

A new genus and three new species of apterous Carventinae from China (Hemiptera: Heteroptera: Aradidae)

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Abstract. The following new apterous flat bugs of the subfamily Carventinae (Hemiptera: Heteroptera: Aradidae) from China are described and illustrated: *Cathaycoris bibulbosus* gen. nov. & sp. nov. from Yunnan Province; *Taiwanaptera guangxiana* sp. nov. from Guangxi Province and *Taiwanaptera montana* sp. nov. from Yunnan Province. A key to all known species of *Taiwanaptera* is provided.

Key words. Hemiptera, Heteroptera, Aradidae, Carventinae, *Cathaycoris*, *Taiwanaptera*, apterous, new genus, new species, China

Introduction

The flat bug subfamily Carventinae of the family Aradidae is widespread and diverse in tropical and subtropical habitats of the Oriental and Australian Region (USINGER 1950, KORMILEV & FROESCHNER 1987). However, only nine genera are recorded to date from China and Taiwan, seven of them being apterous and two macropterous (YANG et al. 2007, HEISS et al. 2014) (see Table 1).

Examining Aradidae collected in the Chinese provinces Yunnan and Guangxi, we have discovered three undescribed taxa of apterous Carventinae. One of these species is so distinctive, to the degree that it cannot be placed in any of the described genera of this subfamily – we therefore propose the new genus *Cathaycoris* gen. nov. to accommodate it (*C. bibulbosus* sp. nov.). The two remaining species belong to the previously monotypic apterous genus *Taiwanaptera* Heiss & Nagashima, 2008, known only from Taiwan and Japan (Ryukyu Islands: Okinawa, Iriamote and Kyushu). The two new species are described as *T. guangxiana* sp. nov. from Guangxi Province and *T. montana* sp. nov. from Yunnan Province and represent the first records of *Taiwanaptera* from mainland China. A key to the three known species of *Taiwanaptera* is also provided.

Table 1. List of Carventinae taxa previously recorded from China, Hainan and Taiwan (YANG et al. 2007, HEISS et al. 2014).

<u>Apterous genera</u>	
<i>Caiaptera</i> Bai & Heiss, 2011a	
<i>picea</i> Bai et al., 2011a	Hainan
<i>Crassocoris</i> Bai et al., 2007	
<i>hsiaoi</i> Bai et al., 2007	Hainan
<i>Libiocoris</i> Kormilev, 1957	
<i>sinensis</i> Bai et al., 2006	Hainan
<i>heissi</i> Bai et al., 2006	Hainan
<i>Notoplocaptera</i> Usinger & Matsuda, 1959	
<i>taiwanica</i> Heiss & Nagashima, 2008	Taiwan, Japan
<i>hainanensis</i> Bai et al., 2011a	Hainan
<i>Paramorphocoris</i> Cui et al., 2015	
<i>henanensis</i> Bai & Heiss, 2015 in CUI et al. (2015)	Henan Prov.
<i>Taiwanaptera</i> Heiss & Nagashima, 2008	
<i>glabra</i> Heiss & Nagashima, 2008	Taiwan, Japan
<i>Vietnamaptera</i> Zhang et al., 2010	
<i>secunda</i> Bai et al., 2011b	Yunnan Prov.
<i>tertia</i> Bai et al., 2011b	Yunnan Prov.
<i>quarta</i> Bai et al., 2011b	Yunnan Prov.
<i>schaeferi</i> Heiss & Bañar, 2015	Guangdong Prov.
<u>Macropterous genera</u>	
<i>Carventus</i> Stål, 1865	
<i>sinensis</i> Kormilev, 1969	Guangdong Prov.
<i>taiwanensis</i> Kormilev, 1969	Taiwan
<i>hainanensis</i> Liu, 1981	Hainan
<i>insularis</i> Heiss & Nagashima, 2008	Taiwan, Japan
<i>Lissonotocoris</i> Usinger & Matsuda, 1959	
<i>membranaceus</i> Usinger & Matsuda, 1959	Hainan, Laos, Vietnam

Material and methods

In order to study several morphological features, it was necessary to clean the specimens from the layer of debris that covered them by hand. Photos were taken using an Olympus SZX 10 binocular microscope with an Olympus E 3 digital camera and processed with Helicon Focus 4.3 software and using Adobe Photoshop and Lightroom 2.3. Measurements were taken with a micrometer eyepiece and are given in millimetres.

