

***Thitarodes* Viette, 1968: a new generic synonym and a new species from China (Lepidoptera: Hepialidae)**

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Abstract

Parahepialus Zou & Zhang, 2010 is synonymized with *Thitarodes* Viette, 1968. *Thitarodes quadrata* Jiang, Li, Li, Li & Han, sp. n. is described from Sichuan, China. Illustrations of the adults and the genitalia are given for the type species of *Parahepialus* and the new species.

KEY WORDS: Lepidoptera, Hepialidae, *Thitarodes*, new generic synonym, new species, China.

***Thitarodes* Viette, 1968: una nueva sinonimia genérica y una nueva especie de China
(Lepidoptera: Hepialidae)**

Resumen

Parahepialus Zou & Zhang, 2010 es sinonimizado con *Thitarodes* Viette, 1968. Se describe *Thitarodes quadrata* Jiang, Li, Li, Li & Han, sp. n. de Sichuan, China. Se dan ilustraciones del adulto y de la genitalia para la especie tipo de *Parahepialus* y de la nueva especie.

PALABRAS CLAVE: Lepidoptera, Hepialidae, *Thitarodes*, nueva sinonimia genérica, nueva especie, China.

Introduction

The genus *Thitarodes* was established by VIETTE (1968) on the basis of *Hepialus armoricanus* Oberthür, 1909 from Tibet, China. The main diagnostic character of the genus was the presence of an acute process protruding from the basal part of the valva of the male genitalia (VIETTE, 1968). NIELSEN *et al.* (2000) gave a world checklist of Hepialidae. In their paper, 51 species are listed in *Thitarodes*, most of them being mainly distributed in Eastern Asia. Besides, *Forkalus* Chu & Wang, 1985 was treated as a junior synonym of *Thitarodes* Viette, 1968, and most species which were described under the genus *Hepialus* Fabricius, 1775 were transferred to *Thitarodes*. CHU & WANG (1985, 2004) reviewed the Hepialidae from China, and did not adopt the genus *Thitarodes* in their system, because they considered that the generic character proposed by Viette should be treated as a character to distinguish between species. Further species were described by UEDA (2000), MACZEY *et al.* (2010), and ZOU *et al.* (2011). ZOU *et al.* (2010) revised the taxonomic system of *Hepialus* currently adopted in China. In their paper, two new genera (*Parahepialus* Zou & Zhang, 2010 and *Ahamus* Zou & Zhang, 2010) are described, and the original *Hepialus* described by Chinese scientists were rearranged into four genera, *Parahepialus*, *Ahamus*, *Hepialus* and *Thitarodes*.

However, there are still some doubts about the new genera established by ZOU *et al.* (2010). The genus *Parahepialus* was erected on the basis of the strange description of the male genitalia of *Hepialus nebulosus* Alphéraky, 1889 in CHU & WANG (2004). The slide used in CHU & WANG

(2004) needs to be reexamined. The validity of the genus *Ahamus* is also uncertain. ZOU *et al.* (2010) erected the genus on the basis of the absence of an acute process protruding from the base of the valva, which was supported by the phylogenetic tree constructed by the CytB gene of some original *Hepialus* species downloaded from Genbank. However, it is not established that the valva of the male genitalia could be treated as a genetic character, and the molecular data of only one gene from Genbank is insufficient. The taxonomy of *Thitarodes* needs to be revised in future.

In this paper, we follow the system of *Thitarodes* provided by NIELSEN *et al.* (2000), propose a new generic synonym of *Thitarodes*, and describe one new species, *T. quadrata* Jiang, Li, Li, Li & Han, sp. n.

Materials and methods

Specimens of *Thitarodes* used come mainly from the Institute of Zoology, Chinese Academy of Sciences, Beijing, China (IZCAS). External and genitalic terminologies follow CHU & WANG (1985; 2004) and UEDA (1996). Photographs of the moths were taken with digital cameras. Composite images were generated using Auto-Montage software version 5.03.0061 (Synoptics Ltd). The plates were compiled using Adobe Photoshop software.

