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ORIGINAL ARTICLE

Distribution of isopod parasites in commercially important marine fishes of the Miri coast, East Malaysia

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Abstract Isopods occur very commonly as parasites in food fishes. Parasitic isopods are typically marine and usually inhabit the warmer seas. They are blood-feeding; several species settle in the buccal cavity of fish, others live in the gill chamber or on the body surface including the fins. Isopods can cause morbidity and mortality in captive fish populations. The infestation usually pressure atrophy often accompanies the presence of larger parasites. The present study was aimed at collecting information on the neglected group of isopod parasites of the marine fishes from the Miri coastal environment, East Malaysia. A very little information available regarding the distribution of isopod parasites of Malaysian coastal environment. In the present study, nine isopod parasites were oberved from ten marine fish species. The maximum number of parasites were observed in the months of June and October, 2013. Maximum prevalence was observed in October (50 %) and the minimum was observed in June (7.14 %). The parasitic infestation may lead to an economic loss in commercial fish species.

Keywords Isopod parasite · Marine fishes · East Malaysia · Infestation

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Introduction

Marine fish parasitology is a vitally emerging field of aquatic science. The systematic study on Marine fish parasitology and diseases are comparatively new. Cymothoids are among the largest parasites of fishes. The species belonging to the genus Cymotha (Isopoda: Cymothoidae) are known to be attached in the mouth, gills and the body surface of their hosts. Sometimes, these parasites make large wounds and it leads to the death of the hosts (Brusca 1981; Bunkley-Williams and Williams 1998; Lester and Roubal 2005). Most of the parasitological studies in Malaysia focused on the fresh water fish species and very few observations have been made in the Marine Waterfish species. Several observations were made on the parasites of Malaysian freshwater fishes such as the catfish *Clarias* sp., and the snakehead *Channa striatus* (Fernando and Furtado 1964; Furtado and Tan 1973; Rahman et al. 1992; Rahman and Bakri 2008). Generally their results described that various species of nematodes and trematodes were often infecting the *Clarias* sp. They have also noticed the acanthocephalans (thorny or spiny headed worms) infections in the *Channa* and *Trichosgaster* sp. (Rahman and Saidin 2012).

A considerable variations were noticed in the effect of isopod parasites on the marine fishes (Grutter 2003; Cuyas et al. 2004; Ravichandran et al. 2001; Ravichandran 2007; Grutter et al. 2008; Fogelman and Grutter 2008). Changes in the histological pattern of *Mugil cephalus* and *Mugil aurema* caused by *Stellantchasmus fulcatus* and *Phagicola longa* were studied by Lee and Cheng (1979) and Toreelaba et al. (1986). Ravichandran et al. (2000) and Ravichandran and Rameshkumar (2004) described the isopod pathogenocity and studied the pressure exerted by the parasite's body, which affect the host tissue. Since there is no much information on the distribution of parasites in the marine fishes, the present study was carried out on the commercially important fishes from the Miri coast, East Malaysia.

Materials and methods

Fish samples were collected during the weekends directly from the fish landing centers located on the Miri coast (Latitude 4°29′38.72″N and Longitude 113°59′46.19″E) Sarawak, East Malaysia (Fig. 1). The external features of fishes were visually examined for the presence of isopod parasites and immediately preserved in ethanol (70 %). The occurrence of isopod parasitisation in several specimens was observed. The site of the attachment, orientation of parasites on the host and the number of parasites in each location were recorded. The lengh of fishes and parasites were measured in cm and described in Table 1. The specimens of the collected isopod parasites were preserved and stored in Curtin University for the database and future studies.

