

First record of the genus *Medaura* Stål (Phasmatodea, Phasmatidae, Clitumninae) from China, with description of a new species

YuHan Qian^{‡,§}, ChongXin Xie[§], Cui Li[§]

[‡] Key Laboratory for Forest Resources Conservation and Utilization in the Southwest Mountains of China, Ministry of Education, Southwest Forestry University, Kunming, Yunnan 650224, China

[§] Faculty of Biodiversity Conservation, Southwest Forestry University, Kunming, Yunnan 650224, China

Corresponding author: YuHan Qian (nerv6667@163.com)

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Abstract

Background

The stick insect tribe, Medaurini in subfamily Clitumninae, contains 11 genera and 75 known species, with species diversity of this tribe being rich in southeast Asia and China, as is reflected in the Phasmida Species File Online [PSF]. The genus *Medaura* includes four named species and they are distributed over Bangladesh, Indonesia and India. The discovery of this new species in Xishuangbanna Dai Autonomous Prefecture marks the first identification of the genus *Medaura* in China.

New information

The genus *Medaura* Stål is reported for the first time from China, based on a new species *M. aculeiformis* Xie & Qian sp. n. and the identification characteristics of species are described and illustrated in this paper.

Keywords

stick insect, Medaurini, new record, taxonomy, Yunnan Province

Introduction

The stick insect genus *Medaura*, proposed by Stål in 1875, includes four valid species currently, which are distributed in Bangladesh and India. The contributions to the taxonomy of *Medaura* have been made by several researchers, including Wood-Mason 1873, Stål 1875, Wood-Mason 1875, Wood-Mason 1877, Kirby 1904, Brunner von Wattenwyl 1907, Brock and Cliquennois 2001, Delfosse 2008, Hennemann and Conle 2008, Bresseel and Constant 2017, Brock et al. 2022.

Medaura can be separated from closely-allied genera by the following characteristics: male head with spines absent or a very short pair of spines or tubercles between eyes; antennae shorter than fore femora. Thorax elongate, with (few to many) tubercles and/or granulations. Legs with slight dentations on femora and/or tibiae. Abdomen elongate, segments VIII-IX widened. End of anal segment incised in centre. Female head with a pair of spines between eyes; antennae less than half the length of the fore femora. Thorax smooth and robust, slightly granulated or tuberculate. Legs with minor dentation, except for mid-legs, which usually have large thorn-like lobes on the dorsal surface of the femora and with one or two shorter thorn-like lobes on the mid-tibiae. Abdomen robust, end of anal segment incised in centre, shape variable. Operculum long, almost reaching end of anal segment. Both male and female abdomens of *Medaura* smooth to slightly granulated. Egg capsule almost oval, with capitulum and operculum with inner ring (Brock and Cliquennois 2001).

In this study, four known species of *Medaura* are reviewed, a new species collected from Mengla County, Xishuangbanna Dai Autonomous Prefecture, Yunnan Province, southwest of China is described and a list and specimen type photos of all species are provided.

Materials and methods

Three last instar nymphs, caught in the wild, were contained in ventilated boxes with some plants inside and fed until adult. Specimens were pinned after death. All materials studied were deposited in the Insect Collection of the Southwest Forestry University, Yunnan Province, China (SWFU).

Morphological observations were made with a SOPTOP SZ stereomicroscope (Sunny Group Co., Ltd., China). Digital images were obtained using a Liyang Super Resolution System LY-WN-YH (Chengdu Liyang Precision Machinery Co., Ltd., China). Whole view images of the new specimens were taken with a Canon 5ds digital camera and LAOWA 100 mm F2.8 2X macro lens (Anhui Changgeng Optics Technology Co., Ltd., China). Stacking was done using the software Zerene Stacker (Zerene Systems LLC, USA, zerenesystems.com/cms/home). Morphological terminology follows that of Bragg (1997) and Bragg (2001).