Taxonomy

Thitarodes Viette, 1968

Thitarodes Viette, 1968, *Ergeb. ForschUnternehmens Nepal Himalaya*, **3**: 128. Type species: *Hepialus armoricanus* Oberthür, 1909, *Étud. Lépid. comp.*, **3**: 411, pl. 25, fig. 135, by original designation.

Forkalus Chu & Wang, 1985, *Sinozoologia*, **3**: 130. Type species: *Forkalus xizangensis* Chu & Wang, 1985, *Sinozoologia*, **3**: 130, by original designation.

Parahepialus Zou & Zhang, 2010, in Zou *et al.*, *J. Hun. Univ. Sci. Tech.*, **25**(1): 115. Type species: *Hepialus nebulosus* Alphéraky, 1889, in Romanoff, *Mém. Lépid.*, **5**: 85, **syn. n.**

The genus *Parahepialus* was established by ZOU *et al.* (2011) based on the description and figure 118 of *Hepialus nebulosus* in CHU & WANG (2004) (Figs 1, 4). However, we found the figure of the male genitalia was weird. So, we examined the original slide of the specimen (Fig. 4) which was used in CHU & WANG (2004). We found that the male genitalia were broken during preparation, and the uncus, tegumen and valva were wrongly assembled. Here, we recombine the male genitalia of the specimen (Fig. 5). It is obvious that *Parahepialus* and *Thitarodes* share a common wing pattern and male genitalia. Thus, we consider *Parahepialus* as a junior synonym of *Thitarodes*. Besides, we believe that *Hepialus nebulosus* in CHU & WANG (2004) may be a misidentification. However, we did not have the chance to examine the type specimens of *T. nebulosus*. More study is needed in future.

Thitarodes quadrata Jiang, Li, Li, Li & Han, sp. n. (Figs. 2, 3, 6-14)

Material examined: Holotype ♂, CHINA: Sichuan (IZCAS): Xiaojin, 10-VI-2015, coll. Li Quanping. Paratypes: Sichuan (IZCAS): 2 ♂♂, 2 ♀♀, same data as holotype.

Description: Male (Fig. 2). Antennae dark brown, filiform, acute terminally. Frons and labial palpi black covered with yellowish brown. Vertex yellowish brown. Thorax yellowish brown mixed with black hairs dorsally, yellowish brown posteriorly and laterally, pale yellowish brown ventrally. Legs without spurs; Foreleg with tibial epiphysis; hind tibia broad with dense scent-brushes dorsally. Forewing length: 13-14 mm. Forewing brown; costa with small greyish white spots; basal greyish white band extending along A, forming a right angle medially, then extending to middle part of cell; transverse lines present as series of dark brown dots edged with black, medial line forming a black patch between Cu_A₂ and A; a greyish white small patch present at apical part of cell; dots of submarginal line fused with each other; area between submarginal line and terminal line greyish white;

a greyish white vaulted band present inside anal angle; fringes yellowish brown suffused with black at veins. Hind wing dark grey; fringes yellowish brown chequered with dark grey at veins. Vein (Figs 13, 14). Forewing with Sc unbranched; R_2 and R_3 stalked, length of stalk about 2/3 length from base of R_{2+3} to margin; cross vein R_5-M_1 weak, reaching R_5 distad from furcation of R_4 and R_5 ; one cross vein between Cup and CuA_2 ; two cross veins between A and CuP. Hind wing similar to forewing but CuP longer, reaching margin. Abdomen dark grey suffused with yellowish brown scales dorsally, yellowish brown ventrally. Female (Fig. 3). Forewing length: 16-17 mm. Essentially as described for male, except colour pale grey, markings on forewing wing less distinct.

Male genitalia (Figs 8-12): Uncus short and acute, strongly sclerotized. Tegumen with terminal margin of rounded, inner margin strongly sclerotized, with a large slight curved spine medially and a short spine anteriorly. Dorso-posterior process not developed. Valve densely hairy and simple. Saccus broad, rounded terminally. A quadrate lobe protruding from base of vinculum with a broad and rounded incision terminally. Juxta almost trapezoidal. Aedeagus not sclerotized.