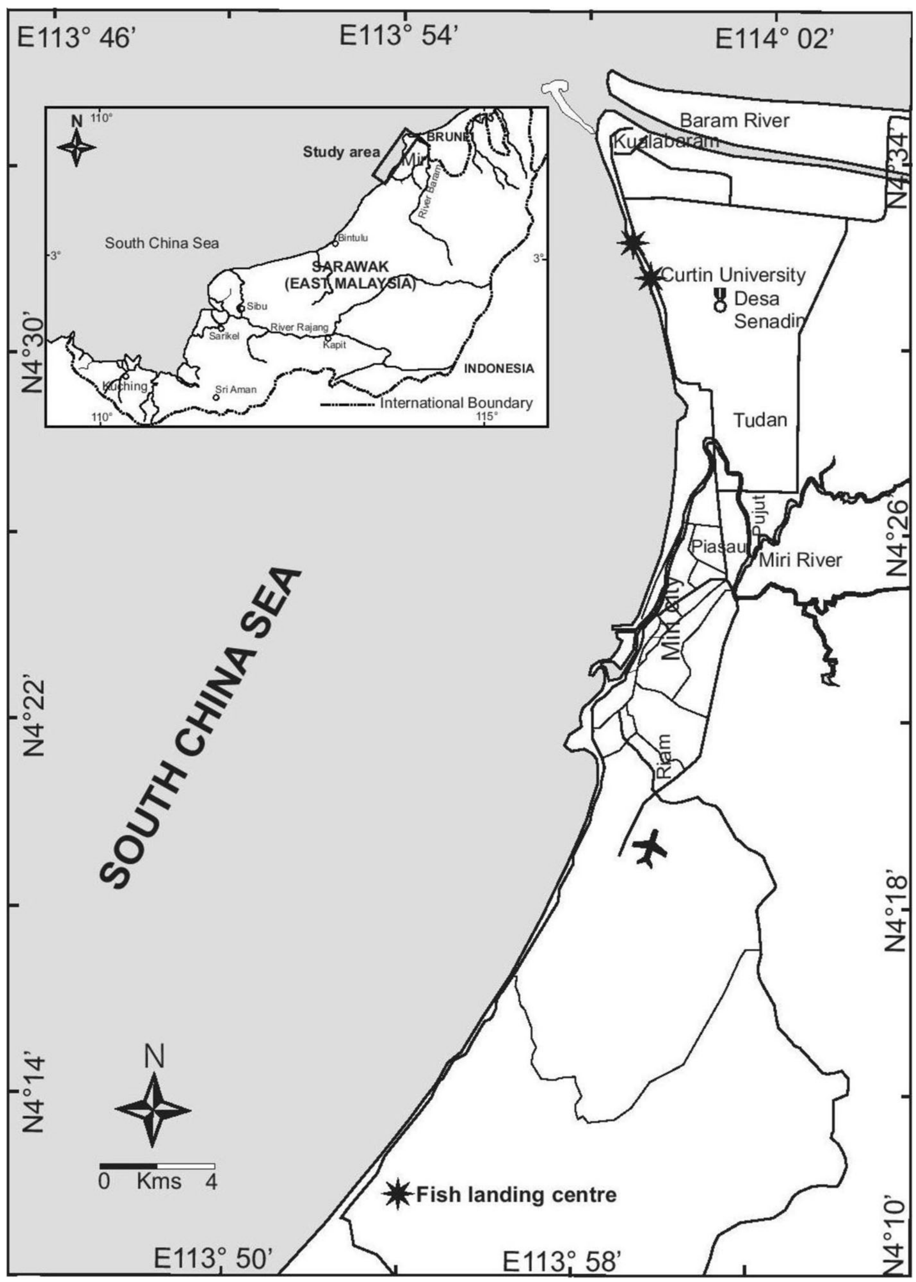

Fig. 1 Location map of the study area showing the fish landing centres (after Anand Kumar et al. 2015)

