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RESEARCH ARTICLE

Renocila richardsonae Williams & Bunkley-Williams, 1992 (Isopoda: Cymothoidae), a parasite of Japanese goatfish, *Upeneus japonicus* off Sarawak, South China Sea

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ABSTRACT

Renocila richardsonae Williams & Bunkley-Williams, 1992 is recorded for the first time from Sarawak coastal waters. During a survey of marine fishes at depth of 200 metres in South China Sea, off the coast of Sarawak from 3° to 5°N and 110° to 111°E, five specimens of *Renocila richardsonae* were collected from Japanese goatfish, *Upeneus japonicus* (Houttuyn, 1782) (Mullidae) with average prevalence of 17% and mean intensity of one isopod per fish from examination of 64 fish. The isopod was observed to cause tissue damage on the site of attachment to the host.

Keywords: Fish isopod; Cymothoidae; *Renocila*; South China Sea; *Upeneus japonicus*.

INTRODUCTION

Cymothoid isopods are obligate fish parasites, attaching to the host externally, in the buccal and gill cavities, and occasionally burrowing into the host flesh. Cymothoid species often have restricted or high host specificity (Smit *et al.*, 2014). Adult Cymothoidae are haematophagous in some cases, whereas the immature stages (mancae) are free living (Williams & Williams, 1980; Rajkumar *et al.*, 2005; Smit *et al.*, 2014). Fish-attaching isopods, particularly in the family Cymothoidae, have been reported to cause problems in aquaculture and wild fish (Horton & Okamura, 2001; Woo, 2006; Ravichandran *et al.*, 2010; Nowak *et al.*, 2020; Watchariya & Apiruedee, 2020). Damage to hosts includes injuries or large wounds to the affected tissues of the host body or gills, or the adult isopods attaching themselves permanently to the fish body leading to stunted growth that sometimes leads to mortality in their hosts (Bunkley-Williams & Williams, 1998; Mladineo, 2003; Lester & Roubal, 2005; Rameshkumar & Ravichandran, 2013; Watchariya & Apiruedee, 2020; Suresh *et al.*, 2021). Anand Kumar *et al.* (2017) also highlighted the morbidity of affected fish due to isopods in commercial marine fish in East Malaysia. During a survey of marine fishes to a depth of 200 metres in the South China Sea, conducted between 27 April to 10 May 2010 off the coast of Sarawak, we found isopods attached to Japanese goatfish, *Upeneus japonicus* (Houttuyn, 1872). The present study aims to determine the prevalence of one species of ectoparasite, *Renocila richardsonae* Williams & Bunkley-Williams, 1992 with clinical observations on its effect on the Japanese goatfish caught from South China Sea.

MATERIALS AND METHODS

Sampling location

Surveys by the research KK *Manchong* vessel at five stations were conducted in 2010. The fish were sampled off the coast of Sarawak at depths ranging from 66 m to 95 m from 02°20.071'N to 04°03.504'N and from 110°33.246'E to 110°42.762'E (Figure 1) using a beam-trawl technique and then sorted and identified according to species before weighing on the deck. Japanese goatfish from each station were examined externally for the isopods which were removed from attached site by hand or forceps and fixed in 70% alcohol for further examination in laboratory. The prevalence of isopods was calculated using Bush *et al.* (1997). A total of 64 Japanese goatfish were examined from five stations, with five associated specimens of *R. richardsonae*.

Isopod identification

The isopods were identified as *Renocila richardsonae* Williams & Bunkley-Williams, 1992, using standard taxonomic identification procedures, below family level using the keys of Bruce (1987b) and Bruce *et al.* (2019). The species was identified from the original description (Williams & Bunkley-Williams, 1992). Voucher specimens of male and female isopods have been deposited in Museum of Tropical Queensland, Townsville, Australia (registration number MTQ WW34362).

