



Integrative taxonomy of *Asiopodabrus fragiliformis* (Kang and Kim, 2000) (Coleoptera: Cantharidae) and its related species

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Abstract

Both the color patterns of the body and the structures of the male genitalia are important characters used in species identification of traditional taxonomy. However, these characters are often limiting when identifying females of some species. In this study, we attempted to evaluate the species reality of *Asiopodabrus fragiliformis* which often has difficulty in being identified due to individual variation in color pattern and lack of female information. Using DNA barcoding, *A. fragiliformis* was represented as having three clades strongly supported by a high bootstrap value (>99%) and with over 3% branch lengths having a 2.9–3.4% barcoding gap. Morphological reexamination based on the result of DNA barcoding, demonstrated three clades: *A. fragiliformis*, *A. kurbatovi*, and *A. koryeoensis* **n. sp.**, respectively, that were clarified based on subtle difference in both male and female morphological characters. This study explicitly showed that DNA barcoding may clearly and rapidly decide the species delineation for morpho-species in certain cases when the identification of female specimens is not clear using traditional methods.

Key words: taxonomy, Cantharidae, DNA barcoding, *Asiopodabrus fragiliformis*, *A. kurbatovi*, *A. koryeoensis* **n. sp.**, polymorphic species, female identification

Introduction

In the traditional taxonomy of the family Cantharidae, color patterns and male genitalia are mainly used as diagnostic characters in identifying species. This is especially the case when overlapping color variation within and between species exists. These species have often been described based only on male individuals without females (ex. Kazantsev, 1998a). Under such conditions, it is impossible to identify species with only female specimens. In particular, members of the genus *Asiopodabrus* apparently seem to be similar in body color and are not easy to classify morphologically. For example, *A. macilentus* (Kiesewetter, 1874) and *A. ainu* (Nakane & Makino, 1990) were originally described from Japan. And then, *A. macilentus* was recorded from the Far East Russian fauna (Medvedev & Ryvkin, 1992). However, through subsequent taxonomic work of these species in Russia, Kazantsev (1998b) corrected the taxonomic status of the Russian populations of *A. macilentus* and of *A. kurbatovi* from *A. macilentus sensu strato* based on male genitalic characters. And, he also pointed out that *A. ainu*, occurring in Kuril Islands, Sakhalin and Hokkaido, can be distinguished from *A. kurbatovi* by the coloration of the head. Thus, *A. kurbatovi* and *A. ainu* are admitted in the Far East Russian fauna (Kazantsev, 1998b; Kazantsev & Brancucci, 2007).

The Korean *Asiopodabrus* were reviewed as four species by previous taxonomic studies (Kang & Kim, 2000; Kang & Okushima, 2003). Among them, *A. fragiliformis* was described as a new species by Kang & Kim (2000) and distinguished from closely resembling species, *A. fragilis* (Nakane & Makino, 1989) and *A. macilentus* in Japan, by the differences in the aedeagal characters. At that time, the description of *A. fragiliformis* included variation in color ranging from a yellow to a melano type. Before describing of *A. fragiliformis*, these two color types were easily recognized and considered to be diagnostic characters of two species. But, the authors of the thesis were able to examine only female specimens in the melano type because no males were available.