as for holotype but Yan Zhi, Qiang Luo, Nian Gong and Yong-Jin Sui leg.; GUGC.

Description

MEASUREMENTS. Body length: male 6.2–7.0 mm (N = 56), female 7.2–7.7 mm (N = 19).

COLORATION. General color yellowish brown (Fig. 3A–B). Eyes blackish brown, ocelli faint yellow, semi-translucent. Antenna, vertex, face and rostrum generally blackish brown. Pronotum and mesonotum blackish brown. Forewing semi-translucent, costal vein with a small dark brown spot; posterior to stigma, in centre of forewing and posterior to clavus with an irregular puce spot, respectively; basal and middle part of forewing with two inner oblique yellow stripes; apical half of forewing with brown patches. Stigma light brown. Veins yellowish brown. Tubercles brown. Hind tibiae yellowish brown. Ventral abdomen blackish brown.

HEAD AND THORAX. Vertex (Fig. 3A, C) 1.1 × as long as wide; lateral carinae strongly elevated, median carina absent. Frons (Fig. 3D) 3.1 × as long as wide. Pronotum (Fig. 3A, C) 1.7 × as long as vertex; posterior margin forming an obtuse angle. Mesonotum 1.1 × as long as pronotum and vertex combined. Forewing (Fig. 3B, E) 2.5 × as long as wide, with thirteen apical cells and seven subapical cells; RP with 4 branches; MP with 5 branches (MP₁₁, MP₁₂, MP₂, MP₃, and MP₄); fork MP₁+MP₂ basad of fork MP₃+MP₄. Metatibiotarsal formula 7/8, second segment of hind tarsus with three platellae.

MALE GENITALIA. Pygofer (Fig. 3F–G) in ventral view symmetrical; in lateral view, lateral lobes arcuate and extended caudally. Medioventral process rectangular (much wider than long). Anal segment (Fig. 3F, H) flat tubular, dorsal margin almost straight, ventral margin straight (parallel to dorsal margin), bending 90 degrees into apical lobe; 1.6 × as long as wide in dorsal view; anal style strap-shaped, not extending beyond anal segment. Gonostyli (Fig. 3G, I) symmetrical in ventral view; in inner lateral view, base of dorsal margin concave, ventral margin with a small process, middle part of apical margin of gonostyli deeply emarginate, forming two processes: a large process around ventral margin, apical margin rounded; another small, around dorsal margin, apical margin pointed. Aedeagus (Fig. 3J–M) with six processes. Ventral margin of periandrium with a sub-triangular process; apical left side of process with a short, small spinose process, directed ventrad; right side of process expanded, forming a laminal process, curved upward, directed cephalad; basal 1/3 of right side of periandrium with a horn-like spinose process, directed dorsocaudad; dorsal margin with a straight medium-length spinose process, directed right-dorsocephalad. Endosoma curved towards left, apical margin gradually narrowed, forming a spinose process, margin with small teeth; basal 1/3 of right side with a laminal process, margin with small teeth.

FEMALE GENITALIA. Tergite IX (Fig. 4A–B, D) moderately sclerotized, with a large, nearly quadrate wax plate. Anal segment (Fig. 4C) rectangular, 1.6 × as long as wide in dorsal view, anal style linguiform. Gonapophysis VIII (Fig. 4E) elongate and slightly curved upwards. Gonapophysis IX (Fig. 4F) with one middle tooth, distance ratio between middle tooth to apex and length of denticulate portion 2.4.

