A new species in the genus *Menida* (Hemiptera: Pentatomidae) from China

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Abstract: A new species, *Menida badia* **sp. nov.** from China, is described. The genetic distance based on the mitochondrial *COI* (633 bp) between *Menida badia* **sp. nov.** and its closely related species *Menida lata* Yang is 11.6%, which exceeds their respect intraspecific genetic distances of 1.2% and 1.4%. Detailed morphological descriptions of *M. badia* **sp. nov.**, including distinguishing characteristics from *M. lata*, as well as an updated key for the determination of *Menida* species from China, are provided.

Key words: Menidini; key; taxonomy

中国曼蝽属 *Menida* 一新种记述（半翅目：蝽科）

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摘要：记述来自中国的曼蝽属 1 新种：拟宽曼蝽 *Menida badia* **sp. nov.**。基于线粒体 *COI* 基因（633 bp）的分析结果显示，拟宽曼蝽与相似物种宽曼蝽 *Menida lata* Yang 的遗传距离为 11.6%，超过了两物种各自的种内遗传距离（分别为 1.2%和 1.4%），达到了种间分化水平。本文详细描述了拟宽曼蝽的形态特征、与宽曼蝽的形态差异，并提供了中国曼蝽属的新检索表。

关键词： 曼蝽族；检索表；分类

Introduction

The genus *Menida* Motschulsky, 1861 is classified under Hemiptera, Pentatomidae, Menidini, with *Menida violacea* Motschulsky designated as its type species in 1902. This genus currently is comprised of a total of 80 species worldwide, exhibiting a widespread distribution across diverse regions except for Nearctic and Neotropical regions, with a concentration in the Palaearctic and Oriental regions (Li 2015). The book “Catalogue of the Heteroptera of the Palaearctic Region” by Aukema & Rieger (2006) documents 21 species within the Palaearctic Region. China harbors 18 species, with a key provided for their identification by Li (2015).

The body shape of *Menida* is typically oval, often accompanied by colored spots and a metallic sheen on the body surface (Fan 2011; Li *et al.* 2015). The adults of *Menida* are generally polyphytophages, with a diverse range of host plants. Several species within this genus have been known to cause damage to economically important crops. For instance,

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Menida versicolor (Gmelin) poses a threat to rice crops, *Menida lata* Yang damages common beans and fava beans, and *M. violacea* is harmful to potatoes (Markova *et al*. 2020; Zhang 1985). In this article, a new species from China is identified and described by combining comparisons of genetic distances and morphological differentiations. An updated key to the species of the *Menida* from China is provided.

Material and methods

The specimens are deposited in the Institute of Entomology, Nankai University, Tianjin, China (NKUM). Photographs of the body are taken with a Canon EOS 5D digital camera, and parameres are captured using a Canon OLYMPUS DP72 digital camera. All measurements are conducted in millimeters (mm). The terminology of morphology descriptions follows Fan & Liu (2013).

Genomic DNA was extracted using a Universal Genomic DNA Kit, the extraction steps were performed according to the instruction manual. The amplification of the COI fragment was conducted using PCR and the primer sets LCO1490 and HCO2198 (Folmer *et al*. 1994). The PCR procedure began with a denaturation at 94°C for 2 minutes, followed by 32 cycles of 30 seconds at 92°C, 30 seconds at 50–52°C, and 1 minute at 72°C, concluded with a final extension at 72°C for 8 minutes. Subsequently, the amplified products were sent to The Beijing Genomics Institute (BGI) for Sanger sequencing. A total of 34 COI fragments, including 4 sequences retrieved from GenBank, were used for subsequent molecular analysis, encompassing 15 species of the genus *Menida* which are distributed in China (Table 1).

The built-in MAFFT in PhyloSuite was used to align the sequences (Zhang *et al*. 2020). All sequences were categorized into 15 species based on their morphological characteristics, and genetic distances within and between species were calculated using MEGA 11 with the model Kimura 2-parameter (Tamura *et al*. 2021).