Female genitalia (Figs 6, 7): Ninth abdominal tergum with an acute incision, papillae anales rounded, densely covered with hairs; median part of ninth abdominal sternum forming an oval well sclerotized and setose area; ductus bursae membranous, about one third length of corpus bursae; corpus bursae heart-shaped without signum.

Diagnosis: This species is similar to *Thitarodes yulongensis* (Liang, 1988), but can be separated by the following characters: the terminal margin of the tegument is rounded, while in *T. yulongensis*, it is quadrate; the base of the vinculum has a quadrate lobe with a rounded incision apically, but *T. yulongensis* does not have this character.

Distribution: China (Sichuan).

Etymology: The species name is based on the Latin word *quadratus*, which means quadrate, referring to the lobe at the base of the vinculum.

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BIBLIOGRAPHY

- ALPHÉRAKY, S. N., 1889.– Lépidoptères rapportés du Thibet par le Général N. M. Przewalsky de son voyage de 1884-1885.– In N. M. ROMANOFF. *Mémoires sur les Lépidoptères*, 5: 59-89.
- CHU, H. F. & WANG, L. Y., 1985.– Insect-Herb' versus Hepialids with descriptions of new genera and new species of Chinese Hepialidae.– *Sinozoologia*, 3: 121-134.
- CHU, H. F., WANG, L. Y. & HAN, H. X., 2004.– *Fauna Sinica. Insecta Lepidoptera, Hepialidae, Epiplemlidae*, 38: 291 pp. Science Press, Beijing.
- LIANG, X. C., YANG, D. R., CHEN, F. R., LONG, Y. C. & YANG, Y. X., 1988.– Four new species of the genus *Hepialus* (Ghost moth) from Yunnan, China.– *Zoological Research*, 9(4): 419-425.
- MACZEY, N., DHENDUP, K., CANNON, P., HYWEL-JONES, N. & RAI, T. B., 2010.– *Thitarodes namnai* sp. nov. and *T. Caligophilus* sp. nov. (Lepidoptera: Hepialidae), hosts of the economically important entomopathogenic fungus *Ophiocordyceps sinensis* in Bhutan.– *Zootaxa*, 2412: 42-52.
- NIELSEN, E. S., ROBINSON, G. S. & WAGNER, D. L., 2000.– Ghost-moths of the world: a global inventory and bibliography of the Exoporia (Mnesarchaeoidea and Hepialoidea) (Lepidoptera).– *Journal of Natural History*, 34: 823-878.
- OBERTHÜR, C., 1909.– Explication des planches.– *Études de Lépidoptérologie Comparée*, 3: 415 pp. Oberthür imprimer, Rennes.
- UEDA, K., 1996.– A new species of *Thitarodes* Viette (Lepidoptera, Hepialidae) from Japan.– *Bulletin of the Kitakyushu Museum of the Natural History*, 15: 35-41.

- UEDA, K., 2000.– Hepialidae.– In T. HARUTA (Ed.). Moths of Nepal. Part 6.– *Tinea*, **16**(Supplement1): 70-93.
- VIETTE, P. E. L., 1968.– Contribution à l'études des Hepialidae (36ème note): Lepidoptera Hepialidae du Népal.– *Khumbu Himal*, **3**: 128-133.
- ZOU, Z. W., LIU, X. & ZHANG, G. R., 2010.– Revision of taxonomic system of the genus *Hepialus* (Lepidoptera, Hepialidae) currently adopted in China.– *Journal of Hunan University of Science and Technology*, **25**(1):114-120.
- ZOU Z. W., LIU, X. & ZHANG, G. R., 2011.– Two new species of *Thitarodes* (Lepidoptera: Hepialidae) from Tibet in China.– *The Pan-Pacific Entomologist*, **87**(2): 106-113.