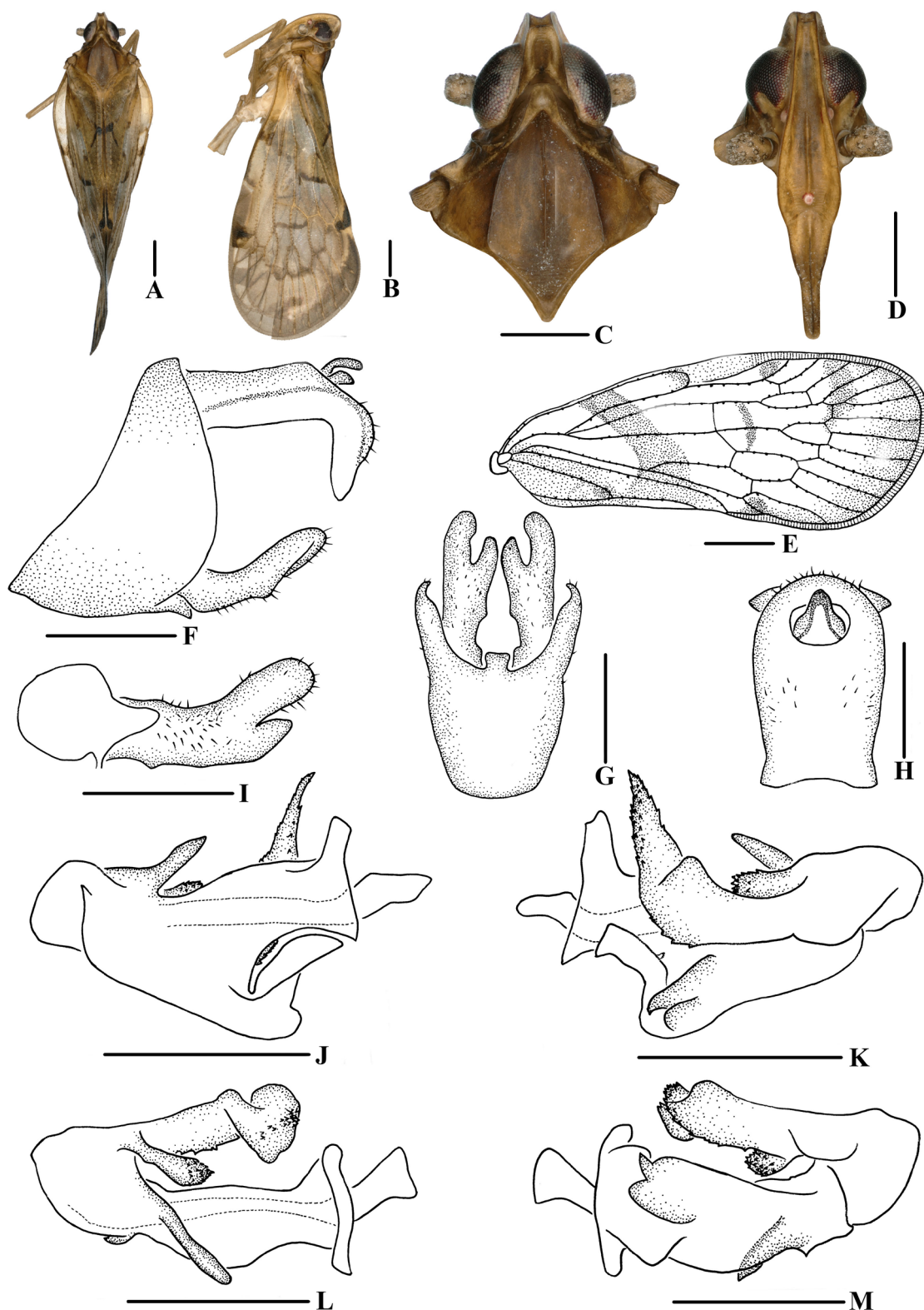


Fig. 3. *Andes bifidus* Wang, Zhi & Chen sp. nov., ♂. **A.** Dorsal view. **B.** Lateral view. **C.** Head and thorax, dorsal view. **D.** Face, ventral view. **E.** Forewing. **F.** Genitalia, lateral view. **G.** Pygofer and gonostyli, ventral view. **H.** Anal segment, dorsal view. **I.** Gonostyli, lateral view. **J.** Aedeagus, right side. **K.** Aedeagus, left side. **L.** Aedeagus, dorsal view. **M.** Aedeagus, ventral view. Scale bars: A–D, F–M = 0.5 mm; E = 1.0 mm.

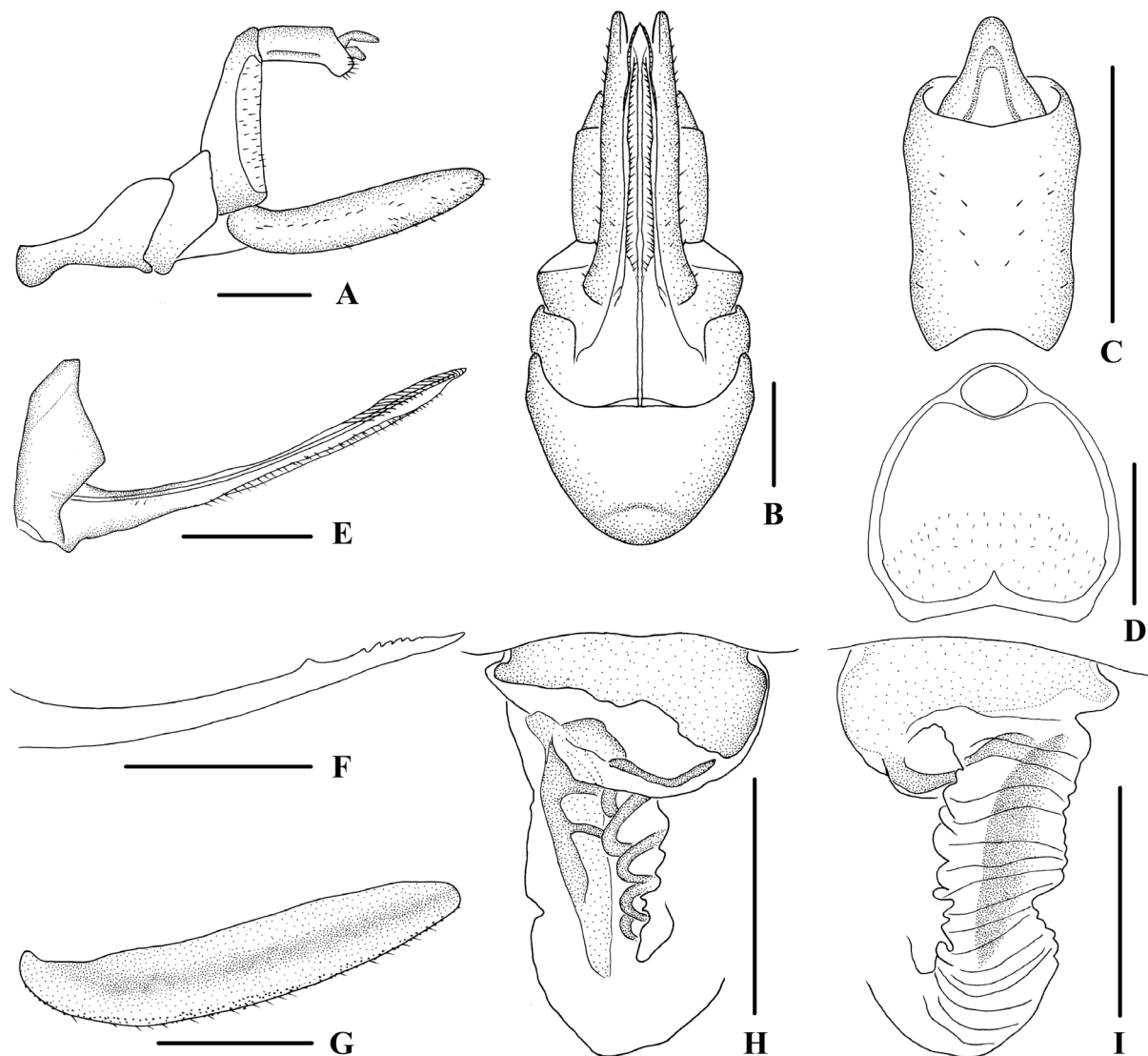


Fig. 4. *Andes bifidus* Wang, Zhi & Chen sp. nov., ♀. **A.** Genitalia, lateral view. **B.** Genitalia, ventral view. **C.** Anal segment, dorsal view. **D.** Tergite IX, caudal view. **E.** Gonapophysis VIII and gonocoxa VIII, dorsal view. **F.** Gonapophysis IX, lateral view. **G.** Gonoplac, inner lateral view. **H.** Posterior vagina, ventral view. **I.** Posterior vagina, dorsal view. Scale bars: 0.5 mm.

