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Original Article

New locality record of *Monaxinoides austrosinensis* (Mazocraeidea, Monaxinoididae) of finlet crevalle, *Atule mate* (Perciformes: Carangidae) from the Gulf of Thailand

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ABSTRACT

Out of 203 *Atule mate* fish specimens examined, only 23 had parasitic monogeneans, *Monaxinoides austrosinensis* from the Gulf of Thailand. The prevalence and intensity of infection were 12.81% and 1.27%, respectively. Morphologically, the leaf-like body of *M. austrosinensis* was 5.88–8.07 mm long and 1.84–3.34 mm wide with a fan-shaped opisthohaptor at the posterior end. Numerous pores on the body tegument were observed using scanning electron microscopy. The muscular structure around the vaginal pore presented a number of sensory papillae. The opisthohaptor was one row of clamps which appeared similar in size. The presence of *M. austrosinensis* in this study is a new locality record in Thailand and is the first description based on scanning electron microscopy.

Introduction

Monogenetic trematodes are mostly ectoparasites that mainly parasitize gill fish species and are more widely distributed in tropical than in moderate regions (Ramasamy et al., 1995). About 3500 described species have been reported from marine fish (Rohde, 2005). They cause severe destruction of the gills and lead to serious problems with a marked pathogenicity (Okamoto, 1963; Morsy et al., 2012). The Polyopisthocotylea is a large group of monogeneans that have a cosmopolitan distribution in marine ecosystems, where marine opisthocotyleans feed on the blood of fish hosts and can induce anemia by heavy infestation of worms (Hayward, 2005). They have well developed attachment structures with hard structures in the form of hooks, anchors or clamps (Halton, 1974; Monteroa et al., 2004; Rohde, 2005).

Scanning electron microscopy (SEM) is a tool that provides three-dimensional images with high magnification that permits an understanding of the spatial relationships among surface structures; in monogeneans, some characteristics such as sensory structures, secretory pores, wide variation in morphological aspects on surface modifications and the appearance of microvillus in different monogenean species may be visible using SEM (Smyth and Halton, 1983). It has also been applied to validate monogenean species and separate species that present as being morphologically identical under light microscopy (Hirschmann, 1983; Gibbons, 1986).

The present study investigated the finlet cravalle, *Atule mate* (Cuvier, 1833) (synonym of *Caranx mate*) as it is an important commercial fish species in Thailand, with several species of monogenea being found in the gills of this fish species such as *Gastrocotyle* sp., *Diclybothrium* sp. and *Leuresticola* sp. caught from the Gulf of Thailand (Premkit, 1989) and *Pseudaxine kurra* from China (Jianying et al., 2003). Ding et al. (2003) reported a new species of *Monaxinoides austrosinensis* from China which had been described previously only using light microscopy. From the literature review, the occurrence of *M. austrosinensis* was the first reported on *A. mate* from the Gulf of Thailand but the SEM description was not reported (Ding et al., 2003). Therefore, this study investigated aims to study the occurrence of this monogenean and to describe it using both light and scanning electron microscopy.

Materials and methods

During 2014, 203 finlet crevalle fish samples were collected from Chonburi province (13°18′14.29″N, 100°54′7.69″E) located in the inner Gulf of Thailand and from Chanthaburi (12°28′54.89″N,

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102°3′44.43″E) and Trat (12°10′14.86″N, 102°23′33.65″E) provinces located in the eastern Gulf of Thailand. All fresh fish were purchased from local fishers and were kept in an ice box and then transported to the laboratory at the Department of Zoology, Faculty of Science, Kasetsart University, Bangkok, Thailand. Fish identification was carried out based on external morphology according to Yoshida et al. (2013). Fish samples were thawed and measured for body weight and standard length or total length before fish dissection. The gills were removed and placed in individual Petri dishes containing normal saline then examined for monogenea under stereomicroscope. The monogenean specimens were counted, recorded and calculated for prevalence and intensity of infection (Gudivada et al., 2012).

For light microscopy (LM), the monogenean samples were preserved in 4% formalin. Some of the fixed and flattened specimens were washed with distilled water to remove excess fixative and then stained with acetocarmine. Dehydration occurred by washing in an ascending alcohol series, clearing in xylene, after which samples were mounted with Canada balsam (Yooyen, 2012). The monogenean specimens were then examined under LM and identified according to the morphological characters described by Yamaguti (1958) and Ding et al. (2003).