Abbreviations used: deltg = dorsal external laterotergite (connexivum), mtg = mediotergite, mst = mediosternite; ptg = paratergite, vltg = ventral laterotergite.

When citing the text on labels attached to the specimens, a slash (/) separates different lines and, a double slash (//) separates different labels. The specimens on which this study is based are preserved in the following collections:

- CAUC Entomological Museum of the China Agricultural University Beijing, China;
 CEHI Ernst Heiss collection, Tiroler Landesmuseum, Innsbruck, Austria;
 EMNU Entomological Museum of Inner Mongolia Normal University, Huhhot, China.

Taxonomy

Cathaycoris gen. nov.

Type species. *Cathaycoris bibulbosus* sp. nov., here designated.

Description. *Head* about as long as wide across eyes; genae produced over clypeus, cleft at middle; antenniferous lobes short and blunt; antennae about 1.7 times as long as width of head, segment I thickest and longest, the following thinner and shorter; eyes globose, not inserted in head; postocular lobes with lateral tooth, then converging to neck. Rostrum arising from a slit-like atrium, shorter than head.

Pronotum about twice as wide as long; collar large, triangularly produced posteriorly, laterally separated from anterolateral angles by an incision; disk with 2(1+1) smooth callosities, lateral sclerites produced anterolaterally, lateral margin concave, posterior margin sinuate, delimited by a transverse carina, raised at humeri.

Mesonotum consisting of a T-shaped scutellum-like, median, posteriorly elevated sclerite, which is fused to 2 (1+1) oval lateral expansions, interpreted as wing pad rudiments; posterior margin of mesonotum fused to metanotum, both delimited by a deep transverse sulcus.

Metanotum. The 2 (1+1) sclerites situated in the lateral margin of the median scutellar projection of mesonotum are of polygonal shape, their surface being irregularly rugose; fused to mtgI, its fusion line marked by a thin suture.

Mtg I+II fused without being delimited by a visible fusion line, of trapezoidal shape; mtgI strongly elevated at middle into 2 (1+1) granulate humps, higher than adjacent median mesonotal elevation; mtg II sloping posteriorly to transverse suture separating it from tergal plate; surface except humps deeply impressed.

Abdomen. Tergal plate with large median elevation highest on mtg IV+V sloping laterally; deltg II+III fused, triangular, anteriorly reaching mesonotum; deltg III–VII separated by sutures; lateral margin with dorsally reflexed vltg V–VII visible as lateral expansions on deltg V–VII; tergite VII strongly raised in male for accommodating the pygophore.

Venter. Prosternum with a median ridge, meso- and metasternum and mstII flat at middle, tooth-like projections directed to coxae not developed; surface of pleural regions rugose, that of sternites III–VII smooth and shiny at middle, rugose laterally of lateral apodemes; spiracles II ventral, III–IV sublateral close to lateral margin and slightly visible from above, V–VII lateral on dorsally reflexed vltg V–VII and visible from above, VIII terminal on ptg VIII; sternite VII of male bears a large glabrous round tubercle, produced posteriorly below the reflexed vltg VII and visible from above.

Legs long and slender, unarmed, claws with thin pulvilli.

Differential diagnosis. Apterous, medium sized; surface of body and appendages are granular and rather mat, tergal plate is glabrous except the median elevation; coloration is black. Distinguished from other genera by sharing the conspicuous T-shaped mesonotum as follows. There are only three apterous genera of Oriental Carventinae sharing the triangularly produced, T-shaped scutellum-like mesonotum extending to mtgI – *Apteraradus* Drake, 1957 from Malaysia, Thailand, Vietnam and Sunda Islands, *Taiwanaptera* Heiss & Nagashima, 2008 from Taiwan and Japan, and *Parataiwanaptera* Heiss, 2010 from Vietnam. *Cathaycoris* gen.

nov. differs from the preceding genera at first glance by the high median elevations on mesonotum, mtgI and tergal plate (which are flat in the other genera), by the shape of pronotum, and the distinct lateral tooth of the postocular lobes.

Etymology. Refers to ‘*Cathay*’ the ancient name for China used by the famous European traveller Marco Polo when returning to Venice in 1295 and ‘*coris*’, the Greek word for bug. The gender is masculine.