Gonoplac (Fig. 4G) rod-like, $4.7\times$ as long as wide in lateral view. Posterior vagina pattern as shown in Fig. 4H–I.

Distribution

China (Yunnan).

Andes furcutus Wang, Zhang & Chen sp. nov.

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Figs 5–6

Diagnosis

The salient features of the new species include: centre of dorsal margin of periandrium with a short laminal process, base large, apex bifurcated (Fig. 5J–L); ventrally around midlength of periandrium with

a slender spinose process, slightly curved (Fig. 5M); apical part of endosoma bifurcated, margin with small teeth (Fig. 5J–M).

Etymology

The specific name is derived from the Latin adjective ‘*furcutus*’, referring to the bifurcate apical part of the endosoma.

Type material

Holotype

CHINA • ♂; Guizhou Province, Jiangkou County, Mount Fanjing National Natural Reserve; 27.9° N, 108.7° E; 20–22 Apr. 2011; Zhi-Min Chang, Zhi-Hua Fan and Xiao-Fei Liu leg.; GUGC.

Paratypes

CHINA • 7 ♂♂, 4 ♀♀; same collection data as for holotype; GUGC.

Description

MEASUREMENTS. Body length: male 6.5–7.2 mm (N = 8), female 7.2–7.7 mm (N = 4).

COLORATION. General color light brown (Fig. 5A–B). Eyes yellowish brown, ocelli faint yellow, semi-translucent. Antenna, vertex and face generally light brown. Rostrum brown. Pronotum and mesonotum brown. Forewing semi-translucent, with many small dark brown spots and irregular smoky speckle stripes. Stigma and veins yellowish brown. Tubercles blackish brown. Hind tibiae yellowish brown. Ventral abdomen yellowish brown.

HEAD AND THORAX. Vertex (Fig. 5A, C) as long as wide; lateral carinae strongly elevated, median carina absent. Frons (Fig. 5D) 3.6× as long as wide. Pronotum (Fig. 5A, C) 1.4× as long as vertex; posterior margin forming an obtuse angle. Mesonotum 1.2× as long as pronotum and vertex combined. Forewing (Fig. 5B, E) 2.2× as long as wide, with fourteen apical cells and seven subapical cells; RP with 5 branches; MP with 5 branches: MP₁₁, MP₁₂, MP₂, MP₃ and MP₄; fork MP₁+MP₂ basad of fork MP₃+MP₄. Metatibiotarsal formula 8/8, second segment of hind tarsus with three platellae.

MALE GENITALIA. Pygofer (Fig. 5F–G) in ventral view symmetrical; in lateral view, lateral lobes arcuate and extended caudally. Medioventral process lanceolar in ventral view. Anal segment (Fig. 5F, H) flat tubular, dorsal margin slightly convex, ventral margin curved, apical margin expanded downward in lateral view; 2.5× as long as wide in dorsal view; anal style strap-shaped, not extending beyond anal segment. Gonostyli (Fig. 5G, I) symmetrical ventrally; in inner lateral view, base of ventral margin concave, apical margin rounded. Aedeagus (Fig. 5J–M) with four processes. Centre of dorsal margin of periandrium with a short laminal process, base large, apex bifurcated, directed dorsocaudad; ventrally around midlength of periandrium with a slender spinose process, slightly curved, directed caudad. Endosoma large, basal part highly sclerotized, apical part with two processes bearing small teeth: one wide and flat, with its tip directed ventrad, the other directed ventrocephalad.

FEMALE GENITALIA. Tergite IX (Fig. 6A–B, D) moderately sclerotized, with a large, nearly elliptical wax plate. Anal segment (Fig. 6C) rectangular, 1.9× as long as wide in dorsal view, anal style linguiform. Gonapophysis VIII (Fig. 6E) elongate, slightly curved upwards. Gonapophysis IX (Fig. 6F) with one middle tooth, distance ratio between middle tooth to apex and length of denticulate portion 1.6. Gonoplac (Fig. 6G) rod-like, 5.2× as long as wide in lateral view. Posterior vagina pattern as shown in Fig. 6H.