For scanning electron microscopy (SEM), some specimens of *M. austrosinensis* were post-fixed in 1% osmium tetroxide (OsO_4) for 1 h, then dehydrated in a grade ethanol series and dried in a critical point drier (Polaron Range CPD7501; Quorum Technologies Ltd.;

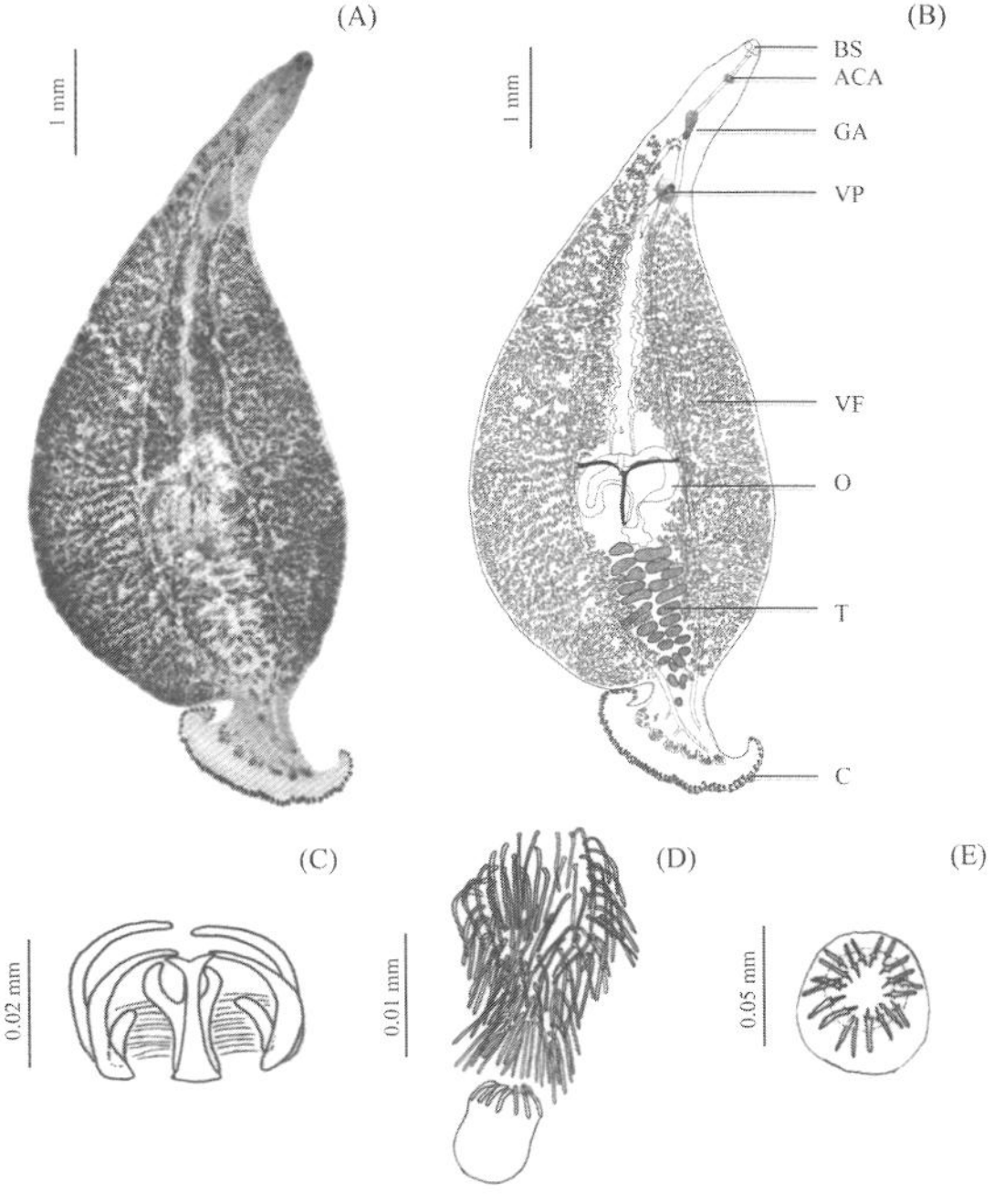

Fig. 1. Light photomicrograph of *Monaxinoides austrasiensis*: (A and B) Whole mount, ACA = accessory copulatory apparatus; BS = buccal suckers; C = clamps; GA = genital atrium; O = ovary; T = testes; VF = vitelline follicles; VP = vaginal pore; (C) clamps, microcotylid type; (D) Genital atrium showing two sets of spines—thick short spines and long spines and muscular sucker; (E) Cupped accessory copulatory apparatus.

Kent, UK), and then were coated with gold in a Sputter Coater (Polaron Range SC7620; Quorum Technologies Ltd.; Kent, UK) and examined using a scanning electron microscope (Quanta 450; FEI Co.; Eindhoven, the Netherlands) operating at 5 keV.

Results

In total, 23 of the 203 *A. mate* samples were infected with *M. austrosinensis*. The prevalence and intensity of infestation were 12.81% and 1.27% parasites per fish, respectively. On the basis of the LM study, the general morphology of *M. austrosinensis* was described (n = 10). The body shape was leaf-like with a pointed tapered anterior containing a mouth opening and a posterior end containing haptors. The body length was 5.88–8.07 mm and the maximum width at the level of post-ovary was 1.84–3.34 mm. The head was 1.56–1.89 mm wide with a ventroterminal mouth aperture. Two buccal suckers were elliptical in shape, aseptate and dimensioned 0.06–0.08 mm × 0.05–0.08 mm. The pharynx was oval or elliptical and the esophagus bifurcated immediately behind the genital atrium at 0.77–1.12 mm from anterior end of the body. Caeca had a lot of branching on each side, terminating separately at the posterior end of the body proper. The opisthohaptor was shaped like a fan and fringed with a single row of 53–56 clamps along its semi-circular posterior margin which were 1.01–1.95 mm (Fig. 1A and B). At one end of the opisthohaptor, there were two pairs of terminal anchors. The clamp skeleton was 0.06 mm × 0.04 mm in size, and of the microcotyle type (Fig. 1C).