***Cathaycoris bibulbosus* sp. nov.**

(Figs 1–4)

Type locality. China, Yunnan, Pingbian, Daweishan, 1333 m, 22°59.405'N, 103°41.072'E.

Type material examined. HOLOTYPE: ♂, ‘China, Yunnan, Pingbian / Daweishan 1333m / N 22°59.405,E 103°41.072 / 2009 V 23, Bai XS / Ent. Mus. CAU Beijing // HOLOTYPE ♂ / *Cathaycoris* nov.gen. / *bibulbosus* nov. sp. / des. BAI, HEISS, CAI 2013 [red label]’ (CAUC). PARATYPE: ♀, same data as holotype (CEHI).

Description. As the generic description is already detailed and based on the type specimens, only few additional characters are added here.

Male (apterous) (Figs 1–3). *Head* only slightly longer than width across eyes (1.15/1.13); apex of clypeus free, flanked by laterally produced genae reaching half of antennal segment I; antenniferous lobes diverging anterolaterally; antennae 1.75 times as long as width of head (1.98/1.13), segment I thickest and longest, II–IV thinner and shorter, length of segments I/II/III/IV = 0.6/0.43/0.55/0.4; eyes globose, granulate; postocular lobes with a distinct lateral tubercle then converging to constricted neck; vertex raised at middle, flanked by 2 (1+1) oval callosities.

Pronotum strongly transverse; anterior lobe with a ring-like collar triangularly produced posteriorly, posterior lobe much wider than anterior one, anterolaterally produced, lateral margin concave, humeri raised.

Mesonotum. T-shaped scutellum-like plate strongly raised posteriorly, flat with rugose surface laterally; lateral wing pad-like oval sclerites fused to T-shaped sclerite separated by a thin suture.

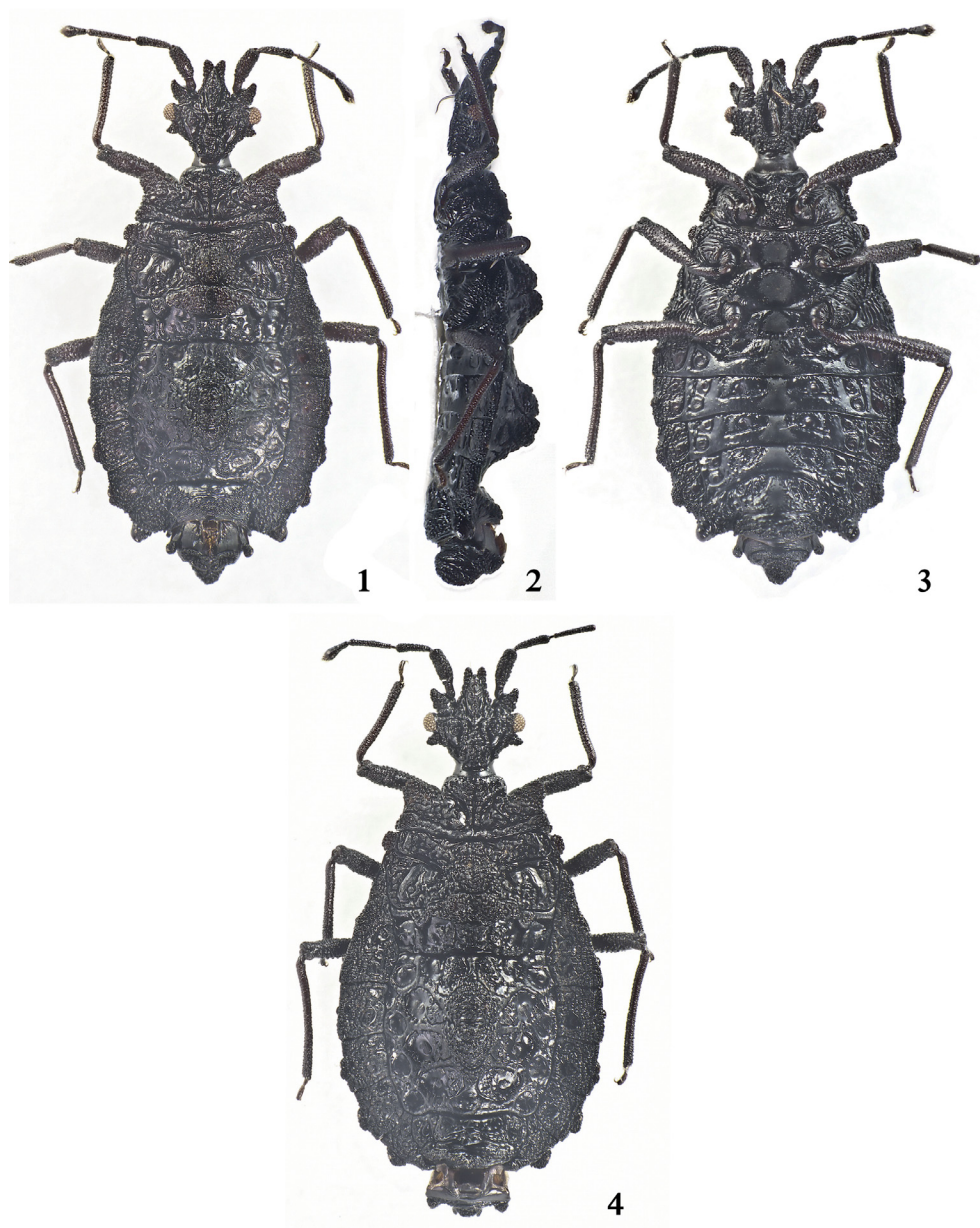
Metanotum. Median part covered by mesonotal scutellar structure, lateral sclerites sloping to lateral margins, posteriorly fused to mtgI marked by a distinct suture.

