Notes on the genus Napialus Chu & Wang (Lepidoptera: Hepialidae), with description of a new species from China

WEICHUN LI1 & HONGYI WEI2
College of Agronomy, Jiangxi Agricultural University, Nanchang 330045, China.
E-mail: 1 weichunlee@126.com; 2 hywei@jxau.edu.cn

Abstract

Napialus spinosus Li & Wei, sp. nov. is described as new based on a male specimen collected in Jiangxi Province of China. Image of the adult, illustrations of the antenna, venation, and eighth abdominal segment as well as male genitalia are presented. A species checklist and key to the species of Napialus are provided and the known distribution of each species is mapped with respect to temperature gradients.

Key words: taxonomy, morphology, Oriental Region

Introduction

The Hepialid moths of China, comprising nine genera, occur in southern and western China, except for Phassus sinensis Moore, P. excrescens (Butler) and Hepialus macilentus Eversmann whose distribution extends to northeastern China (Chu 1984; Chu & Wang 1985a, 1985b; Chu et al. 2004; Grehan 2011). The genus Napialus Chu & Wang, 1985, type species Napialus hunanensis Chu & Wang, 1985, can be recognized by the flagellum of antennae devoid of scales, posteriorly dark, the R\textsubscript{2}+R\textsubscript{3} forked and pointed farther than one fifth length of wing from termen, and the well-developed pseudotegumen posteriorly with a pair of strongly sclerotized pseudoteguminal processes in the male genitalia. The genus comprising four described species and is endemic to China (Chu & Wang 1985a; Wu 1992; Chu, Wang & Han 2004). The present paper adds a fifth species, Napialus spinosus Li & Wei, sp. nov. to the genus. A checklist and a key to all the known species are presented, along with a map showing the distribution of these species.

Material and methods

This study is based on the examination of thirteen specimens collected in Tongbo Hill in the northeastern Jiangxi Province of China at an overnight mercury-vapour light between 27th April and 4th May of 2012, according to the methods introduced by Landry and Landry (1994). Most of these specimens were N. chenzhouensis. However, upon close examination, one specimen proved to represent a distinct species, described as new below.

Terms for morphological structures follow Grehan (2012) and Mielke & Casagrande (2013). Genitalia was prepared and mounted following Li (2002). The map was made using DIVA-GIS (Hijmans et al. 2005a) based on temperature gradients of mean minimum temperature of the coldest month (January) in China of the year (Hijmans et al. 2004, 2005b). The type specimen is deposited in the Insect Museum, Jiangxi Agricultural University, Nanchang, China (JXAUM).
**Napialus Chu & Wang, 1985**


**Generic characters.** Labial palpus with three segments. Haustellum absent. Antenna (Fig. 1) with scape and pedicel larger than flagellar articles; flagellar articles longer than wide, dark posteriorly, and suffused with setae near anterior tip. Wings (Fig. 2) with humeral vein present in both wings; Sc reaching distal two-fifths to one-third of costal margin; R₁ and R₂ apical; R₃ with R₁ stalked, forked distant one-fifth to one-third length of wing from termen; R₁+R₂ and R₃ stalked, then stalked with R₅; cross-veins on forewing R–M₁, M₁–M₂, M₂–M₃ present, and cross-veins on hindwing M–Cu and CuA₁–CuA₂ present. Legs (Figs. 3–7) without epiphysis; femurs of foreleg and metaleg more or less longer than tibiae, femur of mesoleg conspicuously longer than tibia; tarsi five-segmented, first segment much longer than second segment, median three segments with nearly equal length, and fifth segment distinctively longer than fourth segment; tarsal claws with an arolium. Male genitalia with two well-developed tergal lobes, pseudotegumen developed strongly and posteriorly with a pair of strongly sclerotized pseudotegumnal processes.

**Distribution.** South of 30°N in China (Fig. 13).

---

**FIGURES 1–7.** *Napialus chenzhouensis* Chu & Wang: 1, Antenna dorsal view; 2, Wings: 2a, venation of forewing; 2b, venation of hindwing; 3–7, Legs: 3, foreleg; 4, mesoleg; 5, metaleg; 6, distitarsus of metathoracal leg dorsal view; 7, distitarsus of metathoracal leg ventral view.