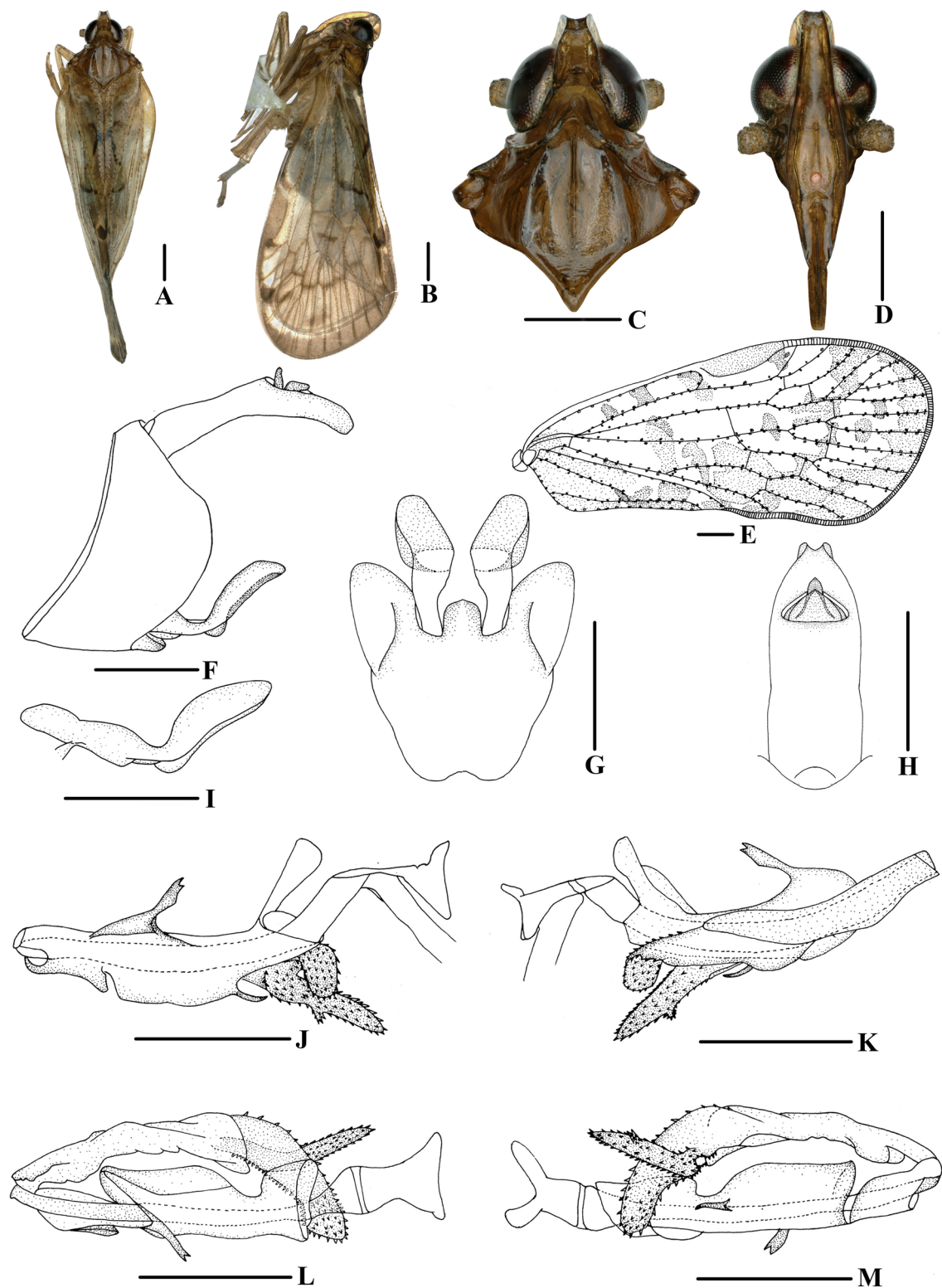


Fig. 5. *Andes furcutus* Wang, Zhang & Chen sp. nov., ♂. **A.** Dorsal view. **B.** Lateral view. **C.** Head and thorax, dorsal view. **D.** Face, ventral view. **E.** Forewing. **F.** Genitalia, lateral view. **G.** Pygofer and gonostyli, ventral view. **H.** Anal segment, dorsal view. **I.** Gonostyli, lateral view. **J.** Aedeagus, right side. **K.** Aedeagus, left side. **L.** Aedeagus, dorsal view. **M.** Aedeagus, ventral view. Scale bars: A–D, F–M = 0.5 mm; E = 1.0 mm.

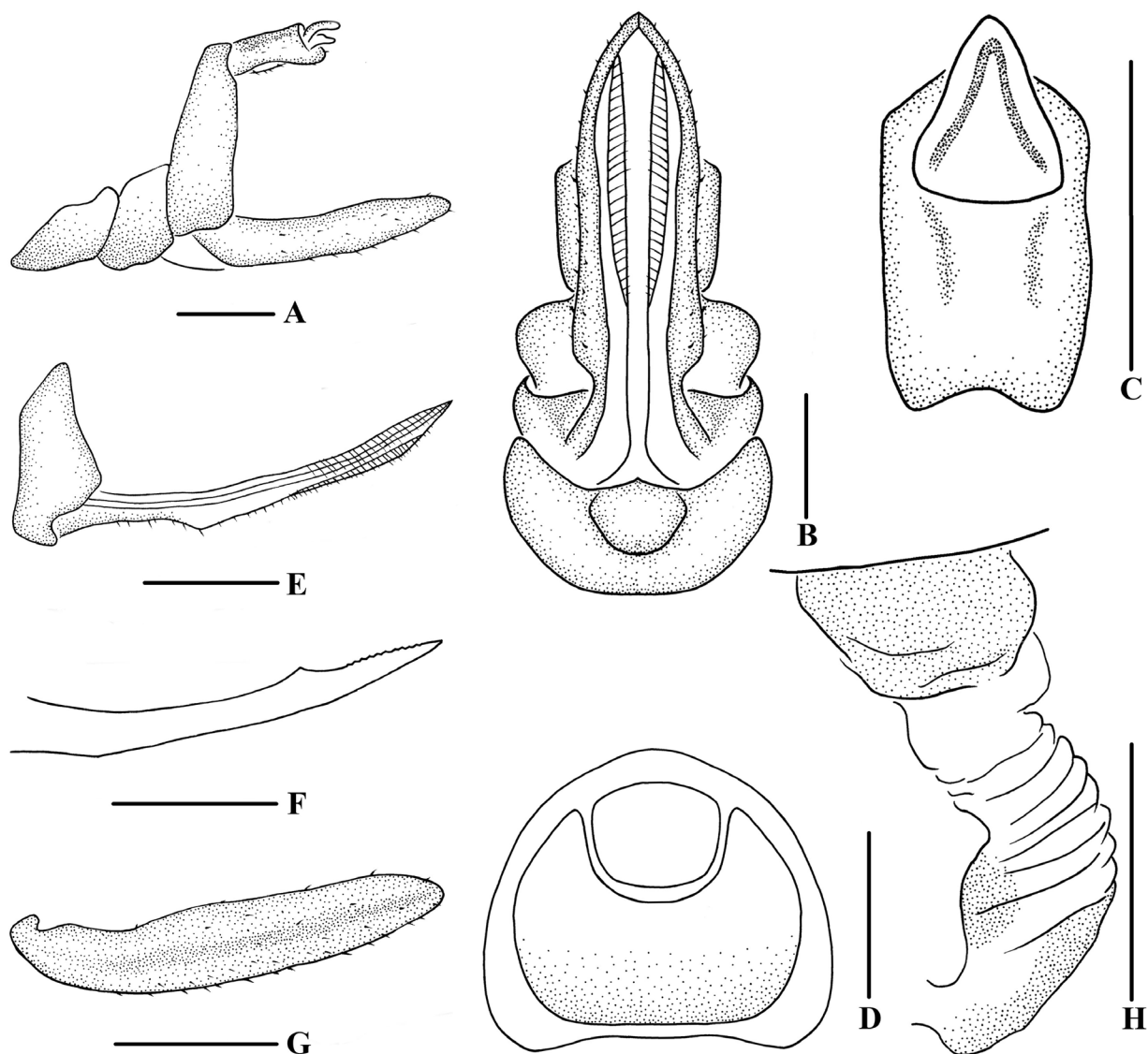


Fig. 6. *Andes furcutus* Wang, Zhang & Chen sp. nov., ♀. **A.** Genitalia, lateral view. **B.** Genitalia, ventral view. **C.** Anal segment, dorsal view. **D.** Tergite IX, caudal view. **E.** Gonapophysis VIII and gonocoxa VIII, dorsal view. **F.** Gonapophysis IX, lateral view. **G.** Gonoplac, inner lateral view. **H.** Posterior vagina, ventral view. Scale bars: 0.5 mm.