MtgI+II completely fused, mtgI raised medially to 2 (1+1) high granulate humps, mtgII sloping posteriorly.

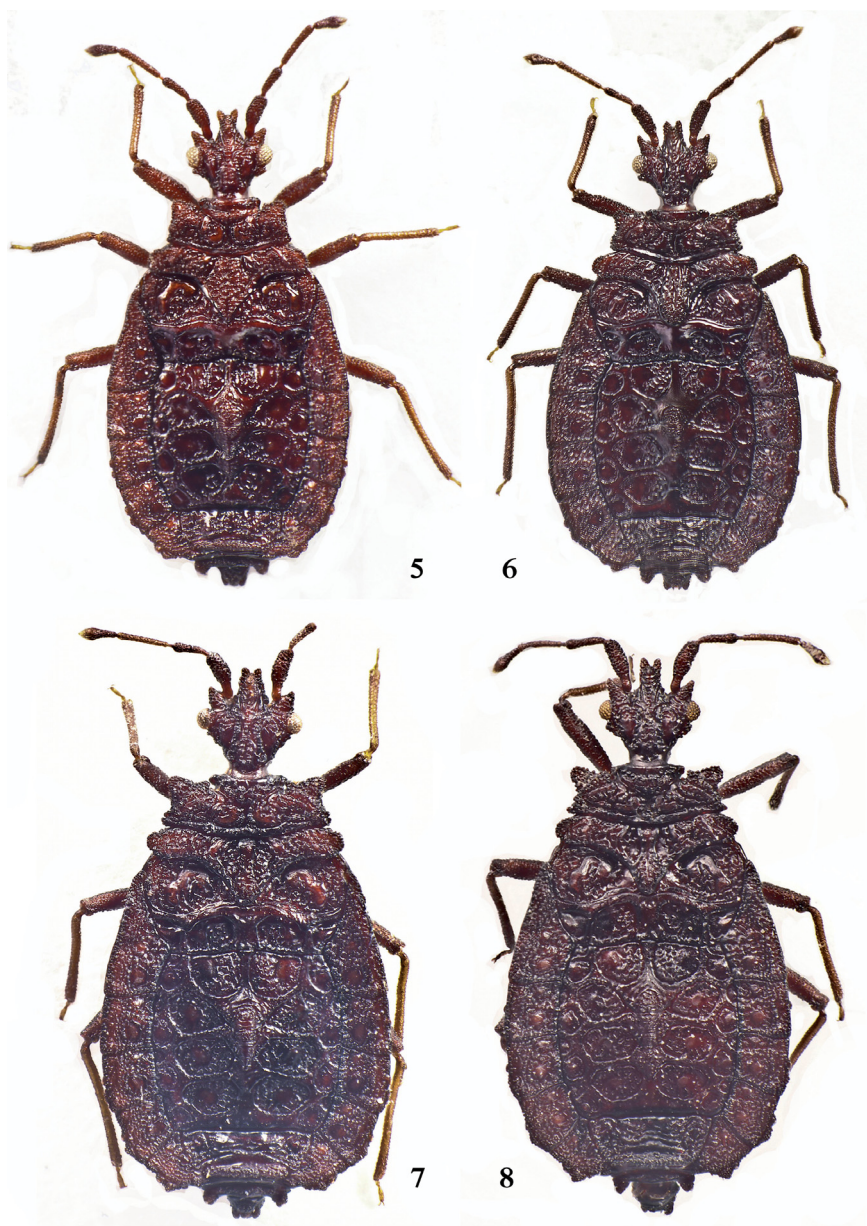
Venter (Fig. 3). Median surface glabrous, lateral parts and pleural regions rather matt, granulate and rugose; meso- and metasternum and mstII with a flat median depression of matt surface, spiracles II ventral, III–IV sublateral close to lateral margin and slightly visible from above, V–VII lateral on dorsally reflexed vltg V–VII and visible from above, VIII terminal on ptg VIII.

