

A new species in the genus *Hedotettix* Bolivar (Orthoptera: Tetrigidae), including chromosome karyotype, from the western Yunnan Province in China

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Abstract: A new species, *Hedotettix nujiangensis* Zheng sp. nov., is described. The chromosome complement of *H. nujiangensis* consists of $2n$ (σ) = 13. Sex determination is XO. All chromosomes are telocentric (T) and the sex chromosome is the fourth element in size. Type specimens are deposited at Southwest Forestry University.

Key words: Caelifera; C-band karyotype; taxonomy

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云南省西部庭蚱属一新种及其染色体记述（直翅目：蚱科）

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摘要: 记述采自云南省西部怒江峡谷庭蚱属1新种, 即怒江庭蚱 *Hedotettix nujiangensis* Zheng sp. nov.。该种染色体数目 $2n$ (σ) = 13, 性别决定机制为 XO 型, 全部为端部着丝粒染色体, 性染色体大小位于第 4 位。模式标本保存于西南林业大学昆虫标本室。

关键词: 蝗亚目; C 带核型; 分类

Introduction

The genus *Hedotettix* was established by Bolívar in 1887 with the type species *Hedotettix gracilis* (Haan, 1842). Zheng & Zeng revised the genus in 2010, and provided a key to 17 species from China (Zheng & Zeng 2010; Deng *et al.* 2013). About 43 species in the genus *Hedotettix* have been described so far, and they are mainly distributed in Asia, Europe, Africa, Australia and North America (Shishodia 1992; Zheng & Mao 1997; Liang & Zheng 1998; Zheng 2006; Deng *et al.* 2007, 2013; Zheng & Ou 2005, 2013; Zheng & Zeng 2010). Here, we

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describe the new species, *Hedotettix nujiangensis* Zheng sp. nov., collected at the altitude of 780 m in a grassland habitat from the Nujiang Gorge in western Yunnan Province in August, 2012. Type specimens are deposited at the Southwest Forestry University. Moreover, the chromosomal karyotype of this species is also analysed in this paper.

Taxonomy

Hedotettix nujiangensis Zheng sp. nov. (Fig. 1)

Male (Fig. 1). Body small size, long and narrow. Head not exerted above the pronotum surface. The width of vertex narrower than an eye (1.0 : 1.2); the anterior margin arched, median keel distinct, and exerted at the anterior margin; the lateral margin slightly counterfolded, and forming an obvious concavity; the vertex and the frontal ridge forming a rounded protuberance from the lateral view; the frontal ridge slightly concave at median ocellus, with a width of the longitudinal sulcus of the frontal bulge equal to that of the antennal coxa. Antennae filiform, and growing under one third part of anterior margin of the compound eyes. The compound eyes oval, salient; the lateral ocelli locating in the middle of the anterior margin of the compound eyes. The back of the pronotum smooth, with small particles, and its anterior margin straight; the whole length of the median carina of the pronotum distinct, its upper margin nearly straight from the lateral view; the lateral carinae of the sulcus of the front zone backwardly contracted and not parallel; the humeral angle obtusely angular, with a pair of short longitudinal keels at both sides of the median carina of the shoulders. The hind process long, conical, obviously reaching beyond the top of the hind femur and extending to one third of the hind tibiae. The posterior margin of the lateral lobes of the pronotum with two concavities; the posterior angle downward and the apex round. The forewing long oval, the apex broadly round; the hind wings well-developed, outreaching the apex of the back protrusion of the pronotum. The fore and middle femora broad and compressed while their upper and lower margins are straight; the width of the middle femur 1.3 times that of the visible part of the forewing. The length of the hind femur 3 times its width; pre-knee teeth and knee teeth at right-angle. Hind tibiae with inner and outer apical spines, with 8 spines on each side; the length of the first segment of the hind tarsus longer than the third segment, the third pulvillus of the first tarsus larger than the first and second pulvilli, the apex of each pulvillus pointed. Subgenital plate short, conical.

Coloration. Body generally fuscous. Posterior wings black. Fore and middle femora with three black transverse stripes; tibiae with two dark transverse stripes.

Female. Unknown.

Measurements. Length of body: ♂ 8.82–9.30 mm. Length of pronotum: ♂ 10.99–11.8 mm. Length of hind femur: ♂ 6.13–6.85 mm.

Holotype. ♂, **China**, Yunnan Province, Nujiang, Shangjiang Town, Denggenghe, 780 m, 07-VIII-2012, coll. by Xiaohong OU; **Paratypes.** 5♂, same data as holotype, coll. by Qing LIU & Jian ZHAO. 2♂, Yunnan Province, Nujiang, Liuku Town, Xincun, 850–860 m, 08-VIII-2012, coll. by Huijun LI.

Etymology. This specific epithet is a noun in apposition, based on the type locality “Nujiang”.