Acronyms for depositories

IZCAS - Institute of Zoology, Chinese Academy of Sciences, Beijing, China

NHMW - Naturhistorisches Museum Wien, Vienna, Austria

NZSI - National Zoological Survey of India collection, Kolcatta, India

OUMNH - Oxford University Museum of Natural History, Oxford, Britain

SWFU - Insect Collection of the Southwest Forestry University, Yunnan Province, China

Taxon treatments

Medaura Stål, 1875

Nomenclature

Medaura: Stål 1875: 69. [as a subgenus of *Stheneboea* Stål, 1875]. -Kirby 1904: 341. [designated *Stheneboea (Medaura) brunneri* as type species]. - Brunner von Wattenwyl 1893: 94. [elevated to genus]. -Brock and Cliquennois 2001: 11. [revision of genus]. -Hennemann and Conle 2008: 73. [genus transferred from Clitumnini to a new tribe, Medaurini].

Menaka: Wood-Mason 1877: 342. [genus established]. -Kirby 1904: 341. [as a synonymy of *Medaura*].

Type species

Stheneboea brunneri Stål, 1875 (= *Medaura scabriuscula*)

List of *Medaura* species and distribution

Table 1

Medaura aculeiformis Xie & Qian, sp. nov.

- ZooBank [AF6D5C8B-DFAF-4A0C-9512-E5DD67F583D5](https://doi.org/10.3896/ABRF.2021.43F76939-9023-593C-BA65-DF8B02B82D08)

Materials

Holotype:

- a. scientificName: *Medaura aculeiformis*; order: Phasmatodea; family: Phasmatidae; genus: *Medaura*; country: China; stateProvince: Yunnan; municipality: Xishuangbanna Dai Autonomous Prefecture; locality: Mengla County; year: 2021; month: 8; day: 6; sex: Female; lifeStage: adult; recordedBy: Jun Wang; institutionCode: SWFU; occurrenceID: 43F76939-9023-593C-BA65-DF8B02B82D08

Paratypes:

- a. scientificName: *Medaura aculeiformis*; order: Phasmatodea; family: Phasmatidae; genus: *Medaura*; country: China; stateProvince: Yunnan; municipality: Xishuangbanna Dai Autonomous Prefecture; locality: Mengla County; year: 2021; month: 8; day: 6; sex: 1 Female; lifeStage: 1 adult; recordedBy: Jun Wang; institutionCode: SWFU; occurrenceID: 764A17CD-C8D3-51BD-88CA-AA31DA7872A5
- b. scientificName: *Medaura aculeiformis*; order: Phasmatodea; family: Phasmatidae; genus: *Medaura*; country: China; stateProvince: Yunnan; municipality: Xishuangbanna Dai Autonomous Prefecture; locality: Mengla County; year: 2021; month: 8; day: 6; sex: 1 Female; lifeStage: 1 nymph; recordedBy: Jun Wang; institutionCode: SWFU; occurrenceID: 78098D79-CF38-5B12-9578-6570E8588A36

Description

Female. Medium-sized. Body slender. General colouration brown (Fig. 1 A-B).

Head. Squarish, longer than wide, vertex slightly concave and with two small granules between compound eyes. Compound eyes rounded, occupying 1/4 of the genae. Occiput centre slightly convex, covered with sparse and small granules (Fig. 1 C, D, H and I). Antennae filiform, 14 segments, shorter than half the length of fore femora; scapus rectangular and flattened, longer than pedicellus, almost 3x length of pedicellus; pedicellus flattened oval and longer than the third segment (Fig. 1H and I).

