

[研究文章 Research Article]

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Notes on Taxonomic Classification of *Podabrus santaritensis* Cockerell, 1936 (Coleoptera: Cantharidae)

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Abstract. *Podabrus santaritensis* Cockerell, 1936 is a fossil cantharid species described based on a single elytron preserved in the Paleocene Sunchal Formation from Quebrada, Jujuy, Argentina. The present study aims to discuss on the questionable familial and generic classification on the basis of the insufficient morphological information preserved in the holotype compression of this species. The case reveals the continuous future works on reexamination of the systematic placement of documented fossil Cantharidae is badly needed.

Key words: Soldier beetles, compression fossil, paleoentomology, classification

Introduction

The family Cantharidae, commonly known as soldier beetles, is a diverse and worldwide distributed group of soft-bodied terrestrial beetles in the superfamily Elateroidea, which includes five subfamilies, over 130 genera and 5,000 species (Delkeskamp, 1977, 1978; Ramsdale, 2010). The earliest fossil record of soldier beetle can be traced back to the Early Cretaceous Lebanese amber, which was mentioned while undescribed by Kirejtshuk & Azar (2013). The oldest cantharids, with credible taxonomic placement, were described from the Late Cretaceous Burmese amber (Poinar & Fanti, 2016; Hsiao et al., 2017; Fanti & Ellenberger, 2017). Fanti (2017c) investigated the fossil records of Cantharidae and listed 61 fossil species based on literatures. Subsequently, 12 additional fossil species were described from amber deposits (Fanti, 2017a, b; Fanti & Vitali, 2017; Fanti & Castiglione, 2017; Fanti & Kupryjanowicz, 2017, 2018; Fanti & Pankowski, 2018; Fanti et al., 2018; Fanti & Michalski, 2018). Thus, a total of 73 fossil cantharid species have been described or identified to species level up to now.

However, the morphological characters preserved in fossils may be sometimes incomplete and insufficient to warrant its systematic placement, especially in partially preserved compression fossils, which would mislead the further biological research. In this study, the familial and generic placement of *Podabrus santaritensis* Cockerell, 1936 described from the Paleocene Sunchal Formation (Quebrada, Jujuy, Argentina) is questioned since it was merely based on the extremely limited characters in one preserved elytron. The case shows the uncertain systematic placement of formerly published fossil cantharids and highlights continuous future works aiming to reexamine described fossil Cantharidae is needed.

Material and methods

The holotype fossil of *Podabrus santaritensis* Cockerell, 1936 is deposited at American Museum of Natural History (AMNH). The present study examined extant specimens deposited in the following institutions and private collection: B.-H. Ho's personal collection, Taipei, Taiwan (BHC); Hokkaido University, Sapporo, Japan (EIHU); National Museum of Natural Science, Taichung, Taiwan (NMNS); Y. Hsiao's personal collection, Taichung, Taiwan (YHC). The specimens were observed by using a Leica EZ4 stereo microscope. The habitus photos were taken using a Nikon COOLPIX P310 digital camera. The illustration of *Podabrus santaritensis* was modified based on Cockerell (1936).

Results

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Podabrus santaritensis Cockerell, 1936

Chinese name: 聖塔里雙齒菊虎

(Fig. 1)

Podabrus (?) *santaritensis* Cockerell, 1936: 5, Fig. 5; Kirejtshuk & Ponomarenko, 2009–2015; Mitchell, 2013 - EDNA The Fossil Insect Database; Fanti, 2017c: 20; The Paleobiology Database.

Type material. Holotype (AMNH), one elytron in dorsal position; sex unknown, D. C. Harrell leg., No. 24520.

Redescription (After Cockerell, 1936) (Fig. 1). Brownish pale. Elytron ca. 4 mm, with apex missing; surface provided with three major, parallel, widely separated, strongly raised elytral costae, with two faint costae between each pair of major costae.