Remarks. This new species is similar to *Hedotettix shangsiensis* Zheng & Jiang, 2003 and

H. bivalvatus Zheng & Jiang, 2002, but differs in the characters detailed in Table 1.

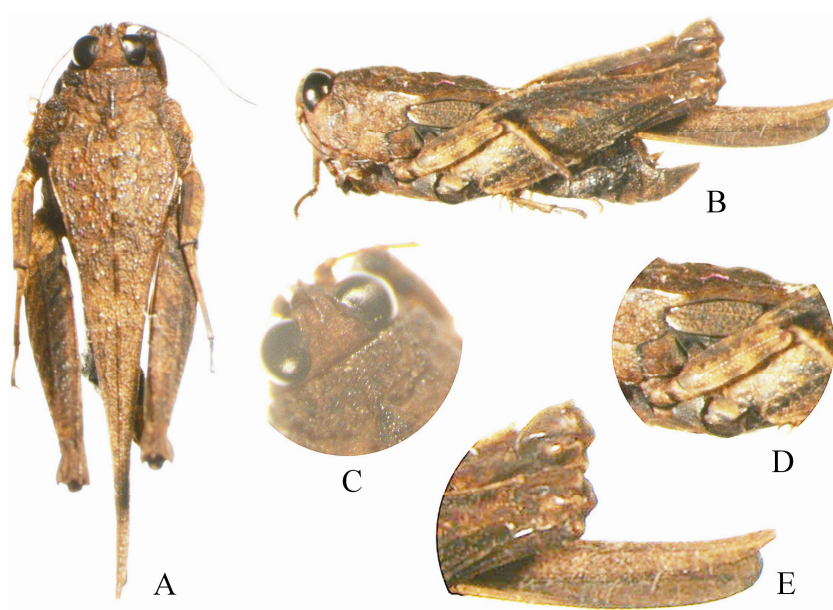


Figure 1. *Hedotettix nujiangensis* Zheng sp. nov. A. Body, dorsal view; B. Body, lateral view; C. Head, front view; D. Midfemur, lateral view; E. Hind wing, lateral view.

Table 1. Differences between *Hedotettix nujiangensis* Zheng sp. nov. and its allies

| | <i>H. shangsiensis</i> | <i>H. nujiangensis</i> Zheng sp. nov. | <i>H. bivalvatus</i> |
|-----------------------------------|---|--|---|
| Width of vertex | Equal to width of an eye | Narrower than an eye | Narrower than 1.5 times the width of an eye |
| Length of hind wings | Outreaching the apex of the back protrusion of the pronotum | Outreaching the apex of the back protrusion of the pronotum | Just reaching the apex of the back protrusion of the pronotum |
| Width of middle femur | Equal to that of the visible part of the forewing | Slightly wider than that of the visible part of the forewing | Equal to that of the visible part of the forewing |
| Apex of pulvillus of first tarsus | Obtuse | Pointed | Pointed |

Chromosome karyotype and C-band

The chromosome C-band karyotype of this pygmy grasshopper was analysed using the method BSG (Ma & Zheng 1994; Yang *et al.* 2009). Five clear and well-distributed mitotic metaphase plates were photographed. Some karyotypical characters, absolute length and C-band length of chromosomes were measured. Other parameters including relative length (RL), heterochromatic content (HC) and total of heterochromatic content (THC) were also

calculated. Chromosomes were classified according to the criteria of Levan *et al.* (1964).

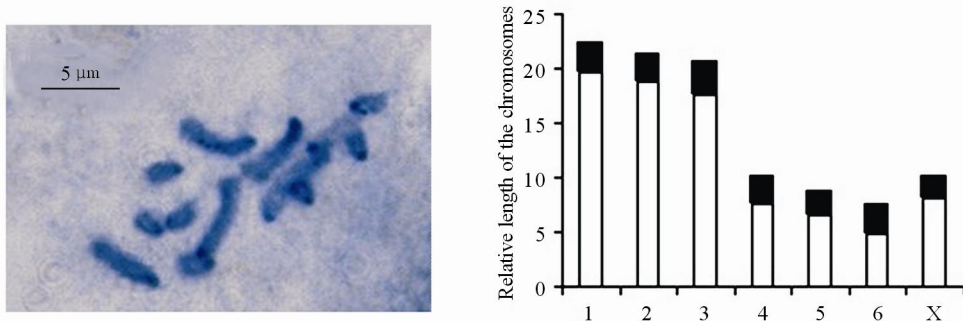


Figure 2. C-banding karyotype and ideogram of *Hedotettix nujiangensis* Zheng sp. nov.

The karyotype of this new species consists of $2n (\text{♂}) = 13$ telocentric chromosomes with a fundamental number = 13 and an XO sex determination mechanism. The karyotype formula is $2n (\text{♂}) = 3L+3M+X$. The autosomes can be divided into two size groups according to their relative lengths: 3 pairs of large chromosomes (L_{1-3}) and 3 pairs of medium chromosomes (M_{4-6}). The X-chromosome, belonging to the large group, is the fourth element in size (Figure 2, Table 2).