Thorax. Pronotum nearly rectangular, slightly longer than width, almost 1/2 length of head, with sparse small granules; transverse and longitudinal sulci crossing at middle area and distinctly. Mesonotum longer than width, anterior narrowed and gradually widened posteriorly, about 4.5x length of pronotum; with distinct median longitudinal carina and sparse small granules; a row of small granules on the lateral carina of mesonotum. Metanotum nearly rectangular, almost 2/3 length of mesonotum, median area narrow, median longitudinal carina distinct; 2-3 small granules on the lateral carina of metanotum (Fig. 1A and B). **Abdomen.** Cylindrical, with slightly granulated, median longitudinal carina distinct. Median segment rectangular, wider than length, almost 1/4 length of metanotum, obviously segmented. Tergum II-VI robust and each segment gradually becoming longer. Tergite VII gradually narrowed. Tergite VIII narrowed in median area and broadened posteriorly, about 3/4 length of tergite VII. Tergite IX about 1/2 length of tergite VIII. Tergites II-IX with distinct lateral carina on both sides of median longitudinal carina. Anal segment gradually narrowing, about 1.5x length of tergite IX, end of anal segment with a deeply V-shaped incision in centre (Fig. 1A, B, E-G and J). Sternite VII with a distinct needle-like praeopercular organ (Fig. 1B, F and G). Operculum not surpassing posterior margin of anal segment, scoop-shaped and tapering posteriorly (Fig. 1E-G). Cerci short, slightly lanceolate and hidden beneath anal segment (Fig. 1H). **Legs.** All long and moderately slender, covered with sparse and short bristles; profemora distinctly curved basally, with minor serrations in dorsal carina; mesofemora with five round-lamellar lobes; metafemora smooth. Pro- and meta-femora shorter than corresponding tibiae; mesofemora about as long as mesotibiae. Protibiae smooth; meso- and meta-tibiae with a few small serrations (Fig. 1A and B).

Measurements(mm): Table 2

Diagnosis

The new species is similar to *M. scabriuscula* and *M. jobrensis*, but can be separated by the fewer antennal segments, ornamentation between the compound eyes, serrations or lobes on legs and the incised shape at end of the anal segment. The new species with two small granules between the compound eyes; antennae 13-14 segments; mesofemora with five round-lamellar lobes and mesotibiae with few tiny serrations; anal segment longer than 9th segment and end with deep and narrowed V-shaped incision in centre (Fig. 1). In *M. scabriuscula*, two bold spines between the compound eyes; antennae 18-19 segments; mesofemora with three large dentate foliaceous lobes dorsally and three small spines on the central carina, mesotibiae with two smaller foliaceous lobes at the proximal end; anal segment longer than 9th segment and tip boldly triangular incised in centre, giving it the appearance of having two leaf-like lobes. In *M. jobrensis*, with two bold spines on raised ridge between the compound eyes; antennae 21-22 segments; mesofemora with three large dentate foliaceous lobes dorsally and three small spines on the central carina, mesotibiae with two smaller foliaceous lobes at the proximal end and other minor spines; anal segment same length as 9th segment and tip slightly and unevenly triangularly incised in centre; end of 9th segment with large twin tubercles in centre (Figs 3, 4; Brock and Cliquennois 2001).

Etymology

The name (lat. *aculeiformis* = needle-like) refers to the needle-like praeopercular organ on sternite VII of female.

Distribution

China (Yunnan).

Notes

Antennal segments of new species have 14 in adult, 13 in the last instar nymph. Three last instar nymphs fed on *Rosa chinensis* Jacq. (Rosaceae) and *Nephrolepis auriculata* (L.) Trimen (Nephrolepidaceae) in the lab, but these may not be the real host plants. One nymph died, two nymphs turned into adults and died soon afterwards without spawning. Adults bite each other, causing the posterior margin of the anal segment to be incomplete. Thus, the egg is unknown.

Type photos

Fig. 1

***Medaura austeni* (Wood-Mason, 1875)**

Nomenclature

Lonchodes austeni: Wood-Mason 1875: 216. [original description].

Promachus austeni: Kirby 1904: 326. [transferred genus].

Medaura austeni: Brunner von Wattenwyl 1907: 241. [transferred genus]. Mandal and Yadav 2010: 31. [Redescribed from literature].