Distribution

China (Guizhou).

Remarks

This species was identified with the help of Pei Zhang, and is similar to *Andes bifidus* sp. nov. in appearance, but differs in: (1) middle dorsal margin of periandrium with a short laminal process, base large, apex bifurcated (dorsal margin of periandrium with a spinose process in *A. bifidus*); (2) ventrally around midlength of periandrium with a slender spinose process, slightly curved (*A. bifidus* without a process in this position); (3) apical part of endosoma bifurcated, margin with small teeth (endosoma not bifurcated in *A. bifidus*).

Andes latanalus Wang & Chen sp. nov.

urn:lsid:zoobank.org:act:43CD1492-8C7F-417E-A99C-93B68ECEC130

Figs 7–8

Diagnosis

The salient features of the new species include: anal segment very short and wide, wider than long (Fig. 7H); basal right side of ventral margin of periandrium with a triangular laminal process, which turns upward to form a long spinose process that bends inward twice at a right angle (Fig. 7J); basal ventral margin of endosoma with a small process that bends inward at an acute angle (Fig. 7J–M).

Etymology

The specific name is derived from the Latin adjective ‘*latanalus*’, referring to the anal segment which is very wide compared to its length.

Type material

Holotype

CHINA • ♂; Guangxi Province, Huanjiang County, Mulun National Natural Reserve; 24.8° N, 108.3° E; 28–29 Jul. 2019; Yong-Jin Sui, Zhi-Cheng Zhou, Xiao-Ya Wang and Jing Wang leg.; GUGC.

Paratypes

CHINA • 18 ♂♂, 25 ♀♀; same collection data as for holotype; GUGC.

Description

MEASUREMENTS. Body length: male 5.9–7.2 mm (N = 19), female 7.2–8.2 mm (N = 25).

COLORATION. General color blackish brown (Fig. 7A–B). Eyes blackish brown, ocelli reddish brown, semi-translucent. Antenna yellowish brown. Vertex and rostrum generally brown. Face blackish brown. Pronotum yellowish brown. Mesonotum blackish brown. Forewing semi-translucent, basal and middle part with two oblique yellowish brown stripes, margin darker, basal costal vein; slightly anterior to stigma, posterior to stigma, radial area near claval fork and near fork $MP_{1+2} + MP_{3+4}$ with an irregular puce spot, respectively; apical half of wing with brown patches. Veins light yellowish brown. Stigma and tubercles blackish brown. Hind tibiae yellowish brown. Ventral abdomen yellowish brown.

HEAD AND THORAX. Vertex (Fig. 7A, C) $1.6 \times$ as long as wide; lateral carinae strongly elevated, median carina absent. Frons (Fig. 7D) $3.6 \times$ as long as wide. Pronotum (Fig. 7A, C) $1.3 \times$ as long as vertex; posterior margin forming a right angle. Mesonotum $1.2 \times$ as long as pronotum and vertex combined. Forewing (Fig. 7B, E) $2.2 \times$ as long as wide, with twelve apical cells and seven subapical cells; RP with 3 branches; MP with 5 branches: MP_{11} , MP_{12} , MP_2 , MP_3 and MP_4 ; fork $MP_1 + MP_2$ basad of fork $MP_3 + MP_4$. Metatibiotarsal formula 8/8, second segment of hind tarsus with three platellae.

MALE GENITALIA. Pygofer (Fig. 7F–G) in ventral view symmetrical; in lateral view, lateral lobes arcuate and extended caudally. Medioventral process lanceolar in ventral view. Anal segment (Fig. 7F, H) very short, dorsal margin almost straight, ventral margin curved, apical margin truncate in lateral view; $1.5 \times$ as wide as long in dorsal view; anal style strap-shaped, extending beyond anal segment. Gonostyli (Fig. 7G, I) symmetrical ventrally; in inner lateral view, dorsal margin obtusely emarginate, apical part expanded, then gradually narrowed. Aedeagus (Fig. 7J–M) with two processes. Basal right side of ventral margin of periandrium with a triangular laminal process, turning upward to form a long spinose process bending inward twice at a right angle directed right-dorsocephalad. Endosoma claviform, long and slightly curved, basal ventral margin with a small process that bends inward at an acute angle, directed left-ventrocephalad.