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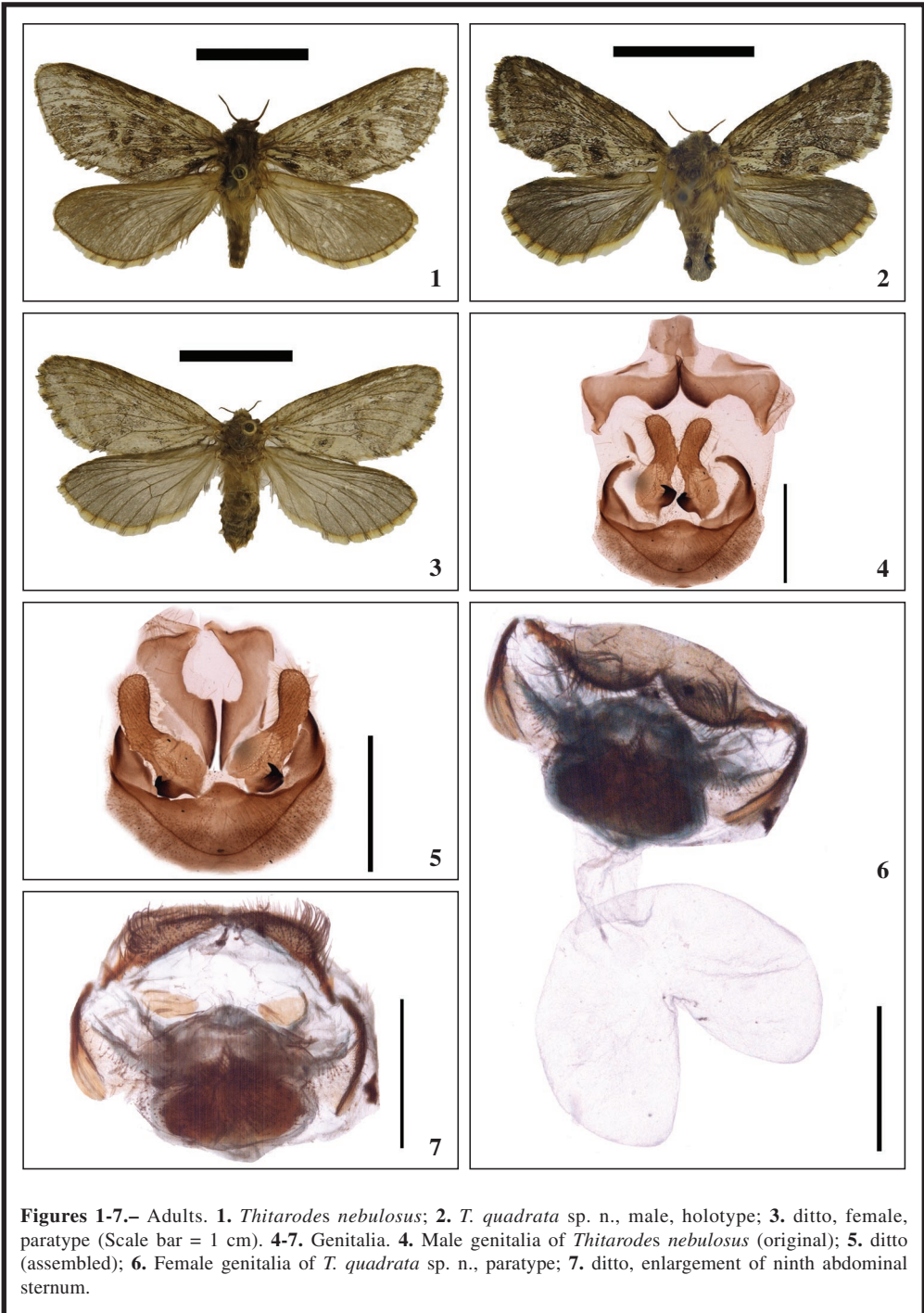
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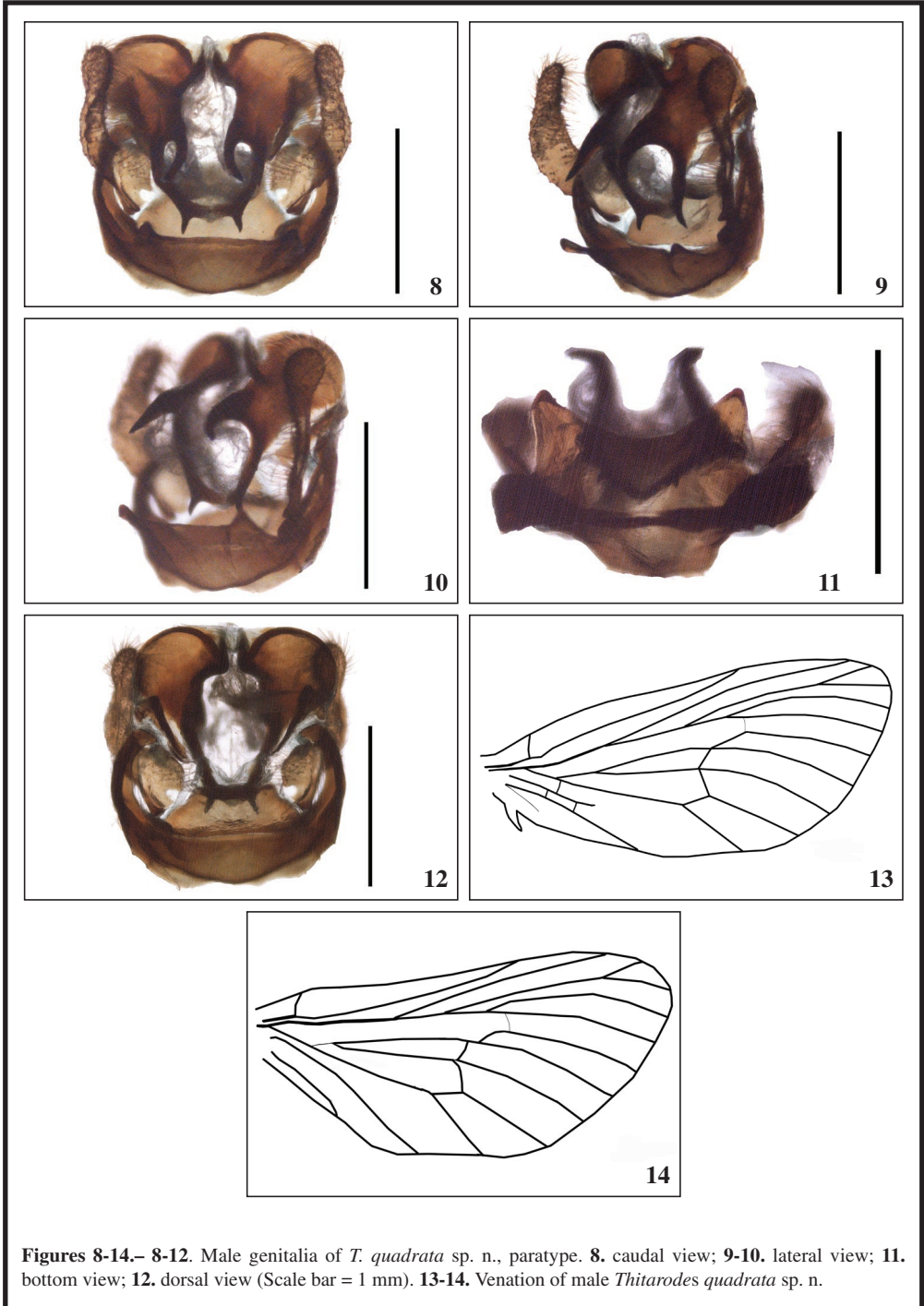
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Figures 8-14.– 8-12. Male genitalia of *T. quadrata* sp. n., paratype. **8.** caudal view; **9-10.** lateral view; **11.** bottom view; **12.** dorsal view (Scale bar = 1 mm). **13-14.** Venation of male *Thitarodes quadrata* sp. n.