A Review of the Genus *Alulatettix* Liang (Orthoptera: Tetrigioidea: Tettigidae)

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**Abstract**  
The taxonomy of the tettigid genus *Alulatettix* Liang is reviewed. A new species, *Alulatettix orthomarginalis* n. sp. is described. The annotated list and key to all known species of *Alulatettix* are given.

**Introduction**  
The genus *Alulatettix* (Orthoptera: Tettigidae) was erected by Liang (1993) with the type species *Alulatettix yunnanensis* Liang from China. Since Liang (1993), several new species of the genus *Alulatettix* have been described (Niu 1994, Zheng & Zhou 1996, Wang & Zheng 1997, Fu et al 1998, Zheng & Zhong 2001, Zheng 2006, 2012, Zhong & Zheng 2003, Tsai & Yang 2005, Liang & Jiang 2005, Deng et al 2006, 2009). Additionally, *Tetrix fornicatus* Ichikawa was transferred to *Alulatettix* by Zheng & Zhong (2001). Deng et al (2006) revised the genus *Alulatettix* from China, and included 11 species. To date, the genus includes 17 known species distributed in China and Japan (Ichikawa 1993, Liang & Zheng 1998, Zheng 2005, Tsai & Yang 2005, Deng et al 2007).

In this paper, the genus *Alulatettix* Liang is systematically revised and we include the clarification of the taxonomic status of the genus *Alulatettix* and determine the characters for species diagnosis. Information on biology and geographical distribution are also added, we describe *Alulatettix orthomarginalis* n. sp. and provide an updated key to the species.

**Material and Methods**  
All specimens used in this study are deposited in the Institute of Zoology, Shaanxi Normal University, Xi’an, China, Department of Chemistry and Life Science, Hechi University, Yizhou, Guangxi, China, and the Research Institute of Entomology, Zhongshan University, Guangzhou, China.

Specimens were examined and illustrated by using a stereomicroscope (Guangzhou LISS Optical Instrument Ltd. XTL-1, China) at ×20 magnification. Photographs were taken with a digital stereomicroscope (Sunny/DMSZM45) with a series of images montage using the program CombineZ5.3 (Hadley 2006). Morphological terminology and measurement landmarks followed those of Vickery & Kevan (1983). Measurements are given in millimeters.

**Taxonomy**  
*Alulatettix* Liang

*Alulatettix* Liang (1993, p. 73), Jiang & Zheng (1998, p. 342), Liang & Zheng (1998, p. 276), Zheng (2006, p. 342), Deng et al (2007, p. 306). Type species: *A. yunnanensis* Liang, 1993, China (Yunnan), by original designation.
**Description.** Body size small, with small granules. Vertex protruding beyond anterior margin of eyes, with median carina. Vertex about 1.5–2.0 times as wide as an eye. Frons oblique, frons costa slightly concave between lateral ocelli and protruding between the base of antennae in profile, longitudinal groove on frontal costa as wide as 1st antennal segment. Lateral ocelli situated middle of anterior margin of eyes. Eyes spherical. Pronotum distinctly tectiform, median carina, lateral carinae, and humeral angles of pronotum well defined; apex of hind process rounded or with triangular concavity; posterior margins of lateral lobes of pronotum with two concavities. Elytra and wings brachypterous. Fore and mid femora with nearly straight or wave-like ventral margin. First segment of hind tarsi longer than the third.