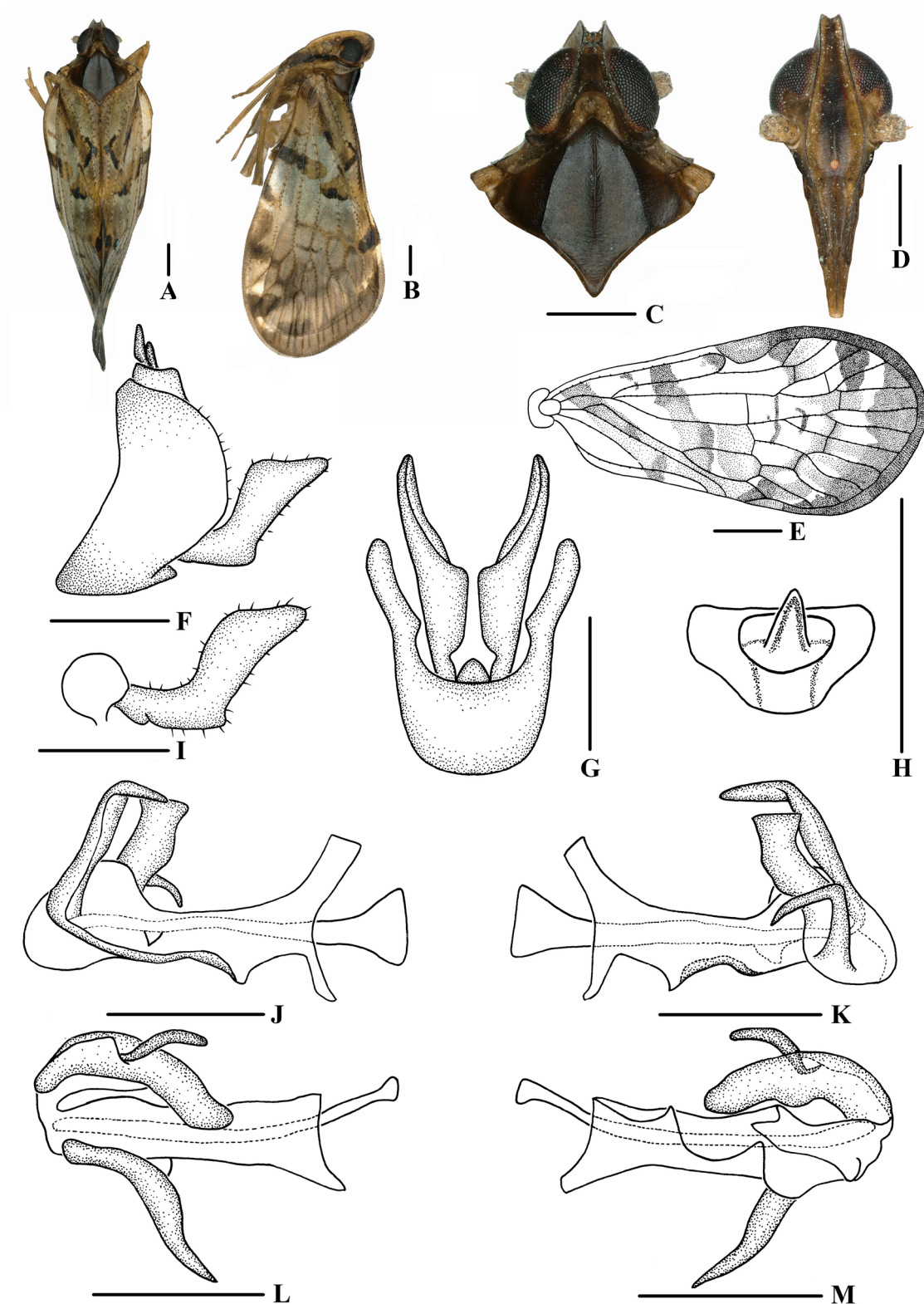


Fig. 7. *Andes latanalus* Wang & Chen sp. nov., ♂. **A.** Dorsal view. **B.** Lateral view. **C.** Head and thorax, dorsal view. **D.** Face, ventral view. **E.** Forewing. **F.** Genitalia, lateral view. **G.** Pygofer and gonostyli, ventral view. **H.** Anal segment, dorsal view. **I.** Gonostyli, lateral view. **J.** Aedeagus, right side. **K.** Aedeagus, left side. **L.** Aedeagus, dorsal view. **M.** Aedeagus, ventral view. Scale bars: A–D, F–M = 0.5 mm; E = 1.0 mm.