Male genitalia. Pygophore conical, twice as wide as long, surface granulate. The single male was not dissected for the study of parameres.

Legs long and slender, femora moderately incrassate, tibiae cylindrical, claws with thin pulvilli.



Figs 1–4. *Cathaycoris bibulbosus* gen. & sp. nov. 1 – holotype, male, dorsal view (5.7 mm); 2 – holotype, male, lateral view; 3 – paratype, male, ventral view; 4 – paratype, female, dorsal view (6.2 mm).



Figs 5–8. *Taiwanaptera* species. 5 – *T. glabra* Heiss & Nagashima, 2008, topotype, female, dorsal view (6.2 mm); 6 – *T. guangxiana* sp. nov., holotype, female, dorsal view (6.2 mm); 7 – *T. montana* sp. nov., paratype, female, dorsal view (Yunnan, Huanglianshan) (6.2 mm); 8 – *T. cf. montana*, female, dorsal view (Yunnan, Daweishan) (6.0 mm).

Female (Fig. 4). Generally as male but of larger size and more rounded, wider abdomen; tergite VII glabrous at middle, slightly raised to a granulate transverse ridge posteriorly; sternite VII lacking tubercle.

Measurements. *Male* (holotype): body length 5.7 mm (including gaping pygophore); length / width of pronotum 0.6/1.6 (1.7 posterior lobe); length / width of mesonotum 0.6/2.0; length / width of mtgI+II 0.6/1.55; width of abdomen across tergite III – 2.75, IV – 2.75, V – 2.65, VI – 1.3.

Female (paratype): body length 6.2 mm; length / width of head 1.3/1.25; length / width of pronotum 0.75/1.75 (1.95 posterior lobe); length / width of mesonotum 0.65/2.25; length / width of mtgI+II 0.7/1.8; width of abdomen across tergite III – 3.25, IV – 3.3, V – 3.2, VI – 2.85; length of antennal segments I/II/III/IV = 0.63/0.45/0.6/0.4, ratio length of antennae / width of head 1.66.

Etymology. The species name is a composed adjective *bibulbosus* (-a, -um) referring to the two distinct elevated structures on mtgI and tergal plate, composed of the Latin words ‘bi-’ (for double) and ‘bulbus’ (for round elevation).

Distribution. China: Yunnan.

***Taiwanaptera* Heiss & Nagashima, 2008**

Taiwanaptera Heiss & Nagashima, 2008: 290. Type species: *Taiwanaptera glabra* Heiss & Nagashima, 2008, original designation.

This genus was erected for *Taiwanaptera glabra* recorded from Taiwan, Japan (Kyushu) and Ryukyu Islands (Okinawa, Ishigaki and Iriamote). Unsurprisingly, the specimens from mainland China belong to different species which can be separated by the key provided below.

