



Morphology and Molecular Phylogeny of the East and Southeast Asian *Meghimatium* slugs (Gastropoda: Pulmonata: Philomycidae) and description of a new species

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Abstract

Meghimatium is a group of terrestrial slugs distributed in Asia. 185 specimens were collected from Taiwan, China, Okinawa (Japan), Thailand and Malaysia. Phylogenetic analyses using concatenated DNA sequences of cytochrome C oxidase subunit I, 16S ribosomal RNA and nuclear 28S ribosomal RNA genes revealed that clades in the resulting molecular phylogeny of *Meghimatium* are largely congruent with taxa identified on the basis of their genitalia. Four monophyletic groups, *i.e.*, the *M. fruhstorferi*, *M. burchi*, *M. uniforme* and *M. striatum* complexes, with moderate to strong statistical supports (86/53/0.98/66, 100/100/1.00/100, 100/100/1.00/100, 100/100/1.00/100) were identified. *M. pictum* is paraphyletic and is clustered with *M. bilineatum* to constitute an additional monophyletic group (100/100/1.00/100). Body size does not show an evolutionary trend either from small to large or vice versa, based on the phylogenetic tree. A new species, *M. baoshanense* sp. nov., is named based on the included specimens constituting a monophyletic group, its medium size (40.1–52.7 mm in body length) and its genitalia with 10–18 papillae at the lower end of the spermathecal duct where it connects to the uterus and vagina.

Key words: 16S rRNA, 28S rRNA, COI, genitalia, *Meghimatium baoshanense*

Introduction

The philomycids are terrestrial slugs in which the mantle covers the whole dorsal and lateral sides nearly reaching the sole margin. There is a large shell sac but no shell, and the foot sole is undivided by longitudinal grooves. The pneumostome is on the right side of the mantle behind the head. The cephalic retractor muscles are completely separated and are inserted towards the ventral side of the lateral body walls. Caudal gland and epiphallus are absent. This family is distributed and native to eastern and southern Asia as well as eastern and south-central North America (Runham & Hunter 1970).

Philomycidae systematics is complex and disputable. Identification of philomycid slugs is difficult because species-diagnostic characters such as body size, body color pattern, jaw, radula and genital morphology are variable. Jaw and radular characters are less variable while body color patterns and genitalia exhibit great amount of variation (Hoffmann 1924; Fairbanks 1986; Wiktor *et al.* 2000). Though jaw and radula are less variable within species, there is considerable variation at the generic and familial levels. On the other hand, different philomycid species commonly have the same body color patterns while different color patterns occur within one species. Therefore, the genital morphology is regarded the only character set that can be used for reliable species identification in the Philomycidae.

In the past, many authors assigned all Oriental philomycids to *Philomycus* (Cockerell 1890; Collinge 1901, 1903; Simroth 1903; Hoffmann 1924; Laidlaw 1937; Kuroda 1941). However, van Hasselt (1823) had introduced the genus *Meghimatium* (type species: *Meghimatium striatum* van Hasselt, 1823, from Java) and Benson (1842) had proposed a new genus, *Incilaria* (type species: *Incilaria bilineata* Benson, 1842, from Chusan, China). Kefer-