**Key to the species of Alulatettix Liang**

1. Anterior margin of pronotum straight..........................2
   – Anterior margin of pronotum protruding acute angular or obtuse angular..................................................8
2. Disk of pronotum with a pair of abbreviated carinae between shoulders .............................................3
   – Disk of pronotum without abbreviated carinae between shoulders ..........................................................4
3. With numerous large and fine tubercles on dorsum of pronotum, median carina of pronotum interrupted; in profile, upper margin of pronotum wave-like ............................................ Alulatettix interrupta Deng et al
   – Dorsum of pronotum smooth, median carina of pronotum complete, in profile, upper margin of pronotum arched.................. Alulatettix angustivertex Tsai & Yang
4. In profile, anterior part of upper margin of pronotum arched, middle part concave, posterior part arched; lower margins of fore and middle femora distinctly wave-like ........................................... Alulatettix wudangshanensis Wang & Zheng
   – In profile, anterior half of upper margin of pronotum arched, posterior half flat ........................................5
5. Width of vertex about two times that of one eye; hind wing reaching posterior margin of first segment of abdomen.......................... Alulatettix biamiangshanensis Fu & Zheng
   – Width of vertex about 1.3–1.6 times that of one eye; hind wing reaching the posterior margin of second or third segment of abdomen ..................................................6
6. Width of vertex about 1.3 times that of one eye; hind wing reaching middle of second segment of abdomen; lower margins of middle femora straight; posterior margin of subgenital plate straight ........................................ Alulatettix rectimargina Zheng
   – Width of vertex about 1.5–1.6 times that of one eye; hind wing reaching posterior margin of third segment of abdomen; lower margins of middle femora undulated ................................7
7. In profile, frontal costa concave between lateral ocelli; width of longitudinal furrow equal to that of first segment of antennae; prozona with lateral keels parallel; first segment of hind tarsi about 1.5 times longer than the third segment ........................................ A. qinglingensis Deng et al
   – In profile, frontal costa straight between lateral ocelli; width of longitudinal furrow wider than that of first segment of antennae; prozona with lateral keels constricted backwards; first segment of hind tarsi about 2.0 times longer than third segment........ Alulatettix ochrotibis Deng & Zheng
8. Anterior margin of pronotum acute-angulary protruding ............................................................................. 9
   – Anterior margin of pronotum obtuse angularly protruding ........................................................................ 10
9. Width of vertex about 1.5 times that of one eye, anterior margin of vertex straight; middle femur 1.6 times width of tegmina; first segment of hind tarsi about 1.3× longer than the third segments........................ A. quangxiensis Zheng & Zhou
10. Apex of hind pronotal process rounded ...............................11
    – Apex of hind pronotal process triangularely excised ............................ 14
11. Anterior margin of vertex rounded; in profile, upper margin of pronotum slightly arched ........................................12
    – Anterior margin of vertex straight; in profile, upper margin of pronotum distinctly spherical ..............................13
12. Disk of pronotum with a pair of abbreviated carinae between shoulders; ovipositor short, valves of ovipositor broad, upper valve 2.5 times as long as wide ................................. Alulatettix fornicata (Ichikawa)
    – Disk of pronotum without abbreviated carinae between shoulders; ovipositor narrow and long, upper valvulae four times as long as width .................. A. yunnanensis Liang
13. Apex of hind pronotal process reaching posterior end of abdomen; hind wings reaching posterior margin of third segment of abdomen .......................... Alulatettix bulbosus Zheng & Zhong
    – Apex of hind pronotal process reaching apex of supra-anal plate; hind wings reaching posterior margin of first segment of abdomen ........................................ Alulatettix leyensis Liang & Jiang
14. Ventral margins of mid femora straight ........................... 15
    – Ventral margins of mid femora undulated ................................ 16
15. In profile, upper margin of pronotum arcuate above fore leg, more straight in middle and posterior part; hind wings reaching posterior margin of second segment of abdomen; middle of posterior margin of subgenital plate of female triangularly projecting ........................................ Alulatettix zhenzi Niu
    – In profile, upper margin of pronotum arcuate; hind wings reaching the posterior margin of 1st segment of abdomen; posterior margin of subgenital plate of female with three teeth ............................ Alulatettix kunmingensis Zheng
16. Width of longitudinal furrow of frontal ridge equal to width of first segment of antennae; lower margin of hind process of pronotum straight; mid-femur two times width visible part of tegmina ................. *A. orthomarginalis* n. sp.

- Width of longitudinal furrow of frontal ridge wider than width of first segment of antennae; lower margin of hind process of pronotum curved; mid-femur three times width visible part of tegmina ...................... 17

17. In profile, frontal costa together with vertex forming an acute angle; posterior margin of subgenital plate of female straight .................. *Alulatettix wufengensis* Zheng & Zheng

- In profile, frontal costa together with vertex forming a right angle; in female, with a slender triangular projection in middle of posterior margin of subgenital plate ...................... *Alulatettix chuxiongensis* Zheng

Checklist of species of the genus *Alulatettix*

*Alulatettix angustivertex* Tsai & Yang

*Alulatettix angustivertex* (Tsai & Yang 2005, p. 53; holotype —male, China: Taiwan, Taitung; in the Department of Entomology, National Chung Hsing University, Taichung, Taiwan).