Discussion

Cockerell (1936) described this species based on one elytron preserved in the compression and assigned this taxon into the modern cantharid genus *Podabrus* Westwood, 1840 according to its three strongly raised and widely separated elytral costae, which can be seen in extant *Podabrus*, evidencing its attribution to Cantharidae. However, this character is apparently too weak to warrant its generic or familial placement because it commonly occurred in several phylogenetically unrelated groups such as Carabidae (Fig. 2), Dascillidae (Fig. 3), Melandryidae (Fig. 4), Scarabaeidae (Fig. 5–8), and Pyrochroidae (Fig. 9). Although several species in *Podabrus* as *P. rugosulus* LeConte, 1850, *P. pygmaeus* Green, 1948 and *P. tricostatus* (Say, 1835) are characterized by three major elytral costae and rounded elytral shape (in *P. pygmaeus* and *P. tricostatus*), which resemble *Podabrus santaritensis*, most *Podabrus* species have more elongate elytra and the elytral costae in some species as *P. alpinus* (Paykull, 1798) (generic type of *Podabrus*; Fig. 10), *P. intrusus* Green, 1947 and *P. osawai* Nakane & Makino, 1981 are weakly developed. Furthermore, strongly raised elytral costae not only autoapomorphically occurred in *Podabrus* but also in other cantharid genera as *Lycocerus* Gorham, 1889, *Yukikoa* Sato, 1976 and *Falsopodabrus* Pic, 1927, which are unrelated among one another (Figs. 11–13), highlighting the inappropriate generic assignment only based on the elytral costae. On the other hand, distinctly raised elytral costae and strongly rounded elytral shape in *Podabrus santaritensis* are apparently closer to many extant scarab beetles in various tribes as Heptophyllini Medvedev, 1951 (e.g., *Hexataenius ezaki* (Nijjima & Kinoshita, 1923); Fig. 5), Melolonthini Leach, 1819 (e.g., *Tocama formosana* (Yu, Kobayashi & Chu, 1998) and *Melolontha taihokuensis* Nijjima & Kinoshita, 1923; Figs. 6–7) and Rhizotrogini Burmeister, 1855 (e.g., *Eotrichia taiwana* (Nomura, 1977); Fig. 8) rather than soldier beetles although it is still insufficient to evidence its placement in Scarabaeidae. Therefore, the morphological characters proposed in Cockerell (1936) cannot well support its original familial attribution nor provide further diagnostic characters used in classification under Coleoptera.

A well-preserved fossil specimen could provide the useful morphological information for further phylogenetic studies and a well-justified fossil calibration is crucial for the molecular dating analysis. Thus, the inaccurate classification of fossil taxa would undoubtedly result in misinterpretation. Up to date, 73 fossil species of cantharid beetles have been described and only approximately half taxa described from amber inclusions are well studied for its taxonomic placement in recent research (e.g., Kazantsev, 2013; Poinar and Fanti, 2016; Hsiao et al., 2017; Fanti & Vitali, 2017; Fanti & Pankowski, 2018; Fanti et al., 2018; Fanti & Michalski, 2018). The case shown in the present paper suggests the further studies on the reexamination of previously described fossil soldier beetles are badly needed.



Figures 1–13. Dorsal view of elytra. 1. *Podabrus santaritensis* Cockerell, 1936 (after Cockerell, 1936) (AMNH); 2. *Pseudozaena* sp., Paussinae, Carabidae (BHC); 3. *Dascillus lanceus* Jin, Ślipiński & Pang, 2013, Dascillidae (YHC); 4. *Melandrya dubia* (Schaller, 1783), Melandryidae (YHC); 5. *Hexataenius ezaki* (Nijjima & Kinoshita, 1923), Heptophyllini, Scarabaeidae (BHC); 6. *Tocama formosana* (Yu, Kobayashi & Chu, 1998), Melolonthini, Scarabaeidae (BHC); 7. *Melolontha taihokuensis* Nijjima & Kinoshita, 1923, Melolonthini, Scarabaeidae (BHC); 8. *Eotrichia taiwana* (Nomura, 1977), Rhizotrogini, Scarabaeidae (BHC); 9. *Pseudopyrochroa obtusicristata* Young, 2000, Pyrochroidae (NMNS); 10. *Podabrus alpinus* (Paykull, 1798) (EIHU); 11. *Lycocerus maculicollis* (Hope, 1831) (EIHU); 12. *Yukikoa masatakai* Takahashi, 2003 (NMNS); 13. *Falsopodabrus refossicollis* (Pic, 1907) (EIHU).

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聖塔里雙齒菊虎分類短記 (鞘翅目：菊虎科)

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摘要: 聖塔里雙齒菊虎 *Podabrus santaritensis* Cockerell, 1936 為根據阿根廷胡胡伊省奎布拉達之古新世孫查爾組所出土的單一翅鞘化石所描述的物種，本研究欲討論因正模式埋藏化石所保存的形態資訊極為不足，以致於本種當前的科級和屬級分類仍有相當存疑的狀況。本案例顯示未來應持續對已紀錄過的菊虎科化石物種的系統分類進行重新檢視。

關鍵詞: 菊虎、埋藏化石、古昆蟲學、分類