Key to *Taiwanaptera* species

- 1 Apex of triangular scutellum-like projection of mesonotum narrow, subacute; its surface transversely rugose without distinct elevation; anterolateral angles of pronotum nearly rectangular. Taiwan, Japan, Ryukyu (Figs 5, 11). ***T. glabra* Heiss & Nagashima, 2008**
- Apex of triangular scutellum-like projection of mesonotum wider and rounded, its surface distinctly medially raised; anterolateral angles of pronotum produced. 2
- 2 Scutellar ridge as wide as diameter of lateral sclerites and of same height on whole length; antennae longer, about twice as long as width of head; postocular lobes with distinct lateral tubercle; spiracles II–IV ventral and not visible from above, V–VII lateral and visible. China: Guangxi (Figs 6, 9). ***T. guangxiana* sp. nov.**
- Scutellar ridge distinctly narrower than diameter of lateral sclerites, depressed at middle; antennae about 1.8–1.9 times as long as width of head; postocular lobes granulate; spiracles II–III ventral and not visible from above, IV sublateral and V–VII lateral and visible. China: Yunnan (Figs 7, 10). ***T. montana* sp. nov.**

Taiwanaptera guangxiana sp. nov.

(Figs 6, 9)

Type locality. China, Guangxi, Longshenghuaping, 748 m, 25°37.508'N, 109°54.514'E.

Type material examined. HOLOTYPE: ♀, 'China, Guangxi / Longshenghuaping / 2008 V 2, Bai XS / Ent.Mus.Imnu., Huhhot // HOLOTYPE / Taiwanaptera / guangxiana nov. sp. / des. BAI, HEISS, CAI 2013 [red label]' (EMNU). PARATYPE: ♀, same data as holotype (CEHI).

Description. Female (apterous). Surface of body glabrous with irregular rugosities, legs and antennae finely granulate; coloration dark reddish-brown, tibiae and antennal segments II–IV ochraceous.

Head slightly longer than width across eyes (1.2/1.1); granulate genae produced anteriorly over narrow clypeus leaving a gap in the middle, reaching about half the length of antennal segment I; clypeus longitudinally rugose, a round dorsal tubercle near apex; antenniferous lobes diverging anterolaterally, apex subacute; antennae 2.07 times as long as width of head (2.28/1.1), segment I thickest and constricted at base, II shorter and slender, III thinner and longest, IV fusiform with pilose apex; length of antennal segments I/II/III/IV = 0.65/0.45/0.73/0.45; eyes semicircular granulate; postocular lobes with a distinct tubercle anteriorly then strongly converging toward constricted neck, vertex granulate at middle with 2(1+1) ovate callosities laterally. Rostrum arising from a slit-like atrium, shorter than head; rostral groove deep, closed posteriorly.

Pronotum transverse, 2.5 times as wide as long (1.75/0.7); ring-like collar with a posterior median granulate elevation, delimited by a deep groove; lateral margins converging anteriorly, anterolateral angles roundly produced, not projecting over collar; lateral sclerites of disk irregularly rugose, raised toward lateral margins, separated at middle by a deep groove bearing a thin carina; posterior margin sinuate delimited by a smooth transverse ridge.

Mesonotum 2.7 times as wide as long (2.18/0.8); laterally expanded lobes rounded at apices, surface rugose; median scutellar projection as wide as diameter of lateral sclerites, its surface elevated and rugose.