Table 1. Collection information and GenBank accession numbers for the species used in molecular analysis

Species	Locality	Accession number
Menida atkinsoni Distant	Ruili, Yunnan, China	PP693110*
	Ruili, Yunnan, China	PP693139*
Menida disjecta (Uhler)	Zunyi, Guizhou, China	PP693111*
	Shijiazhuang, Hebei, China	PP693112*
	Yan'an, Shaanxi, China	PP693113*
Menida formosa (Westwood)	Pu'er, Yunnan, China	PP693114*
	Jinghong, Yunnan, China	PP693115*
Menida lata Yang	Hechi, Guangxi, China	PP693116*
	Jiyuan, Henan, China	PP693117*
	–	OP066241
Menida badia **sp. nov.**	Wushan, Chongqing, China	PP693118*
	Enshi, Hubei, China	PP693119*
	Yixing, Jiangsu, China	PP693120*

Table 1 (continued)

Species	Locality	Accession number
Menida metallica Hsiao & Cheng	Leishan, Guizhou, China	PP693121*
	Zunyi, Guizhou, China	PP693122*
	Lichuan, Hubei, China	PP693123*
	–	MK617948
Menida musiva (Jakovlev)	Jiamusi, Heilongjiang, China	PP693124*
	Jixian, Tianjin, China	PP693125*
	–	OP066239
Menida ornate Kirkaldy	Dali, Yunnan, China	PP693126*
Menida pinicola Zheng & Liu	Shangluo, Shaanxi, China	PP693127*
	Lijiang, Yunnan, China	PP693128*
Menida speciosa Zheng & Xiong	Ledong, Hainan, China	PP693129*
	Ledong, Hainan, China	PP693139*
Menida szechuensis Hsiao & Cheng	Danba, Sichuan, China	PP693130*
	Lijiang, Yunnan, China	PP693131*
Menida varipennis Westwood	Linzhi, Xizang, China	PP693132*
	Yuxi, Yunnan, China	PP693133*
Menida versicolor (Gmelin)	Nanping, Fujian, China	PP693134*
	Nanning, Guangxi, China	PP693135*
	Yuanjiang, Yunnan, China	PP693136*
Menida wuyiensis Lin & Zhang	Shangrao, Jiangxi, China	PP693137*

*Obtained in this study.

Molecular analysis. After aligning and trimming, we obtained a dataset comprised of 633 bp mitochondrial *COI* fragments. Genetic distances within the *Menida* species ranged from 0 to 1.6%, while interspecific genetic distances spanned from 7.4% to 19.5% (Table 2). Notably, the genetic distance between *M. badia* **sp. nov.** and its closest related species *M. lata* was 11.6%, exceeding their respective intraspecific genetic distances, 1.2% and 1.4%, indicating a substantial level of interspecific differentiation (Table 2).

Taxonomy

Genus *Menida* Motschulsky, 1861

Type species. *Menida violacea* Motschulsky, 1861.

***Menida badia* sp. nov.** (Figs 1A, 1B, 1D, 1E)

Coloration and punctures. Dorsum from yellowish brown to fuscous. Some individuals with irregular brownish suffusion, creating a mottled pattern; others with yellowish patches varying in shape and size. Head, pronotum, scutellum black, thickly punctate. Head fuscous, with several yellowish unpunctured longitudinal fasciae; ventral surface yellowish brown, inner side of eyes and the outer side of buccula densely punctured. Antennae ochraceous, distal two thirds of antennomere IV and antennomere V brown. Pronotum punctured,

uniformly arranged in sinuate short lines. Calli from brown to black, with a yellowish spot centrally, two darker spots laterally, surrounding by punctures. Scutellum with a pair of small unpunctured yellowish spots at each basal angel, apical area paler. Some individuals creamy yellowish or yellowish at basal half, extending towards apex. This coloration often is inconspicuous in certain specimens (Fig. 2). Corium concolorous with scutellum, punctured more sparsely to the tip, with irregular paler patches; membrane transparent, with a large brown patch. Thoracic pleura yellowish brown, with large black patches; mesosternum and metasternum black; scent gland with brown peritreme and black evaporative area. Legs yellowish brown, femur with small black spots more dense to the distal end and a big black subapical spot. Connexiva yellowish brown, both sides of each segment black. Abdominal venter yellowish brown, with a large black longitudinal band in the middle and each submarginal area. The disk of abdominal venter unpunctured, gradually punctured more densely towards the lateral margin.