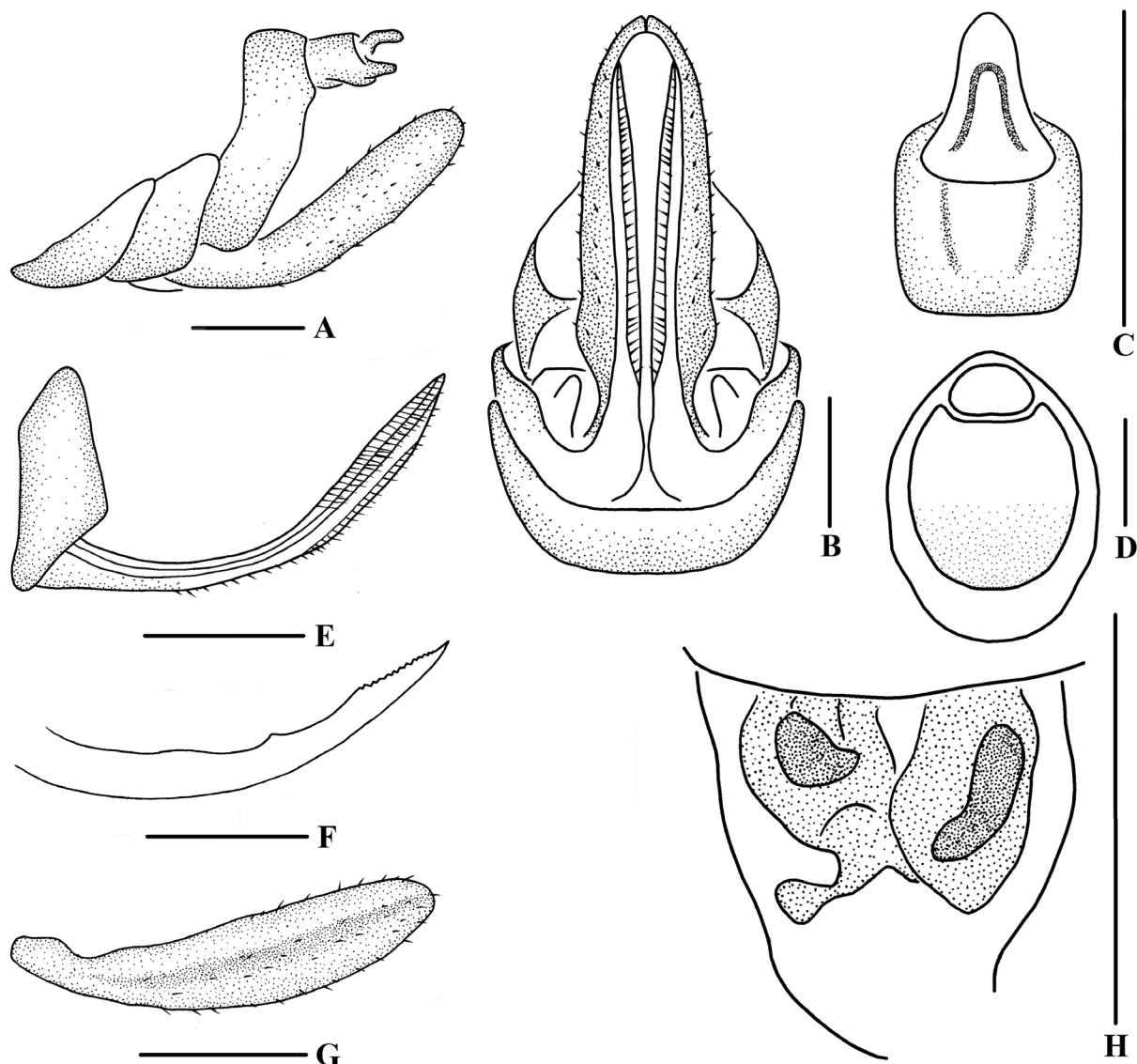


Fig. 8. *Andes latanalus* Wang & Chen sp. nov., ♀. **A.** Genitalia, lateral view. **B.** Genitalia, ventral view. **C.** Anal segment, dorsal view. **D.** Tergite IX, caudal view. **E.** Gonapophysis VIII and gonocoxa VIII, dorsal view. **F.** Gonapophysis IX, lateral view. **G.** Gonoplac, inner lateral view. **H.** Posterior vagina, ventral view. Scale bars: 0.5 mm.

FEMALE GENITALIA. Tergite IX (Fig. 8A–B, D) moderately sclerotized, with a large, nearly elliptical wax plate. Anal segment (Fig. 8C) rectangular, 1.6× as long as wide in dorsal view, anal style linguiform. Gonapophysis IX (Fig. 8F) with one middle tooth, distance ratio between middle tooth to apex and length of denticulate portion 2.0. Gonoplac (Fig. 8G) rod-like, 4.4× as long as wide in lateral view. Posterior vagina pattern as shown in Fig. 8H.

Distribution

China (Guangxi).

Remarks

This species is similar to *Andes formosanus* (Mastsumura, 1914) in appearance, but differs in: (1) anal segment is very short and wide, much wider than long (anal segment longer than wide in *A. formosanus*);

(2) basal ventral margin of periandrium with a triangular laminal process, which turns upward to form a long spinose process that bends inward at right angles (*A. formosanus* without process in the same position); (3) basal ventral margin of endosoma with a small process that bends inward at an acute angle (endosoma without a spinose process in *A. formosanus*).

Andes pallidus Wang & Chen sp. nov.

[urn:lsid:zoobank.org:act:5E597C6C-18F4-4736-9DFA-0785533476B0](https://doi.org/10.21203/rs.3.rs-10000000/v1)

Fig. 9

Diagnosis

The salient features of the new species include: apical right side of the ventral margin of periandrium with a long spinose process, bending upwards, directed cephalad, parallel to periandrium (Fig. 9J); apical ventral margin of periandrium with a bifurcated process (Fig. 9M); endosoma lamellar, basal left side of dorsal margin with small teeth (Fig. 9L).

Etymology

The specific name is derived from the Latin adjective ‘*pallidus*’, referring to the forewings which are largely pale, white.

Type material

Holotype

CHINA • ♂; Guizhou Province, Wangmo County, Dayi town; 25.4° N, 106.1° E; 14 Aug. 2020; Feng-E Li, Jian-Kun Long and Sha-Sha Lv leg.; GUGC.

Paratype

CHINA • ♂; same collection data as for holotype; GUGC.

Description

MEASUREMENTS. Body length: male 7.0–7.5 mm (N = 2).

COLORATION. General color yellowish white (Fig. 9A–B). Eyes brown, ocelli light red, semi-translucent. Antenna, vertex and face yellowish white. Rostrum yellowish brown. Anterior parts of pronotum white, posterior parts yellowish brown. Mesonotum yellowish brown. Forewing semi-translucent, whitish, costal vein with 3 small, spaced dark brown spots, from centre of ScP+RA to near claval fork with a fawn-coloured stripe; middle part of clavus and behind clavus with an irregular puce spot, respectively; apical half of wing with yellowish brown patches.

HEAD AND THORAX. Vertex (Fig. 9A, C) 1.8 × as long as wide; lateral carinae strongly elevated, median carina absent. Frons (Fig. 9D) 2.7 × as long as wide. Pronotum (Fig. 9A, C) 1.1 × as long as vertex; posterior margin forming a right angle. Mesonotum 1.1 × as long as pronotum and vertex combined. Forewing (Fig. 9B, E) 2.3 × as long as wide, with thirteen apical cells and six subapical cells; RP with 4 branches; MP with 5 branches: MP₁₁, MP₁₂, MP₂, MP₃ and MP₄; fork MP₁+MP₂ basad of fork MP₃+MP₄. Metatibiotarsal formula 8/7-8, second segment of hind tarsus with one platella.

MALE GENITALIA. Pygofer (Fig. 9F–G) in ventral view symmetrical; in lateral view, lateral lobes arcuate and extended caudally. Medioventral process rounded in ventral view. Anal segment (Fig. 9F, H) flat tubular, dorsal margin almost straight, ventral margin curved in lateral view; apical margin truncate, 2.2 × as wide as long in dorsal view; anal style strap-shaped, not extending beyond anal segment. Gonostyli (Fig. 9G, I) symmetrical ventrally; in inner lateral view, dorsal margin concave, middle part