*Specimens examined.* No specimens were examined.

*Distribution.* People’s Republic of China: Taiwan.

*Alulatettix anhuiensis* Zheng

*Alulatettix anhuiensis* Zheng and Zhong 2001, p. 195 (holotype —female, China: Anhui, Gunuijiang; in the Institute of Zoology, Shaanxi Normal University).

*Specimens examined.* One ♀, Anhui, Gunuijiang, 15.viii.1984.

*Distribution.* People’s Republic of China: Anhui.

*Alulatettix bamianshanensis* Fu & Zheng

*Alulatettix bamianshanensis* (Fu et al 1998; p. 41; holotype —female, China: Hunan, Guidong; in the Institute of Zoology, Shaanxi Normal University).

*Specimens examined.* Six ♂, four ♀, Hunan, Linxiang, 4 Aug. 2010; one ♀, Hunan, Guidong, 10.viii.1996.

*Distribution.* People’s Republic of China: Hunan.

*Alulatettix bulbosus* Zheng & Zhong

*Alulatettix bulbosus* Zheng & Zhong 2001, p. 197 (holotype —male, China: Hubei, Luotian; in the Institute of Zoology, Shaanxi Normal University).

*Specimens examined.* One ♂, Hubei, Luotian, 14 June.1999; three ♂, Hubei, Luotian, 10 June.1999; two ♂, four ♀, Zhejiang, Linan, 28.vi.2012.

*Distribution.* People’s Republic of China: Hubei and Zhejiang.

*Alulatettix chuxiongensis* Zheng

*Alulatettix chuxiongensis* Zheng and Zhong 2001, p. 201 (holotype—female, China: Yunnan, Chuxiong; in the Research Institute of Entomology, Zhongshan University; Zheng 2005, p. 345; Deng et al 2007, p. 310).

*Specimens examined.* Five ♂, four ♀, Yunnan, Zhenxiong, 15 Aug. 2008; one ♀, Yunnan, Chuxiong, 21 July 1997; one ♀, Yunnan, Chuxiong, 1.viii.1975.

*Distribution.* People’s Republic of China: Yunnan.

*Alulatettix fornicata* (Ichikawa)

*Tetrix fornicatus* (Ichikawa 1993, p. 2; holotype—female, Japan: Hatsutani Mts; in OMNH Osaka); *A. fornicata* (Ichikawa, 1993; Zheng and Zhong 2001, p.197).

*Specimens examined.* No specimens were examined.

*Data is recovered only from the literature.*

*Distribution.* Japan: Osaka prefecture, Mie prefecture, Kyoto prefecture, Hyogo prefecture, Okayama prefecture.

*Alulatettix guangxiensis* Zheng & Zhou

*Alulatettix guangxiensis* Zheng & Zhou 1996, p. 87 (holotype —male, China: Guangxi, xingan; in the Institute of Zoology, Shaanxi Normal University); Jiang and Zheng 1998, p. 34; Zheng 2005, p. 342; Deng et al 2007, p. 308.

*Specimens examined.* One ♂, one ♀, Guangxi, xingan, 4.vi.1994.

*Distribution.* People’s Republic of China: Guangxi.

*Alulatettix interrupta* Deng et al

*Alulatettix interrupta* (Deng et al 2006, p. 115; holotype —female, China: Guangxi, Beihai; in the Institute of Zoology, Shaanxi Normal University; Deng et al 2007, p. 307).

*Specimens examined.* One ♀, Guangxi, Beihai, 8.viii . 2005.

*Distribution.* People’s Republic of China: Guangxi.

*Alulatettix kunmingensis* Zheng

*Alulatettix kunmingensis* (Zheng 2006, p. 365; holotype —female, China: Yunnan, Kunming; in the Institute of Zoology, Shaanxi Normal University; Deng et al 2007, p. 311).