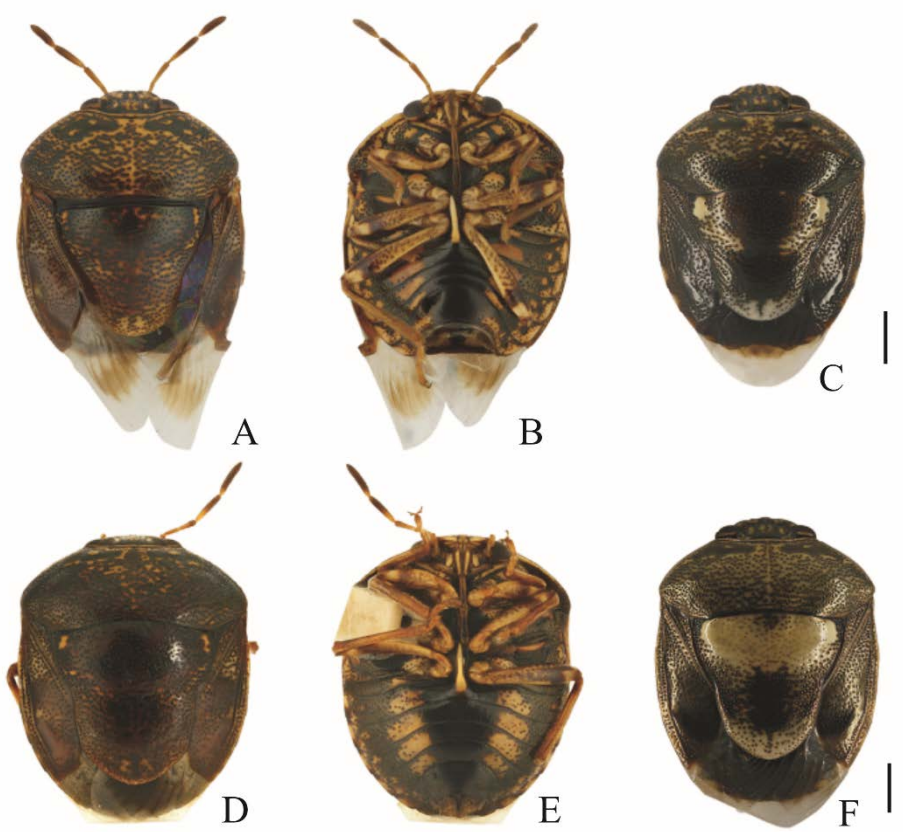

Figure 1. *Menida* spp. A, B. *M. badia* **sp. nov.** (holotype, ♂); C. *M. lata* (♂); D, E. *M. badia* **sp. nov.** (Paratype, ♀); F. *M. lata* (♀). A, C, D, F. Dorsal views; B, E. Ventral views. Scale bars = 1 mm.

Head. Broader than long. Mandibular plates subequal to clypeus in length, outer margin arched, gradually tapering towards the distal end. Antennae 5-segmented, V> IV> III> II> I in length. Labium reaching to the metacoxa, apex of the first segment not surpassing buccula.

Figure 2. *M. badia* **sp. nov**. Coloration variation of scutellum.

Thorax. Pronotum elevated, anterior angles extending laterally, forming small processes, surpassing the outer margin of eyes; anterolateral margins convex slightly; humeral angles obtuse; posterior margin concave. Scutellum broad ligulate, the length from the lateral margin's bending point to the distal apex exceeding half of the total length. Membrane distinctly beyond the abdominal end. Peritreme narrowly elongated. Abdomen. Connexiva barely exposed; process of abdominal base reaching to the median of the mesocoxa.