Diagnosis

As the type specimen of *Medaura austeni*, deposited in NZSI, has been lost (Mukherjee and Sirinivasan 2013), we did not provide the photos here. From literature, only the male characters were described including: head and thorax with minute granules; mesonotum, metanotum and abdomen with carina and strong spines; anal segment small, fused at base, rounded; subgenital plate compressed and hood-shaped; middle and posterior femora at base below with single spine (Mandal and Yadav 2010).

***Medaura jobrensis* Brock & Cliquennois, 2001**

Nomenclature

Medaura jobrensis: Brock and Cliquennois 2001: 19. [original description] Delfosse 2008: 3 [biology]. Brock et al. 2016: 178. [type data].

Diagnosis

The type specimen of *Medaura jobrensis* was deposited in NHMW. The original literature provides a detailed description of male, female and egg (Brock and Cliquennois 2001).

Type photos

Fig. 2, Fig. 3

***Medaura makassarinus* (Westwood, 1859)**

Nomenclature

Bacillus makassarinus: Westwood 1859: 179. [original description].

Medaura makassarinus: Kirby 1904: 341. [transferred genus].

Diagnosis

The type specimen of *Medaura makassarinus* was deposited in OUMNH. As only the male was simply described in literature, we organised photos of the male from PSF, but unfortunately the photo of the abdomen dorsal view is unclear.

Type photos

Fig. 4

***Medaura scabriuscula* (Wood-Mason, 1873)**

Nomenclature

Bacillus scabriusculus: Wood-Mason 1873: 55. [original description].

Menaka scabriuscula: Wood-Mason 1877: 342. [transferred to new genus].

Medaura scabriusculus: Kirby 1904: 341. [catalogue of species]. Brock and Cliquennois, 2001: 15. [redescription, first description male and egg, synonymy]. Delfosse 2008: 3. [biology].

Synonym: *Stheneboea (Medaura) brunneri*: Stål 1875: 69. [original description]. Wood-Mason 1877: 342. [listed as a synonym of *Menaka scabriuscula*]. Kirby 1904: 341. [type species designation, listed as synonym of *Medaura scabriusculus*].

Synonym: *Medaura nimia*: Brunner von Wattenwyl 1907: 241. [original description]. Brock 1998: 46. [type data]. Brock and Cliquennois 2001: 15. [listed as synonym of *Medaura scabriuscula*].

Synonym: *Medaura subintegra*: Carl 1913: 1. [original description]. Brock and Cliquennois 2001: 15. [listed as synonym of *Medaura scabriuscula*].

Diagnosis

All type specimens of *Medaura scabriuscula* were deposited in NZSI, NMW and MHNG. However, only the female was simply described in the original literature. Subsequently, Brock and Cliquennois (2001) described the male and provided a supplementary description of the female and egg.

Type photos

Fig. 5

Discussion

The stick insect genus *Medaura* is recorded for the first time in China and now 10 genera of Medaurini are distributed in the country. The new species was collected in Mengla County of Xishuangbanna Dai Autonomous Prefecture in the south of Yunnan, its borders with the northwest of Laos and neighbouring Burma in the west belonging geographically to the transition zone of Asian mainland and the southeast Asia peninsula. The climate in Mengla is humid tropical monsoon. The other four known species of *Medaura* are also principally tropical in distribution. The distribution of *Medaura* is now further to the north since *M. aculeiformis* sp. nov. has been found.

China is one of the diversity hotspots in the world because of the highly complex topography. The biodiversity and endemism of phasmids occupy high proportions in the south-western mountainous regions, the taxa showing higher diversity in southern China, tropical regions bordering Vietnam, Thailand or Myanmar in particular (Hennemann et al. 2008). Yunnan belongs to the Oriental Region and recorded 30 genus and 137 species of stick insects at present (through the generalisation of the literature data). Xishuangbanna as the south China mountain subregion is one of the most abundant species regions in China; it has important implications for investigating stick insects in this area more thoroughly.