The testes were obliquely long and irregular in shape, extending from behind the ovary to the near posterior end of the intestinal field, approximately 1.04–1.92 mm in size. The vas deferens was raised with asymmetrical undulation and the cirrus

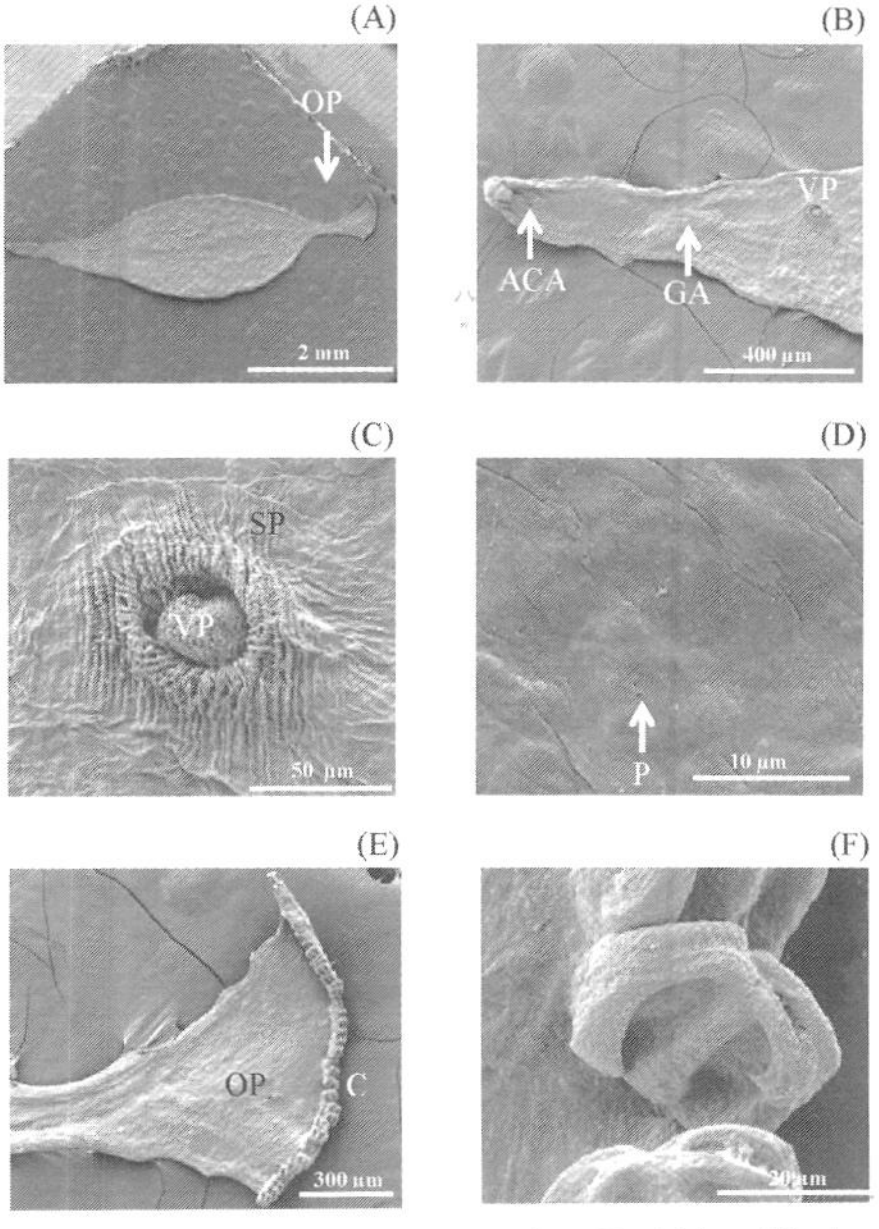

Fig. 2. Scanning electron micrograph of *Monaxinoides austrasiensis*: (A) Whole mount, 23×. PR = prohaptor, OP = opisthohaptor; (B) Anterior region of body proper showing the opening of accessory copulatory apparatus (ACA), position of genital atrium (GA) and vagina pore (VP), 120×; (C) Vaginal pore (VP), showing tegument folds around vaginal pore with numerous sensory papillae (SP), 1000×; (D) Tegument of posterior region of body showing distribution of numerous pores, 3000×; (E) Posterior region of body proper showing an opisthohaptor (OP) with a single row of clamps (C), 150×; (F) Clamps, microcotylid type, 2500×.