**Key to species of *Napialus* based on male genitalia**

1. CuP of hindwing reaching termen. ................................................................. 2
   - CuP of hindwing not reaching termen ...................................................... 3
2. Anterior tip of pseudotegumen bearing tooth processes (Fig. 12) .................. *N. spinosus* Li & Wei, **sp. nov.**
   - Anterior tip of pseudotegumen lacking tooth process (Wu 1992: Fig. 3) ...... *N. chongqingensis* Wu
3. Anterior part of pseudotegumen dentate on outer side (Chu, Wang & Han 2004: Fig. 135) ................................................................. *N. jiangxienensis* Chu & Wang
   - Anterior part of pseudotegumen concave as C-shaped on outer side ................ 4
Napialus spinosus Li & Wei, sp. nov.

Type material. Holotype: ♂, China, Jiangxi Province, Shangrao City, Guangfeng County, Tongboshan Town, Tongbo Hill, Dadongkeng forestry center (28°03′N, 118°12′E), 28.iv.2012, leg. Weichun Li, prep. gen. LW13059. Deposited in the Insect Museum, Jiangxi Agricultural University, Nanchang, China.

FIGURES 8–12. Napialus spinosus Li & Wei, sp. nov.: 8, Antenna dorsal view, holotype, male; 9, Adult, holotype, male; 10, Wings, holotype, male: 10a, venation of forewing; 10b, venation of hindwing; 11, Segment VIII of abdomen, holotype, male: 11a, tergum; 11b, sternum; 12, Male genitalia ventral view, holotype, prep. gen. LW13059.
Diagnosis. This species is similar to *Napialus chongqingensis* Wu in having the CuP of hindwing reaching the termen, and the finger-shaped process on inner side of pseudotegumen absent in the male genitalia. It can be distinguished from the latter by the seventh flagellum of antenna with a spine on the ventral surface, and the pseudotegumen bearing 11 well-developed tooth processes (Figs. 8, 12). In *N. chongqingensis*, the antenna without spine, and the pseudoteguminal tooth processes are inconspicuous (Wu 1992: Figs. 3–4).

Description. Head: Frons and vertex densely covered with yellowish brown hairs. Labial palpus three-segmented, yellowish brown, covered with dense yellowish brown hairs on ventral side; third segment about twice as long as second segment, distal half tapering to pointed tip. Antenna (Fig. 8) with 18 articles, scape and pedicel pale brown, scape slightly broader than pedicel; flagellum with first 11 articles pale brown posteriorly and pale yellow anteriorly, remaining articles blackish brown excluding yellowish brown distal tip, 7th article ventrally with spine near anterior tip. Patagium and tegula ochreous yellow. Thorax (Fig. 9): Prothorax and mesothorax covered with dense ochreous hairs, metathorax covered with dense yellowish brown hairs. Forewing (Fig. 9): Length 18.0 mm. Region between costa and R yellowish brown on basal three fifths, distal two fifths grayish brown. Basal region yellowish brown. Central dark brown region between region of M and anal margin with elongate discal dash. Medial band yellowish brown edged with dark brown, distributed between R and anal margin, outcurve between M₁ and CuA₁, followed by continuous yellowish brown transverse band between R₅ and M₂. Submarginal band yellowish brown edged with dark brown, distributed between R₅ + R₆ and M₃, connected with transverse band on inner side; outside of submarginal band with Y-shaped yellowish brown band between R₅ and M₆. Submarginal band with Y-shaped yellowish brown band between R₅ and R₆, edged with dark brown. Apex with yellowish brown dot between R₃ and R₄. Marginal region grayish brown. Hindwing: grayish brown. Venation (Fig. 10): Sc reaching extended to about distal two-fifths of costal margin; R₂+R₃ forked at one-fifth from termen; M₁ on forewing free, M₃ with M₄ stalked; M₆ on hindwing with M₇+M₈ stalked; CuA₁ and CuA₂ free. CuP on forewing not reaching termen, but reaching termen on hindwing; A free. Legs: Foreleg covered with dense grayish brown hairs; mesoleg and metaleg covered with dense yellowish brown hairs. Abdomen (Figs. 9, 11): Densely covered with blackish brown hairs, distal one-fourth ochreous yellow. Tergum VIII nearly rectangular, posterior margin convex, tuberculate plate absent; sternum VIII reduced to tongue-shaped sclerite.