There are still some problems in *Medaura* that have not been well solved. Regarding the taxonomic position of *M. austeni* and *M. makassarinus*, we agree with Brock and Cliquennois's view (2001) that these two species may not belong to *Medaura*. However, we think that more collecting is needed to obtain more adult and egg specimens in order that we can better discuss the taxonomic position. This problem also applies to other genera of Medaurini; if sufficient material is available, molecular methods can be applied to help solve some problems of Chinese Phasmatodean in future studies.

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Ms. Gen-Ying Zhao who fed the stick insects in the Insect Lab of Southwest Forestry University.

Author contributions

YuHan Qian and ChongXin Xie are co-first authors of the article.

References

- Bragg PE (1997) A glossary of terms used to describe phasmids. *Phasmid Studies* 6 (1): 24-33.
- Bragg PE (2001) *Phasmids of Borneo*. Natural History Publications (Borneo), Kota Kinabalu, 772 pp.
- Bresseel J, Constant J (2017) The new stick insect genus *Medauromorpha* gen. nov. with one new species from Vietnam and notes on *Medauroides* Zompro, 2000 (Phasmida: Phasmatidae: Clitumninae). *Belgian Journal of Entomology* 45: 1-38.
- Brock PD (1998) Studies on the stick-insect genus *Eurycnema* Audinet-Serville (Phasmida; Phasmatidae) with particular reference to Australian species. *Journal of Orthoptera Research* 7: 61-70. <https://doi.org/10.2307/3503495>
- Brock PD, Cliquennois N (2001) A review of the genus *Medaura* Stal, 1875 (Phasmatidae: Phasmatinae), including the description of a new species from Bangladesh. *Phasmid Studies* 9 (1-2): 11-25.
- Brock PD, Marshall JA, Beccaloni GW, Harman AJ (2016) The types of Phasmida in the Natural History Museum, London, UK. *Zootaxa* 4179 (2): 151–208.
- Brock PD, Büscher T, Baker E (2022) Phasmida species file online. Version 5.0/5.0. [25 October 2022]. <http://Phasmida.SpeciesFile.org>
- Brunner von Wattenwyl C (1893) Revision du systeme des Orthopteres et description des especes rapportees par M. Leon Fea de Birmanie. *Annali del Museo civico di Storia naturale di Genova* 2 (13): 1-230.
- Brunner von Wattenwyl K (1907) *Die Insektenfamilie der Phasmiden II*. Verlag von Wilhelm Engelmann, Leipzig, 181-338 pp.
- Carl J (1913) Phasmides nouveaux ou peu connus du Museum de Geneve. *Annates de la Societe Zoologique Suisse et du Museum d'Histoire Naturelle de Geneve* 21 (1): 1-56.
- Delfosse E (2008) Taxinomie, biogéographie et biologie de *Medaura jobrensis* Brock & Cliquennois, 2001 et *Medaura scabriuscula* (Wood-Mason, 1873); notes à propos du genre *Medaura* Stål, 1875 (Insecta: Phasmatodea: Phasmatidae). *Le Bulletin d'Arthropoda* 35 (12): 3-17.
- Hennemann FH, Conle OV (2008) Revision of Oriental Phasmatodea: The tribe Pharnaciini Günther, 1953, including the description of the world's longest insect, and a survey of the family Phasmatidae Gray, 1835 with keys to the subfamilies and tribes (Phasmatodea: "Anareolatae": Phasmatidae). *Zootaxa* 1-316.
- Hennemann FH, Conle OV, Zhang WW (2008) Catalogue of the Stick and Leaf-insects (Phasmatodea) of China, with a faunistic analysis, review of recent ecological and biological studies and bibliography (Insecta: Orthoptera: Phasmatodea). *Zootaxa* 1735: 1-77. <https://doi.org/10.11646/zootaxa.1735.1.1>