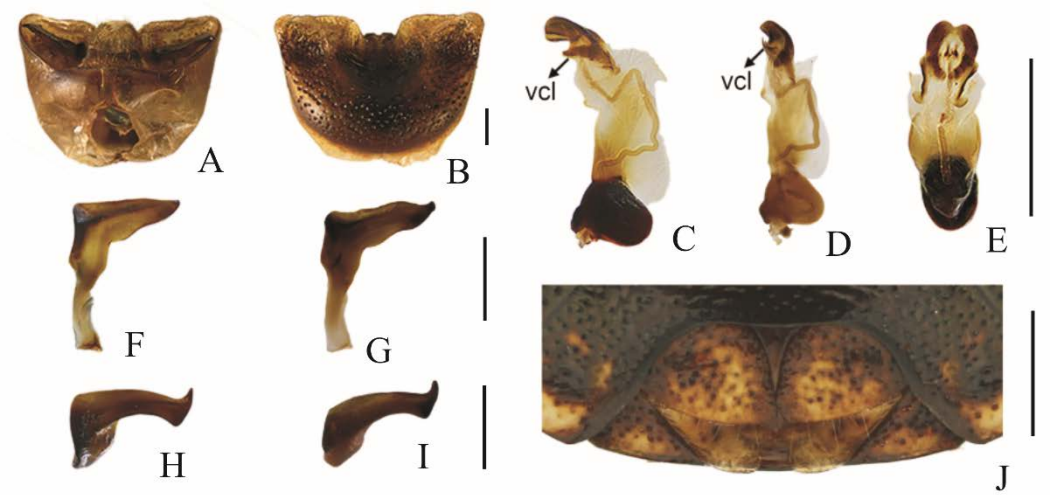

Figure 3. *Menida* spp. A, B. Pygophore, *M. badia* **sp. nov.**; C–E. Aedeagus, C, E. *M. badia* **sp. nov.**; D. *M. lata*; F–I. Paramere, F, H. *M. badia* **sp. nov.**; G, I. *M. lata*.; J. Female external genitalia, *M. badia* **sp. nov.** A. Dorsal view; B. Ventral view; C, D, F, G. Lateral view; E, H, I. Apical view. Scale bars = 0.5 mm (A, B, F, G); 0.2 mm (C–E). vcl – ventral conjunctival lobe.

Male genitalia. Pygophore cup-shaped, lateroposterior angles blunted, higher than the center of ventroposterior rim; the middle of the ventroposterior rim inwardly concave, forming a "U" shape; bottom of the "U"-shaped pit with a distinct central depression and two smaller depressions on each side; laminar protrusion of dorsoposterior rim, retuse, with sparse setae (Figs 3A, 3B). Phallotheca stout, hemispherical, heavily sclerotized. Conjunctive with 3 sets of processes; a membranous small apical conjunctival lobe, a pair of small basolateral

conjunctival lobes with slightly sclerotized apex, and a pair of sclerotized ventral conjunctival lobes (Figs 3C, 3E). Median plates, finger-like, curved, moderately sclerotized, and centrally concaved; vesica short, not exceeding median plates (Figs 3C, 3E). Paramere simple, blade extending laterally, tapering apicad, boot-shaped; the outer margins of stem and blade sinuate (Figs 3F, 3H).

Female genitalia. Gonocoxites VIII far apart basally, slightly touching or separated distally. Paratergites IX not surpassing beyond the eighth tergite (Fig. 3J).

Measurements (in mm). Male. Body length 6.1–6.4; width 4.2–4.3. Head length 1.1–1.3; width 2.0–2.1; antennal length of I : II : III : IV : V = 0.27 : 044 : 0.55 : 0.75 : 0.80. Pronotum length 1.6–1.8. Scutellum length 2.5–2.6; width 3.2–3.4. Female. Body length 6.9–7.7; width 4.4–4.7. Head length 1.2–1.3; width 2.0–2.2; antennal length of I : II : III : IV : V = 0.29 : 0.44 : 0.58 : 0.76 : 0.82. Pronotum length 1.7–1.8. Scutellum length 2.8–3.3; width 3.3–3.5.

Holotype. ♂, **China**, Hubei, Enshi Tujia and Miao Autonomous Prefecture, Badong Town, 31.31N, 110.36E, 429 m, 12-VI-2023, coll. KB WANG & YY ZHANG. **Paratypes.** 2♂3, same as holotype, 1♀ (PP693119) used for molecular analysis; 1♀, **China**, Hubei, Yichang City, Wufeng County, Yuyangguan Town, 30.17N, 111.08E, 300 m, 24-VII-1990, coll. CR LI.