Male genitalia (Fig. 12): Tergal lobes softly sclerotized, tapering to pointed apex. Pseudoteguminal processes strongly sclerotized, median third nearly triangular and dentated on outer margin, distal third incurved and tapered to pointed tip. Pseudotegumen asymmetrical, anterior tips connected: left side with three small tooth processes and one big tooth process on outer margin, ending with two spine-shaped tooth processes; right side with two small tooth processes and one big tooth process, ending with thumb-shaped tooth process and spine-shaped tooth process. Valvae thin and long, nearly evenly width, apex blunted and rounded. Fultura inferior broad anteriorly, narrowed towards anterior two-fifths, and then broadened towards posterior tip. Saccus broad posteriorly, narrowed towards blunted and rounded anterior tip.

Female unknown.

Distribution. China (Jiangxi).

Etymology. The specific name is derived from the Latin *spinosus* = spinous, in reference to the anterior tips of pseudotegumen with spine-shaped tooth processes in the male genitalia.

Checklist of *Napialus* species

*Napialus hunanensis* Chu & Wang, 1985

*Napialus hunanensis* Chu & Wang, 1985a: 130, figs. 35, 36. Type locality: Changsha, Hunan Province, China.

Distribution. China (Guangdong, Guangxi, Hainan, Hunan, Jiangxi).

*Napialus chongqingensis* Wu, 1992

*Napialus chongqingensis* Wu, 1992: 55, figs. 1–4. Type locality: Beibei, Chongqing Municipality, China.

Distribution. China (Chongqing).

*Napialus chenzhouensis* Chu & Wang, 2004

*Napialus chenzhouensis* Chu & Wang, 2004, in Chu, Wang & Han, 2004: 185, figs. 134a, 134b, pl. v fig. 1. Type locality: Chenzhou, Hunan Province, China.

Distribution. China (Hunan, Jiangxi).

*Napialus jiangxiensis* Chu & Wang, 2004
*Napialus jiangxiensis* Chu & Wang, 2004, in Chu, Wang & Han, 2004: 186, figs. 135a, 135b, pl. v fig. 2. Type locality: Taihe, Jiangxi Province, China. 

Distribution. China (Jiangxi).

*Napialus spinosus* Li & Wei, sp. nov.

Distribution. China (Jiangxi).

FIGURE 13. Map showing distribution where *Napialus* species (■ *N. hunanensis*, ▲ *N. chongqingensis*, ▼ *N. chenzhouensis*, ◀ *N. jiangxiensis*, ► *N. spinosus*) are recorded (within the scope of the black dot line), potential distributed ranges in China (within the scope of the pale purple dash line) and mean minimum temperature of the coldest month (January) of the year.

Biogeographical considerations

Three *Napialus* species are each known from only a single province: *N. chongqingensis* Wu occurs in Chongqing, *N. jiangxiensis* Chu & Wang and *N. spinosus* Li, sp. nov. are both recorded in Jiangxi. In contrast, the distribution of *N. hunanensis* Chu & Wang much broader, covering the five provinces of Guangdong, Guangxi, Hainan, Hunan and Jiangxi (Chu, Wang & Han 2004).

*Napialus* species are recorded from regions where the mean minimum temperature of the coldest month (January) is no colder than 0°C (Fig. 13). These data suggest that *Napialus* is a subtropical taxon. But none species is recorded in the potential distributed ranges with the similar temperature that showed by the pale purple dash line on the map (Fig. 13), such as the eastern Sichuan, the southern Hubei, Anhui and Jiangsu, the most part of Shanghai, Zhejiang, Fujian and Guizhou, the middle and southern Yunnan. Considering the presently distribution and the recorded collected data of the genus, the collected time of specimens must be one of the important factors to cause the very limited known localities. Generally the collected time of Lepidoptera is mainly focused on July and August in southern China, but the emergences of *Napialus* species were recorded in January, March and April (Chu & Wang 1985a; Chu, Wang & Han 2004; Wu 1992). So based on the potential distributed ranges of the genus, they might be expected to occur in wider ranges as well as to describe the largely unstudied diversity of the group in China.
Acknowledgements

We are grateful to Dongsun Ding (Forest Pest Control and Quarantine Bureau of Jiangxi, China), Li Huang (Forest Pest Control and Quarantine Bureau of Fengcheng, China) and Yueqing Duan (Tongboshan Nature Reserve Administration, China) for the field company during the Lepidoptera expedition to Tongboshan Nature Reserve from April to September of 2012. Special thanks are given to John R. Grehan and Carlos G. C. Mielke for their valuable suggestions. The research was supported by the National Natural Science Foundation of China (No. 31160428) and Scientific and Technological Project of Jiangxi Province (No. 2011BBF60032).

References

http://dx.doi.org/10.1002/joc.1276