- Kirby WF (1904) A synonymic catalogue of Orthoptera, Vol. I. Orthoptera Euplexoptera, Cursoria et Gressoria (Forficulidae, Hemimeridae, Blattidae, Mantidae, Phasmidae). Longman & Co., London 1-501.
- Mandal SK, Yadav K (2010) Some Phasmida (stick and leaf insects) of India. Records of the Zoological Survey of India Occasional Paper 318: 1-64.
- Mukherjee TK, Sirinivasan G (2013) Type specimens of phasmids in the National Zoological Survey of India collection (NZSI), Kolkata, India (Insecta: Phasmida). Phasmid Studies 18 (1&2): 24-33.
- Stål C (1875) Recensio orthopterorum. Revue critique des Orthoptères décrits par Linné, De Geer et Thunberg, 3. P. A. Norstedt & Söner, Stockholm, 105 pp.
- Westwood JO (1859) Catalogue of orthopterous insects in the collection of the British Museum. Phasmidae. British Museum. London Part 1: 196 pp.
- Wood-Mason J (1873) On new or little known species of Phasmidae. Part I, - Genus *Bacillus*. Journal of the Asiatic Society of Bengal 42 (2): 45-56.
- Wood-Mason J (1875) On new or little known species of Phasmidae, with a brief preliminary notice of the occurrence of a clasping apparatus in the males throughout the family. Journal of the Asiatic Society of Bengal 44 (2): 215-220.
- Wood-Mason J (1877) Notes on Phasmidae. Journal of the Asiatic Society of Bengal 46 (4): 342-352.

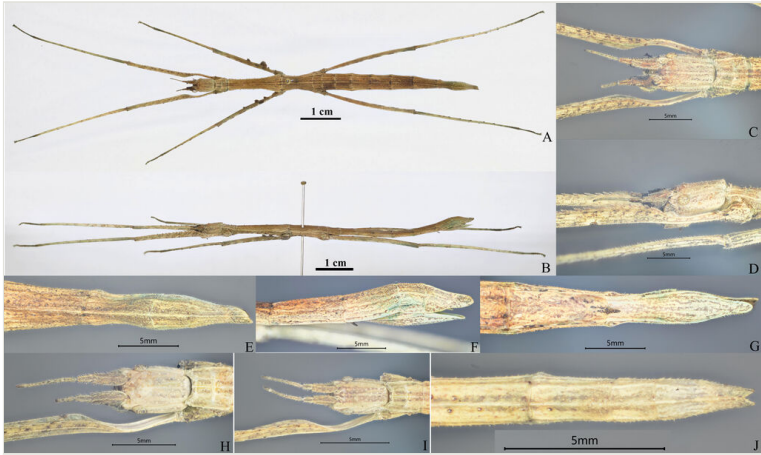


Figure 1.

Medaura aculeiformis sp. n. **A-G** Holotype, female: **A** habitus, dorsal view; **B** habitus, lateral view; **C** head, dorsal view; **D** head, lateral view; **E** terminalia, dorsal view; **F** terminalia, lateral view; **G** terminalia, ventral view; **H-J** Paratypes, females ♀; **H** head, dorsal view, adult; **I** head, dorsal view, nymph; **J** terminalia, dorsal view, nymph.

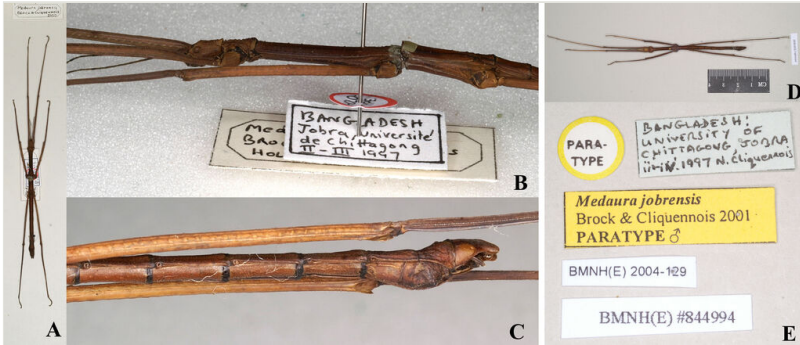


Figure 2.