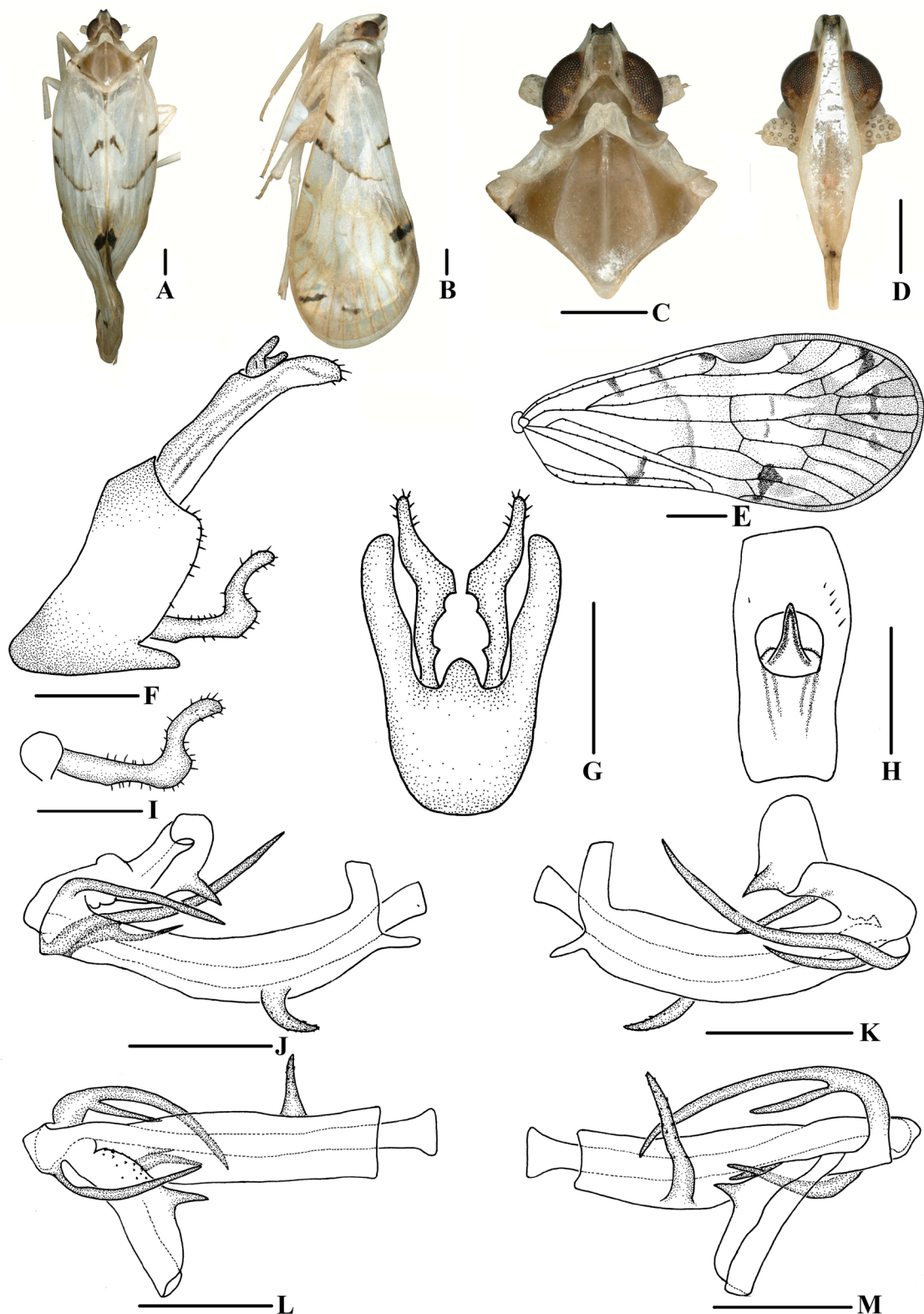


Fig. 9. *Andes pallidus* Wang & Chen sp. nov., ♂. **A.** Dorsal view. **B.** Lateral view. **C.** Head and thorax, dorsal view. **D.** Face, ventral view. **E.** Forewing. **F.** Genitalia, lateral view. **G.** Pygofer and gonostyli, ventral view. **H.** Anal segment, dorsal view. **I.** Gonostyli, lateral view. **J.** Aedeagus, right side. **K.** Aedeagus, left side. **L.** Aedeagus, dorsal view. **M.** Aedeagus, ventral view. Scale bars: A–D, F–M = 0.5 mm; E = 1.0 mm.

of ventral margin convex, middle part expanded, then apical part gradually narrowed. Aedeagus (Fig. 9J–M) with seven processes. Apical ventral margin of periandrium with a long spinose process, bending upwards, directed cephalad, parallel to periandrium, directed right-dorsocephalad; apical dorsal margin of periandrium with a long spinose process, slightly curved, directed cephalad; below midlength of ventral margin of periandrium with a longish spinose process, directed dorsad; middle part with a short spinose process, directed cephalad, apex bifurcated, forming two spinose processes: dorsal one long, directed left-dorsocephalad, another short one directed ventrad. Endosoma lamellar, left side of base rolling upwards, right side of apex rolling inwards, nearly apical margin with a spinose process, directed dorsocephalad, basal left side of dorsal margin with small teeth.

Distribution

China (Guizhou).

Remarks

This species is similar to *Andes lachesis* Fennah, 1956 in appearance, but differs in: (1) apical ventral margin of periandrium with a long spinose process, bending upwards, directed cephalad, parallel to periandrium (apical dorsal margin of periandrium with a spinose process in *A. lachesis*); (2) basal ventral margin of periandrium with a bifurcated process (*A. lachesis* without process in the same position); (3) endosoma lamellar, basal left side of dorsal margin with small teeth (endosoma coarsely shagreen or sub-fimbriate in *A. lachesis*).

Discussion

Despite the fact that species of *Andes* are quite similar in appearance, the Chinese species can be distinguished from all other species of the genus in the Oriental Region by the general structure of the male genitalia. For example, *A. balteiformis* sp. nov. and *A. maculifrons* Muir, 1925 are easily distinguished from the other species in the genus based on the shape of the aedeagus and the genital styles, but they are indistinguishable in body color and wing markings. Australian species of *Andes* seem to have originated from two different lineages, based on the presence and shape of the cucullus (the expanded semi-enclosed structure of the periandrium). African species have differently shaped male genitalia, lacking a virga (the long spinose process arising from the apex of the periandrium) and cucullus (Löcker *et al.* 2007). Among the Chinese species, the virga and cucullus are present or absent, but the endosoma shows high diversity, especially among the new species described in this paper.

Host plant relationships for the new Chinese species of *Andes* have not yet been determined; however, during field trips *Andes* was mostly observed in dark and humid environments with many mosses and ferns, which could potentially be the plants on which they feed.

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