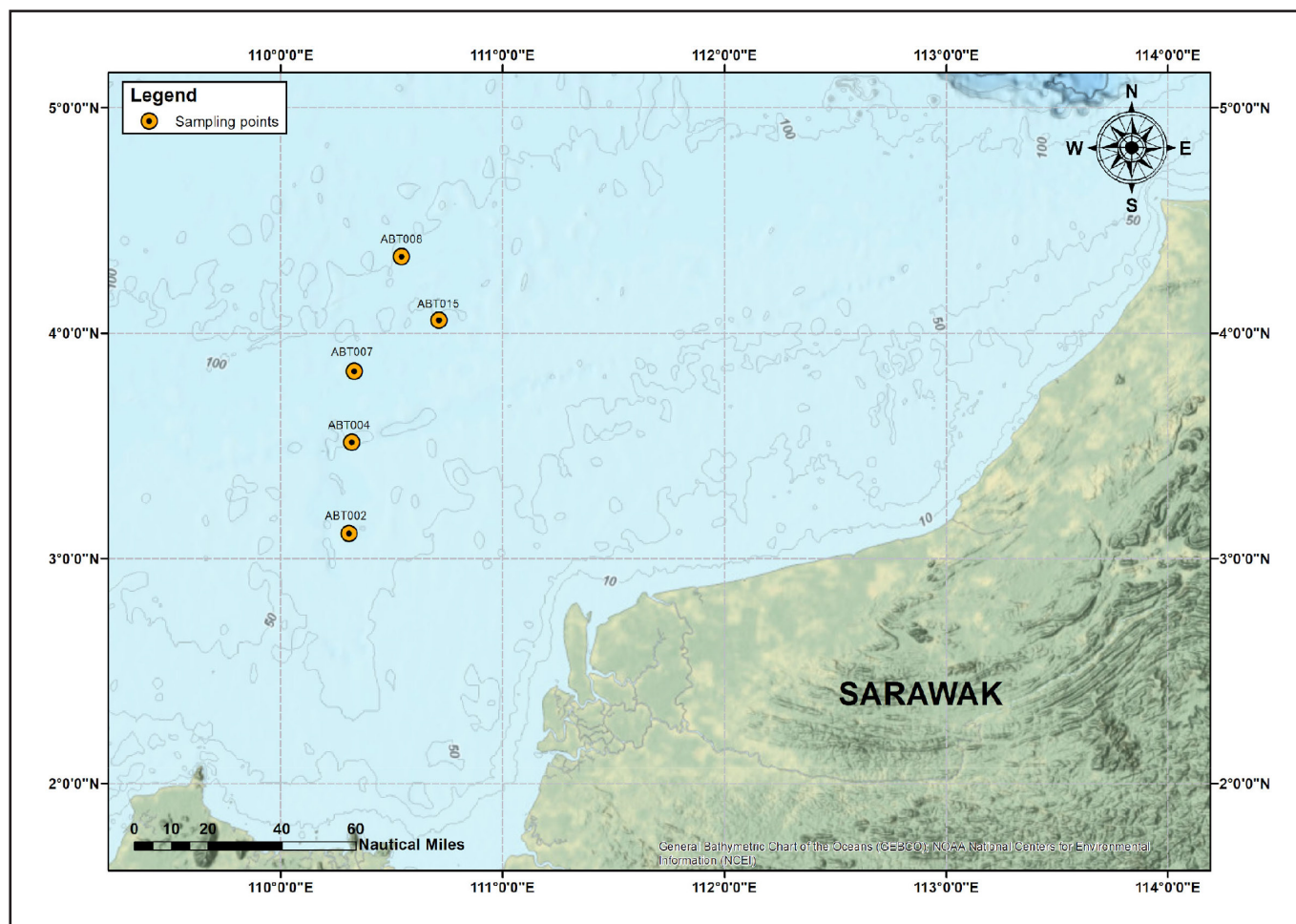


Figure 1. Location of five stations where *Upeneus japonicus* were sampled during the survey of isopods in Sarawak, Malaysia.