Medaura jobrensis Brock & Cliquennois, 2001. **A-C** Holotype, male (from Phasmida Species File 2022, photos by Paul Brock, published under CC BC -ShareAlike 4.0 International Licence): **A** habitus, dorsal view; **B** head and thorax, lateral view; **C** end of abdomen, lateral view; **D & E** Paratype, male (from Phasmida Species File 2022, photos by Paul Brock, published under CC BC -ShareAlike 4.0 International Licence): **D** habitus, dorsal view; **E** paratype data labels.



Figure 3.

Medaura jobrensis Brock & Cliquennois, 2001. **A-D** Paratype, female (from Phasmida Species File 2022, photos by Paul Brock, published under CC BY -ShareAlike 4.0 International Licence): **A** habitus, dorsal view; **B** head and thorax, lateral view; **C** end of abdomen lateral view; **D** female, paratype data labels; **E** habitus, dorsal view (Modified from Brock and Cliquennois 2001).

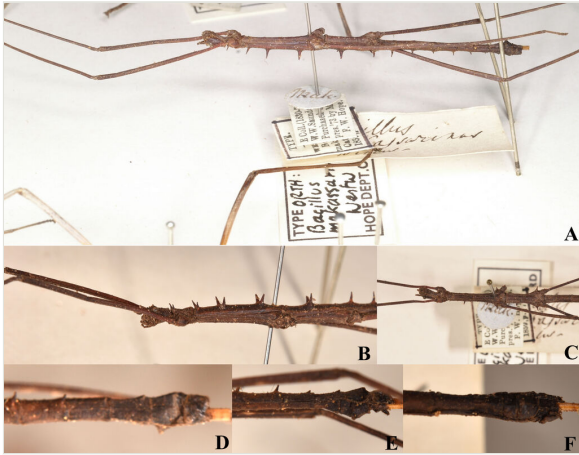


Figure 4.

Medaura makassarinus (Westwood, 1859). **A-F** Holotype, male (from Phasmida Species File 2022, photos by Paul Brock, published under CC BY - ShareAlike 4.0 International Licence): **A** habitus, lateral view; **B** head and thorax, lateral view; **C** head and thorax, ventral view; **D** end of abdomen, dorsal view; **E** end of abdomen lateral view; **F** end of abdomen, ventral view.

Table 1.

List of the genus *Medaura* of species and distribution.

Species	Female	Male	Egg	Distribution	Notes
<i>M. aculeiformis</i> Xie & Qian sp. n.	known	unknown	unknown	China	
<i>M. austeni</i> (Wood-Mason, 1875)	unknown	known	unknown	India	Loss of type specimen
<i>M. jobrensis</i> Brock & Cliquennois, 2001	known	known	known	Bangladesh	
<i>M. makassarinus</i> (Westwood, 1859)	unknown	known	unknown	Indonesia (Sulawesi)	
<i>M. scabriuscula</i> (Wood-Mason, 1873)	known	known	known	India	Type-species

Table 2.

Measurements of *Medaura aculeiformis* Xie & Qian sp. n. (mm).

Length (mm)	Holotype	Paratype	
	♀	♀	♀(nymph)
Body	69.5	57.2	41.8
Head	6.3	4.7	3.3
Antennae	6.5 (incomplete)	6.9	5.7
Pronotum	3.3	3.0	2.1
Mesonotum	13.8	12.0	8.4
Metanotum	7.9	7.2	5.5
Median segment	2.9	2.5	1.7
Profemora	22.7	18.3	13.8
Mesofemora	15.7	13.1	9.3
Metafemora	21.4	17.1	10.0
Protibiae	24.1	missing	15.0
Mesotibiae	16.0	12.9	9.1
Metatibiae	23.7	19.4	10.4