*Specimens examined.* Two ♂, four ♀, Yunnan, Luliang, 7 Aug. 2006; two ♂, two ♀, Yunnan, Kunming, 5.vii.2004.

*Distribution.* People’s Republic of China: Yunnan.

*Alulatettix leyensis* Liang & Jiang

*Alulatettix leyensis* (Liang & Jiang 2005, p. 56; holotype —female, China: Guangxi, Leye; in the Research Institute of Entomology, Zhongshan University).

*Specimens examined.* No specimens were examined.

*Data is recovered only from the literature.*

*Distribution.* People’s Republic of China: Guangxi.

*Alulatettix ochrotibis* Deng & Zheng

*Alulatettix ochrotibis* (Deng et al 2009, p. 259; holotype —male, China: Yunnan, Qiubei; in the Institute of Zoology, Shaanxi Normal University).
**Specimens examined.** Two ♂, four ♀, Yunnan, Qiubei, 5. viii. 2006.

**Distribution.** People’s Republic of China: Yunnan.

**Alulatettix orthomarginalis** n. sp. (Figs 1–3, 4–11, 12)

**Description**

**Female.** (Fig 1) Size small. Head not projecting above upper level of pronotum (Fig 4). Anterior margin of vertex curved (Fig 2), slightly protruding beyond eyes, median carina conspicuous, the vertex between eyes 1.6 and 1.7 times wider than width of one eye from above. Vertex and frontal ridge curved in profile, frontal ridge concave between lateral ocelli (Fig 3), frontal ridge protruding archly between antennae, width of longitudinal furrow equal to width of first segment of antennae (Fig 5). Antennae filiform (Fig 6), 15 segmented, situated between lower margin of eyes (Figs 3–6), the eighth segment about five times as long as wide. Eyes globular. Lateral ocelli placed between middle of anterior margins of eyes (Figs 2 and 3). Pronotum in dorsal view tectiform, anterior margin obtuse angular (Fig 2), dorsal margin arched in profile (Figs 1 and 3). Posterior process of pronotum short, just reaching two thirds of hind femora, apex of process triangularly incised in middle (Fig 2). Lower margin of hind process straight (Figs 1 and 3), lateral carinae in metazona straight. Lateral carinae in prozona inconspicuous, parallel; humeral angle obtuse. Posterior margin of lateral lobes in lateral view with two concavities (Fig 3), the first extremely shallow; posterior angles of lateral lobes of pronotum turned downwards, with rounded apex. Tegmina smaller, brachypterous (Fig 8), elliptic, visible part of tegmen 3.5 times as long as wide. Hind wings strongly reduced as strips (Fig 8), just reaching the posterior margin of 1st segment of abdomen, in lateral view slightly exposed by the pronotum. Ventral margins of fore and mid femora slightly undulating (Fig 7); mid femur 2.0 times wider than visible part of tegmen. Hind femora stout, 3.0 times as long as wide; dorsal and ventral side of femora gentle dentate; pregenicular spine

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**Figs 1–3** *Alulatettix orthomarginalis* n. sp. female. 1 Lateral view of body; 2 head and pronotum, dorsal view; 3 head and pronotum, lateral view (*scale bar* 1 mm)

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**Figs 4–11** *Alulatettix orthomarginalis* n. sp. 4 Head, lateral view; 5 head, frontal view; 6 antennae; 7 middle femur, lateral view; 8 elytra and wings, lateral view; 9 ovipositor of female, lateral view; 10 subgenital plate of female, ventral view; 11 subgenital plate of male, lateral view (*scale bar* 1 mm)
Alulatettix orthomarginalis is similar to A. wufengensis and A. chuxiongensis from which it differs in the vertex and frontal ridge curved in profile, the width of longitudinal furrow of frontal ridge equal to width of the first segment of antennae, the lower margin of hind process straight, the middle femur 2.0 times wider than the visible part of tegmen and in the triangularly projecting posterior margin of female subgenital plate.

**Etymology.** The species name is derived from the Latin ortho and marginis, meaning lower margin of hind process straight.