Etymology. The new species epithet is named for its brown body color, *badia* based on the Latin word “badius”.

Diagnosis. *M. badia* **sp. nov.** and *M. lata* share the characteristics of a broad and short body shape, as well as a ligulate-shaped scutellum, enabling rapid diagnosis among *Menida* species in China. The ventral conjunctival lobes of *M. badia* **sp. nov.** have a more obtuse apex compared to *M. lata*, which is elongated and sharp (Figs 3C, 3D). The body coloration of *M. lata* is black, with whitish patches, whereas the body coloration of *M. badia* **sp. nov.** spans from yellowish brown to fuscous, with yellowish patches (Figs 1A–F).

Bionomics. Adult specimens from Hubei and Chongqing Province were collected from early June to late July, 2023. These specimens were found on the plants belonging to *Indigofera* spp., Fabaceae, which are 1–2 m tall flowering shrubs. The collection sites spanned an altitude from 429 m to 1,059 m.

An updated key to *Menida* from China

1. Half distal part of scutellum widely ligulate-shaped ····· 2
-. Half distal part of scutellum not widely ligulate-shaped ····· 3
2. Body ground color black, with whitish patches; ventral conjunctival lobes of aedeagus with a narrow and sharp apex ····· *M. lata*
-. Body ground color yellowish brown or fuscous, with yellowish patches; ventral conjunctival lobes of aedeagus with a blunted apex ····· *M. badia* **sp. nov.**
3. Dorsum golden-greenish, with distinct metallic luster ····· *M. metallica*
-. Dorsum not uniformly golden-greenish ····· 4
4. Both pronotum and legs orange-reddish ····· *M. versicolor*
-. Pronotum and legs not orange-reddish ····· 5
5. Dorsum purple-bluish, with metallic luster; posterior half of pronotum paler ····· *M. violaceus*
-. Dorsum not purple-bluish ····· 6
6. Lateral margin of pronotum with long white sparse hairs ····· *M. pinicola*

-. Lateral margin of pronotum without long white sparse hairs ····· 7
7. Each side of the anterior margin at the distal end of scutellum with a large and a small golden-green or black irregular patches ····· *M. vitalisana*
-. Each side of the anterior margin at the distal end of scutellum without a large and a small golden-green or black irregular patches ····· 8
8. Process of abdominal base not reaching the mesocoxae ····· 9
-. Process of abdominal base reaching or surpassing the mesocoxae ····· 10
9. Antennae paler yellowish; abdominal venter blackish ····· *M. varipennis*
-. Antennae blackish; distal end of antennomere IV and basal third of antennomere V paler yellowish; abdominal venter paler yellowish ····· *M. disjecta*
10. Process of abdominal base reaching procoxae ····· 11
-. Process of abdominal base not reaching procoxae ····· 12
11. Dorsum with metallic luster; anterior half of pronotum purple-bluish or purple-greenish ····· *M. ornate*
-. Body color yellowish brown; middle of basal scutellum with a large black spot ····· *M. macullisutellata*
12. Body color blackish; middle of pronotum with a large yellowish spot; each side of basal portion of the scutellum with a concolor spot ····· *M. atkinsoni*
-. Middle of pronotum without a large yellowish spot ····· 13
13. Anterior half of pronotum with four or nine blackish round spots arranged horizontally ····· *M. musiva*
-. Anterior half of pronotum without any blackish round spots ····· 14
14. Antennae blackish; both end of antennomere IV and basal half of antennomere V paler yellowish ····· *Menida mosaica*
-. Antennae not blackish, or both end of antennomere IV and basal half of antennomere V not paler yellowish ····· 15
15. Dorsum with strong greenish or bluish metallic luster; membrane far beyond the abdominal end ····· *M. speciosa*
-. Dorsum dull, without any metallic luster ····· 16
16. Distal end of metafemora blackish ····· *M. formosa*
-. Distal end of metafemora not blackish; legs with densely small blackish spots ····· 17
17. Process of abdominal base reaching or surpassing anterior margin of mesocoxae ····· *M. szechuensis*
-. Process of abdominal base reaching posterior margin of mesocoxae ····· *M. wuyiensis*

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