The C-banding pattern of this new species is simple, characterized by the presence of centromeric C-bands in all chromosome pairs. The total of heterochromatic content (THC) in *H. nujiangensis* sp. nov. is 19.77%; the highest content is 34.3% in the pair M_6 , then 24.5% in L_2 ; the heterochromatic content (HC) of the X-chromosome is 19.57% (Figure 2, Table 2).

Table 2. The chromosome data of *Hedotettix nujiangensis* Zheng sp. nov. in mitosis metaphase

| Number | Groups | Absolute length (μm) | Relative length (%) | Centromeric bands length (μm) | Heterochromatic content (%) | Chromosome type |
|--------|--------|----------------------|---------------------|-------------------------------|-----------------------------|-----------------|
| 1 | L1 | 5.20 | 22.26 | 0.60 | 11.54 | t |
| 2 | L2 | 4.95 | 21.20 | 0.55 | 11.11 | t |
| 3 | L3 | 4.81 | 20.60 | 0.70 | 14.55 | t |
| 4 | M4 | 2.32 | 9.94 | 0.53 | 22.84 | t |
| 5 | M5 | 2.00 | 8.57 | 0.49 | 24.50 | t |
| 6 | M6 | 1.72 | 7.37 | 0.59 | 34.30 | t |
| X | L | 2.35 | 10.06 | 0.46 | 19.57 | t |
| Total | | 23.35 | 100.00 | 3.92 | 16.79 | - |

There are few species among the family Tetrigidae that have undergone karyotypical work. But we can still surmise from the available data that species in this group have some common karyological features, such as the fixed chromosome number of $2n (\text{♂}) = 13$, a similar chromosome morphology (telocentric or sub-telocentric) and a high percent of heterochromatic content (THC). Further research covering a wider range of the pygmy grasshopper genera will be needed to establish patterns in the evolution of the group

chromosome C-band karyotype, and to determine whether this is of phylogenetic significance.

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References

- Deng WA, Zheng ZM & Wei SZ. 2007. *Fauna of the Tetrigoidea from Yunnan and Guangxi*. Guangxi Science & Technology Press, Nanning, 458 pp.
- Deng WA, Zheng ZM, Zhang GH & Wu ZR. 2013. A new species in the genus *Hedotettix* Bolívar (Orthoptera: Tetrigoidea: Tetrigidae) from Guizhou, China. *Entomotaxonomia*, 35(3): 165–168.
- Haan W. 1842. Bijdragen tot de kennis der Orthoptera. In: Temminck CJ (Ed.), *Verhandelingen over de natuurlijke geschiedenis der Nederlandsche overzeesche bezittingen*. Natuurkundige Commissie in Indië, Leiden, pp. 167–169.
- Levan A, Fredga K & Sandberg AA. 1964. Nomenclature for centromeric position of chromosomes. *Hereditas*, 52: 201–220.
- Liang GQ. 1998. *Hedotettix* Bolivar. In: Liang GQ & Zheng ZM (Eds.), *Fauna Sinica, Insecta Vol. 12, Orthoptera, Tetrigoidea*. Science Press, Beijing, pp. 142–145.
- Ma EB & Zheng L. 1994. The C-banding karyotype of *Tetrix japonica* (Bol.) (Orthoptera: Tetrigoidea). *Journal of Shanxi University*, 17(4): 445–448.
- Shishodia MS. 1992. Taxonomy and zoogeography of the Tetrigidae (Orthoptera: Tetrigoidea) of North Eastern India. *Records of Zoological Survey of India*, 140: 154–164.
- Yang GH, Mao BY & Xu JS. 2009. A comparative study on the karyotype and C-band of two *Tetrix* species from the Cangshan Mountain Region. *Journal of Dali University*, 68(8): 70–72.
- Zheng ZM. 2006. Four new species of Tetrigidae (Orthoptera: Tetrigoidea) from Yunnan Province. *Acta Zootaxonomica Sinica*, 28(3): 161–168.
- Zheng ZM & Mao BY. 1997. A survey of Tetrigoidea from the Hengduan Mountain Region of western Yunnan, China (Orthoptera). *Entomological Journal of East China*, 6(1): 5–11.
- Zheng ZM & Ou XH. 2005. New species of the genus *Hedotettix* Bolivar from Yunnan Province, China (Orthoptera: Tetrigidae). *Journal of Shaanxi Normal University (Natural Science Edition)*, 33(2): 80–83.
- Zheng ZM & Ou XH. 2013. Two new species of the genus *Hedotettix* Bolivar from Yunnan Province, China (Orthoptera: Tetrigoidea). *Acta Zootaxonomica Sinica*, 38(1): 1–3.
- Zheng ZM & Zeng HH. 2010. Revision of the genus *Hedotettix* Bolivar (Orthoptera: Tetrigidae) from China, with description of a new species. *Oriental Insects*, 44: 235–242.