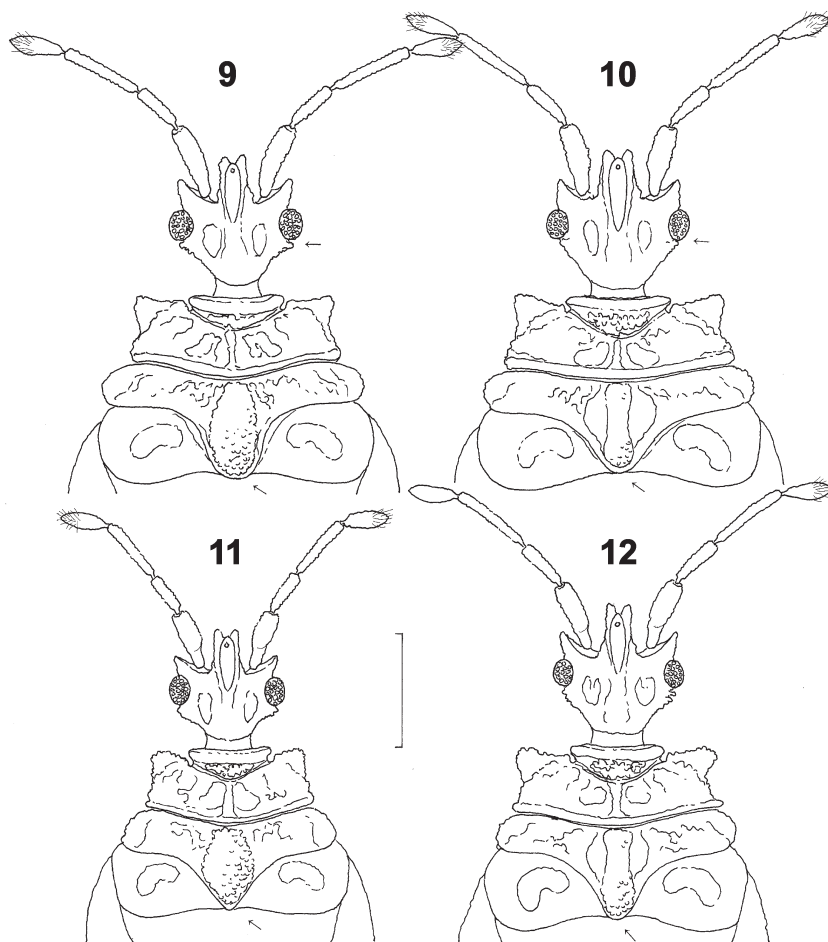
Metanotum formed by 2 (1+1) oval rugose sclerites lateral of mesonotal scutellar projection, anteriorly separated from mesonotum by deep furrows; posterior margin bisinuate, fused to mtg I+II, fusion line indicated by a thin sulcus.

Mtg I+II fused, anterior margin forming a bisinuate smooth transverse ridge from which 2 narrower lateral and one wide median smooth ridge produced posteriorly with 4 (2+2) deep oval depressions between them; posterior margin slightly concave at middle.

Abdomen. Fused tergal plate of oval outline, surface with a median elevation highest on mtg IV–V; lateral apodemal impressions flat, delimited by smooth carinate margins; deltg II+III fused, deltg III–VII separated by sutures, their surface granulate and raised along lateral margin; posteriorly to dorsally visible spiracle VI with small rim and posterior to spiracle VII a triangular projection representing the dorsally reflexed portions of veltg VI and VII.

Venter: Prosternum with a median ridge, meso- and metasternum fused to sternites II+III, flat matt depression medially; spiracles II–IV ventral, V sublateral but visible from above, VI and VII lateral and visible, VIII dorsal on transverse paratergites VIII.

Legs long and slender, straight; protibial comb present; claws with long thin pulvilli.



Figs 9–12. *Taiwanaptera* species, head and thorax. 9 – *T. guangxiana* sp. nov., holotype female; 10 – *T. montana* sp. nov., paratype, female (Yunnan: Huanglianshan); 11 – *T. glabra* Heiss & Nagashima, 2008, topotype, female; 12 – *T. cf. montana*, female (Yunnan: Daweishan). Arrows indicate differences in structure. Scale bar: 0.5 mm.

Measurements. *Female*: Holotype: Length 6.2 mm; width of abdomen across tergite III 3.25, IV 3.35, V 3.25, VI 3.0; width of paratergite VIII 0.9; paratype: length 6.0 mm; head length/width 1.2/1.1; pronotum length/width 0.7/1.65; mesonotum length/width 0.75/2.05; length of antennal segments I/II/III/IV = 0.6/0.45/0.68/0.45; ratio length of antennae / width of head 1.97; width of abdomen across tergites III 3.1, IV 3.15, V 3.1, VI 2.88.

Etymology. Adjective *guangxianus* (-a, -um), given after the province of Guangxi where this species was discovered.

Distribution. So far only known from the type specimens from China, Guangxi province.

Taiwanaptera montana sp. nov.

(Figs 7, 10)

Type locality. China, Yunnan, Lvchum, Huanglianshan, 1791 m, 22°56.625'N, 102°17.785'E.

Type material examined. HOLOTYPE: ♂, 'China, Yunnan, Lvchum / Huanglianshan 1791m / N22°56.625, E102°17.785 / 2009 V Bai XS / Ent.Mus.CAU, Beijing // HOLOTYPE / Taiwanaptera / montana nov. sp. / des. BAI, HEISS, CAI 2013 [red label]' (CAUC). PARATYPE: ♀, labelled as holotype (CEHI).