RESULTS

The survey revealed that five out of 64 examined Japanese goatfish (average weight range of 8 to 21.4 g) were found infested with isopods. The isopod length measured from 2.0 to 2.7 cm; all isopods were attached to the external body particularly to the abdominal area and caudal peduncle of the fish. The average prevalence of the isopods was 17% (range from 3 to 33%) with mean intensity of one isopod per fish (Table 1). Comparison of photographs of the Sarawak specimens to the description and figures given by Williams and Bunkley-Williams (1992) show a close correspondence of the anterior margin of the head, the shape and form pereonites, pereonites 5–7 in particular, the shape and form of the pleonites, the shape of the pleotelson with its distinct median point and the

shape and relative proportions of the uropodal rami. The presence of a process on the inferodistal margin of the pereopod ischium of one specimen further supports this identification. The specimen agrees well with the generic description provided by Bruce (1987b) and with the key of Bruce *et al.* (2019) and with the original description of *Renocila richardsonae* Williams & Bunkley-Williams, 1992 (Figure 2).

Further observation on the site attachment showed that the isopods attached themselves using the hooked dactylus of the pereopods that penetrates into the fish muscle (Figure 3A). The strongly hooked dactylus of the pereopods is embedded deep into the fish muscle and this strong attachment enables the parasite to secure itself permanently in the host. In one of the affected fishes, one of the isopods caused puncture on the fish skin and further exposed injury (Figure 3B).

Table 1. Isopod *Renocila richardsonae* isolated from *Upeneus japonicus*

ID Location	Average weight (g)	Site infestation	Number of fish examined	Number of fish infested	Prevalence (%) (mean intensity)
ABT002	21.4	Body (abdominal area)	14	1	7.14 (1)
ABT004	10.0	Body (dorsal)	3	1	33.33 (1)
ABT007	12.0	Body (abdominal area)	5	1	20.00 (1)
ABT008	21.6	Body (caudal peduncle)	37	1	2.70 (1)
ABT015	8.0	Body (caudal peduncle)	5	1	20.00 (1)
Total			64	5	Average = 16.63 (1)



Figure 2. *Renocila richardsonae* attached on the body of two different *Upeneus japonicus*.