**Distribution.** People’s Republic of China, Guizhou.

Alulatettix qinlingensis Deng et al

Alulatettix qinlingensis Deng et al 2006, p. 114 (holotype — male, China: Shaanxi, Xian; in the Institute of Zoology, Shaanxi Normal University).

**Specimens examined.** Four ♂, four ♀, Shaanxi, Xian, 4.vi. 2005.

Distribution. People’s Republic of China: Shaanxi.

Alulatettix rectimargina Zheng

Alulatettix rectimargina (Zheng 2012, p. 8; holotype — female, China: Yunnan, Ruili; in the Institute of Zoology, Shaanxi Normal University).

**Specimens examined.** One ♀, Yunnan, Ruili, 7.viii.2005.

**Distribution.** People’s Republic of China: Yunnan.

Alulatettix wudangshanensis Wang & Zheng

Alulatettix wudangshanensis (Wang & Zheng 1997, p. 57; holotype — male, China: Hubei, Danjiangkou; in the Institute of Zoology, Shaanxi Normal University; Liang & Zheng 1998, p. 177).

**Specimens examined.** Nine ♂ eight ♀, Hubei, Danjiangkou, 13 July 1990; One ♀, Hubei, Shennongjia, 21.vii.1990.

**Distribution.** People’s Republic of China: Hubei.

Alulatettix wufengensis Zhong & Zheng

Alulatettix wufengensis Zhong & Zheng 2003, p. 167 (holotype — female, China: Wufeng; in the Research Institute of Entomology, Zhongshan University).

**Specimens examined.** One ♀, Hubei, Wufeng, 15.viii.2000.

**Distribution.** People’s Republic of China: Hubei.

Alulatettix yunnanensis Liang

Alulatettix yunnanensis (Liang 1993; p. 73; holotype — male, China: Yunnan, Kunming; in the Research Institute of Zoology, Zhongshan University; Liang and Zheng 1998, p. 178; Zheng 2005, p. 344; Deng et al 2007, p. 309).

**Specimens examined.** Two ♂, three ♀, Yunnan, Kunming, 4 Aug. 2005; one ♂, three ♀, Yunnan, Dali, 6.vii.1995.

**Distribution.** People’s Republic of China: Yunnan.

Alulatettix zhengi Niu

Alulatettix zhengi (Niu 1994; p. 35; holotype — male, China: Henan, Xixia; in the Institute of Zoology, Shaanxi Normal University; Liang and Zheng 1998, p. 179).

**Specimens examined.** One ♂, Henan, Xixia, 6 Jue. 1987; one ♀, Henan, Lushan, 28.iii.1992; one ♀, Henan, Xixia, 30.vi.1986

**Distribution.** People’s Republic of China: Henan.
Discussion

The original description of the genus was exclusively based on characters from external morphology. The morphology of *Alulatettix* is quite homogeneous and species can be differentiated mostly by the brachypterous elytra and wings. Recent molecular studies based on *A. qiningensis* cytochrome oxidase I (Fang et al. 2010) demonstrated *Alulatettix* to be closely related to the genus *Tetrix* Latreille. *Alulatettix* and *Tetrix* belong to the subfamily Tettiginae, and both of these genera are similar in the head not projecting above upper level of pronotum and the posterior margin of lateral lobes in lateral view with two concavities, but they differ in the shape of pronotum and degree of development of tegmina and hind wings. Tettiginae are one of the most basal members of Tettigoidea, but the phylogenetic studies focusing on the relationships within Tettiginae are limited. Therefore, phylogenetic relationships between *Alulatettix* and other Tettiginae genera are not well understood.

Species of the genus *Alulatettix* are usually associated with, but not limited to, shady environments, living under fallen leaves or grasses in tropical rainforests. Some (Mao et al. 2011) have suggested that the brachypterous hind wings are not adapted for flying. The diet is consisted mainly of algae growing on moist ground, along with lichens and some forms of humus. Species of *Alulatettix* generally overwinter as adults. Almost all species of *Alulatettix* are distributed in the Oriental region, except one species known from the east part of the Palearctic region (Japan: Honshu Island; Zheng 2012).

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