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Three new species of freshwater *Macrostomum* (Platyhelminthes, Macrostomida) from southern China

TING SUN[1], LV ZHANG [1], AN-TAI WANG[1] & YU ZHANG[1, 2, 3]

[1]*Shenzhen Key Laboratory of Marine Bioresource and Eco-environmental Science, College of Life Science, Shenzhen University, Shenzhen, PR China*
[2]*Shenzhen Engineering Laboratory of Marine Algal Biotechnology, College of Life Science, Shenzhen University, Shenzhen, PR China*
[3]*Corresponding author. E-mail: biozy@szu.edu.cn*

Abstract

Macrostomum is a diverse genus of turbellarians with more than 180 species described from around the world. However, the *Macrostomum* fauna in China is poorly known. In this study, three new species of freshwater *Macrostomum* were described from southern China based on morphology of the penis stylet, an important character for species identification in this genus. In *M. heyuanensis* **n. sp.**, the penis stylet bends 108° leftwards at its 1/2 length then backwards besides the distal opening, and the terminal region is thicker than other parts of penis stylet. In *M. dongyuanensis* **n. sp.**, the penis stylet is J-shaped, with the opening at the tail end. In *M. bicaudatum* **n. sp.**, the penis stylet is C-shaped, with the upper margin of the distal end longer but slimmer than the lower margin. In addition, molecular phylogenetic analyses were conducted to aid the classification of the novel species. Finally, their habitat and taxonomic status are compared and discussed.

Key words: turbellarian, Platyhelminthes, Macrostomida, *Macrostomum*, new species, taxonomy

Introduction

Macrostomum is a genus of free living dorsoventrally flattened turbellarians in the phylum Platyhelminthes (flatworms). To date, around 180 species of *Macrostomum* have been recorded globally (http://macrostomorpha.info/). Species of *Macrostomum* have some common characteristics. For example, they are usually transparent and have 2 sets of reproductive organs throughout the year. They are small, with body lengths ranging from 1 to 3 mm, and are characterized by the arc-shaped anterior end. The head of *Macrostomum* has two eyes (e), with a longitudinal mouth (m) and a pouched intestine (in) in rearward direction. Both sides of the intestine (in) are surrounded by pharyngeal glands (pg), testes (t) and ovaries (o) in an anterior to posterior sequence. The mating organs are located in the posterior end of the body and contain false vesicula seminalis (fvs), vesicula seminalis (vs), vesicula granulorum (vg) and penis stylet (ps). Among the morphological characters used to describe the species within this genus, the penis stylet (ps) is most important as this structure is relatively stable in shape, although its length will increase as the individual grows (Zhao *et al.* 2011). Furthermore, previous study indicated that the sperms from different species of this genus vary in their morphology, and the variation is possibly related to the structural difference among their penis stylet (Schärer *et al.* 2011).

Mainland China stretches widely over the Palaearctic region and the Oriental region. However, only seven species of *Macrostomum* have been reported from mainland China. In the 20th century, only one *Macrostomum* (Tu 1934) was described from specimens collected from the campus of Tsinghua University, Beijing (the Palaearctic region). During the past decade, six species of *Macrostomum* have been described from the Oriental region of China (Wang *et al.* 2004, Wang & Luo 2004; Wang 2005; Zhao *et al.* 2011), which is characterized by subtropical climate and is densely covered by a network of rivers.

In this study, three novel species of the genus *Macrostomum* were collected, with two from the Dongjiang River basin and one from an artificial lake on Shenzhen University campus. Detailed morphological descriptions

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