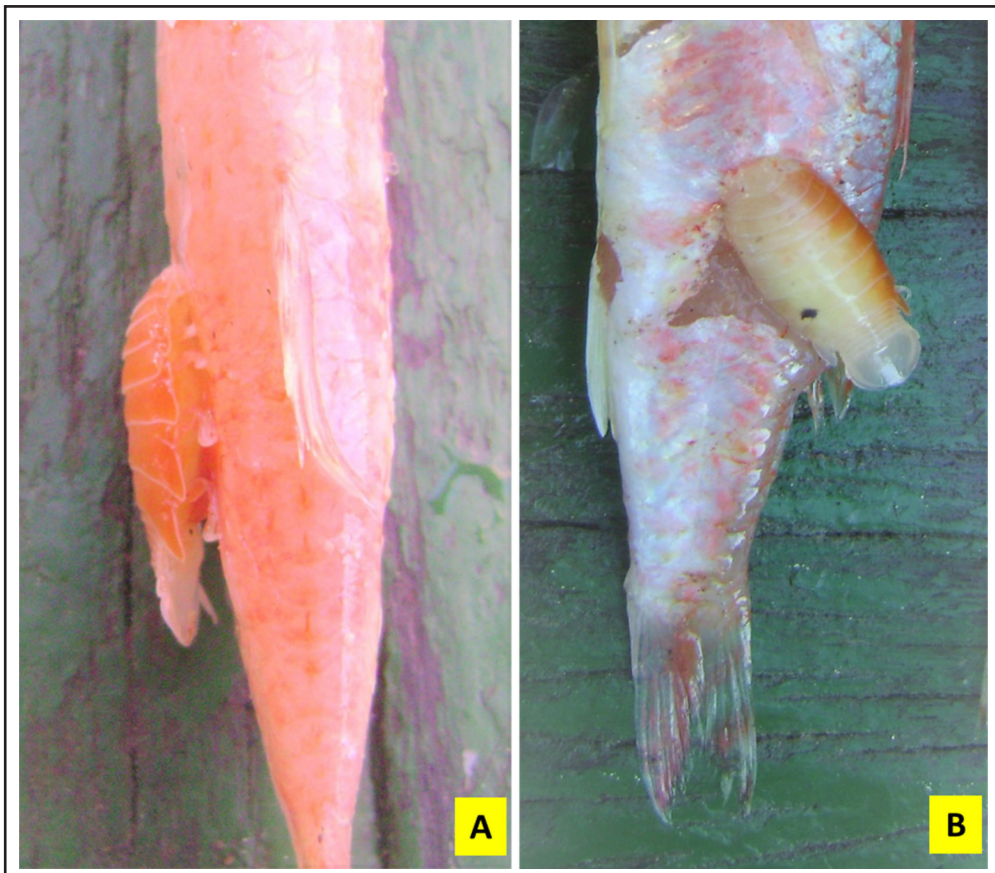


Figure 3. Effect of isopod at the attachment site of affected *Upeneus japonicus*: A, embedded hooked dactylus of the pereopods into the fish muscle and B, injury on the fish skin.

DISCUSSION

The genus *Renocila* has been widely reported in Indo-Pacific region, attaching to species such as flamefish, belted cardinal fish and harlequin bass (Bruce, 1987a; Bruce & Harrison-Nelson, 1988; Bruce, 1991; Aneesh et al., 2020, 2022). There are 20 named species of *Renocila*, half of which occur in the tropical western Pacific (Aneesh et al., 2022). The genus shows a high degree of host specificity (Williams & Williams, 1980; Aneesh et al., 2022). In the present study, we report *Renocila richardsonae* Williams & Bunkley-Williams, 1992, with site infestation on the abdominal area and caudal peduncle with prevalence of 17%. Arthur and Lumanlan-Mayo (1997) reported *R. richardsonae* on Mullidae and an unidentified snapper (Lutjanidae) in the Philippines. We regard the identification from snapper as unconfirmed in the absence of specimens or corroborating illustrations. Goatfish (*Upeneus* spp.) have been reported as one group of marine fish that are used as trash fish in Malaysia, Vietnam and Indonesia (Richard et al., 1998; Edwards et al., 2004; Ruckert et al., 2009). Ruckert et al. (2009) reported that there are three species of goatfish (*U. moluccensis*, *U. sulphureus* and *U. vittatus*) used as trash fish in Indonesia which are able to transfer endohelminths parasites to grouper mariculture. The finding from present study brings us to evaluate the risk of Japanese goatfish infested with *R. richardsonae* to farmed fish. Marine fish record statistics from the Malaysian Department of Fisheries show 18,069 tonnes or 48% of goatfish in 2017 (SEAFDEC, 2022). If infected Japanese goatfish with fully mature adult *R. richardsonae* are present in aquaculture area, there is a risk of disease horizontal transmission particularly for the mancae and the swimming aegathoid stage to the cultured fish. Ravichandran et al. (2009) reported that cymothoid isopods attached to the fish body could limit the growth or inhibit reproduction of the fish. In the present study, *R. richardsonae* was seen to cause injury at the site of attachment. The impact of this species on the host, Japanese goatfish has not previously been reported. However, judging from the observed issue damage showed by farmed fish, if infested will have high risk of injury. Heavy infestations of parasitic juveniles have the potential to kill smaller fish as stated in the case of the isopod *Cymothoa indica* infestation by larvae of Asian seabass *Lates calcarifer* in India with 16.54% mortality (Rajkumar et al., 2005). Therefore, in a culture system, prevention may be achieved by eradicating the immature forms of isopod when they are planktonic. This information is useful for those farming species of Mullidae, to know the threats of this isopod in coastal waters. In Malaysia, the species *Mugil cephalus* has been cultured since 2016 with the highest production was 114 metric tonnes in 2018 (DoF, 2018). Further study of the effects of these parasites in both farmed and wild fish populations is therefore required to understand the biology of cymothoid parasites and their effects.

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Conflict of interests

The authors declare that they have no conflict of interests.

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