Additional material examined. 1 ♂ 1 ♀ (Figs 8, 12), 'China, Yunnan, Pingbian / Daweishan 1333m / N22°59.405, E103°41.072 / 2009 V 23 Bai XS / Ent.Mus.' (CAUC).

Description. *Male* (holotype, apterous). Surface of body rugose, legs and antennae finely granulate; coloration dark reddish brown, tibiae and antennal segments II–IV paler.

Head about as long as width across eyes (1.1/1.08); genae produced over clypeus, gaping at middle; antenniferous lobes with subparallel lateral margins; antennae 1.81× as long as width of head (1.95/1.08), length of antennal segments I/II/III/IV = 0.55/0.4/0.6/0.4, structure as *T. guangxiana* sp. nov.; eyes granulate, postocular lobes granulate, anteriorly without distinct tubercle, straightly converging to constricted neck; vertex rostrum arising from a slit-like atrium, shorter than head, rostral groove deep, closed posteriorly.

Pronotum about 2.7 times as wide as long (1.7/0.63); smooth ring-like collar with granulate transverse ridge posteriorly; lateral margins converging towards produced rounded anterolateral angles; disk granular, lateral sclerites separated at middle by a deep furrow; posterior margin sinuate, smooth and thickened.

Mesonotum 2.6 times as wide as long (1.95/0.75); scutellar projection with rounded apex its median ridge subparallel, half as wide as diameter of lateral sclerites, these rounded and raised laterally; surface rugose, depressed basally laterad of median ridge.

Metanotum consisting of oval sclerites laterad of mesonotal scutellar projection, deeply depressed toward inner angles, surface with an inclined smooth callosity; posterior margin bisinuate.

Mtg I+II raised at fusion line to metanotum, sloping posteriorly; structure as in *T. guangxiana* sp. nov.

Abdomen. Tergal plate with median elevation on mtg IV+V, lateral apodemal impressions with granulate surface around smooth apodemes; deltg II+III fused, deltg III–VII separated by sutures, their lateral margin raised; tergite VII raised medially for reception of pygophore; a small rim of dorsally reflexed vltg IV–VII is visible posteriorly to spiracles IV–VI which is triangularly produced on deltg VII.

Venter. Prosternum with a median ridge, meso- and metasternum fused to sternites II+III, with a flat matt depression medially; spiracles II–III ventral and not visible from above, IV sublateral, V–VII lateral and distinctly visible from above, VIII terminal on ptg VIII; sternite VII with 2 (1+1) distinct sublateral tubercles directed ventrally.

Legs long and slender, straight, protibial comb present; claws with long thin pulvilli.

Male genitalia. Pygophore pear shaped, transversely rugose; paratergites VIII small, reaching half of pygophore. The single male was not dissected for the study of parameres.

Female. Basically similar to male, however of larger size and with a wider and more rounded abdomen; tergite VII raised posteriorly to a transverse ridge, surface rather smooth with few transverse striae.

Measurements. Male (holotype). Length 5.3 mm; width of abdomen across tergite III – 2.50, IV – 2.55, V – 2.50, VI – 2.35. Female (paratype). length 6.2 mm; length/width of head 1.25/1.175; length/width of pronotum 0.65/1.85; length/width of mesonotum 0.75/2.2; length of antennal segments I/II/III/IV = 0.6/0.4/0.65/0.45; ratio length of antennae / width of head 1.79; width of abdomen across tergites III – 3.15, IV – 3.2, V – 3.15, VI – 2.9.

Variation. The two specimens from Yunnan, Pingbian, Daweishan share all essential characters of *T. montana* sp. nov., but show slight differences in minor structures (e.g. slightly longer antennae, somewhat wider antenniferous tubercles, postocular lobes more granulate, compare Figs 10, 12). The Daweishan mountains are located about 108 km distant from Huanglianshan and are not directly connected. These records are presently classified as *T. montana* sp. nov., but not included in the type series, as it cannot be excluded that the species from Daweishan represents an endemic taxon, which needs to be tested by molecular data and dissection of genitalia.

Etymology. The species name, *montanus* (-a, -um), is the Latin adjective referring to the mountainous region of Yunnan where it occurs.

Distribution. Recorded from China, Yunnan Province.

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