Table 1 Parasitological index of the parasites collected from the Miri coast

Name of the parasites	Host	Location in the host	Date of collection	Size of the host (cm)	Size of the parasite (cm)	Total no. of fish examined	No. of fishes infested (% prevalence)	Total no. of parasites collected (mean intensity)
Nerocila depressa	*Setipinna tenuifilis*	Body surface	09.03.13	16.4	1.7	25	4 (16)	5 (1.25)
Alitropus typhus	*Trichiurus lepturus*	Body surface	23.06.13	58.8	1.4	28	2 (7.14)	3 (1.5)
Catoessa boscii	*Alectis indicus*	Buccal cavity	23.06.13	16.8	2.4	36	8 (22.2)	10 (1.25)
Norileca indica	*Carangid malabaricus*	Branchial cavity	30.06.13	15.7	2.9	24	4 (16.6)	5 (1.25)
Norileca indica	*Rasrelliger kanagurta*	Branchial cavity	30.06.13	22.3	3	45	6 (13.3)	7 (1.16)
Catoessa boscii	*Scomberomorus guttattus*	Buccal cavity	30.06.13	36	1.2	9	3 (33.3)	3 (1)
Cymothoa eremita	*Psettodes erumei*	Buccal cavity	15.09.13	24.6	2.8	20	4 (20)	5 (1.25)
Nerocila sigani	*Johnius dussumieri*	Body surface	06.10.13	7.9	1.5	38	7 (18.4)	9 (2)
Nerocila depressa	*Alectis indicus*	Body surface	06.10.13	8.5	1.5	14	2 (14.2)	3 (1.5)
Nerocila arres	*Netuma bilineata*	Body surface (tail)	06.10.13	15.2	3	10	2 (20)	3 (1.5)
Joryma brachysosma	*Netuma bilineata*	Buccal cavity	06.10.13	14.6	1.4	8	2 (25)	3 (1.5)
Lobothorax typus	*Trichiurus lepturus*	Buccal cavity	17.10.13	35.2	2.1	10	4 (40)	5 (1.25)
Cymothoa eremita	*Psettodes erumei*	Buccal cavity	27.10.13	22.7	2.3	2	1 (50)	2 (2)
Nerocila depressa	*Netuma bilineata*	Body surface	05.11.13	14.3	1.1	6	1 (16.6)	1 (1)
Total						230	44	57

Result and discussion

Nine isopod parasites were distributed in ten fish species. A total of 230 fishes belonging to ten species (*Setipinna tenuifilis*, *Trichiurus lepturus*, *Alectis indicus*, *Carangid malabaricus*, *Rasrelliger kanagurta*, *Scomberomorus guttattus*, *Psettodes erumei*, *Johnius dussumieri*, *Netuma bilineata*, *Ilisha megaloptera*) were examined for the distribution of parasites during March to November, 2013. Among them 44 fishes were infested by isopod parasites. Overall, nine isopod parasites were obtained from ten fish species. Most of the parasites were attached in the body surface of the host fishes (Fig. 2a–j). As described in the Table 1, *Nerocila depressa* were attached in the body surface of *S. tenuifilis*, *A. indicus*, and *N. bilineata*. *Alitropus typhus* was attached in the body surface of *T. lepturus*. *Catoessa boscii* was attached in the buccal cavity of *A. indicus* and *S. guttattus*. *Nerocila sigani* was attached in the body surface of *J. dussumieri*. Similarly, *Nerocila arres* was attached in the body surface of *N. bilineata*. *Joryma brachysosma* was attached in the buccal cavity of *N. bilineata*. The maximum number of parasites was observed in the months of June and October, 2013.

It is very difficult to identify the *Nerocila* species because it is the largest genus of the family Cymothoidae which includes a minimum of 65 species found attached to the fins and skins of the fishes (Rameshkumar et al. 2011, 2013; Trilles et al. 2013). In the present study, three *Nerocila* species were recorded. Most recently, Anand Kumar et al. (2015) studied the occurrence of *Nerocila longispina* and *Nerocila loveni* in *Terapon puta*, *Chirocentrus dorab* and *Otolithes ruber* in the Miri coastal waters. A detailed taxonomic description of *N. arres* and *N. sigani* were reported by Trilles et al. (2013) collected from the Indian marine fishes. The distribution of these parasites have been reported previously from Hong Kong (Bruce 1990); Indonesia (Trilles 1979); European seas and Thailand (Printrakoon and Purivirojkul 2011). The minimum and maximum

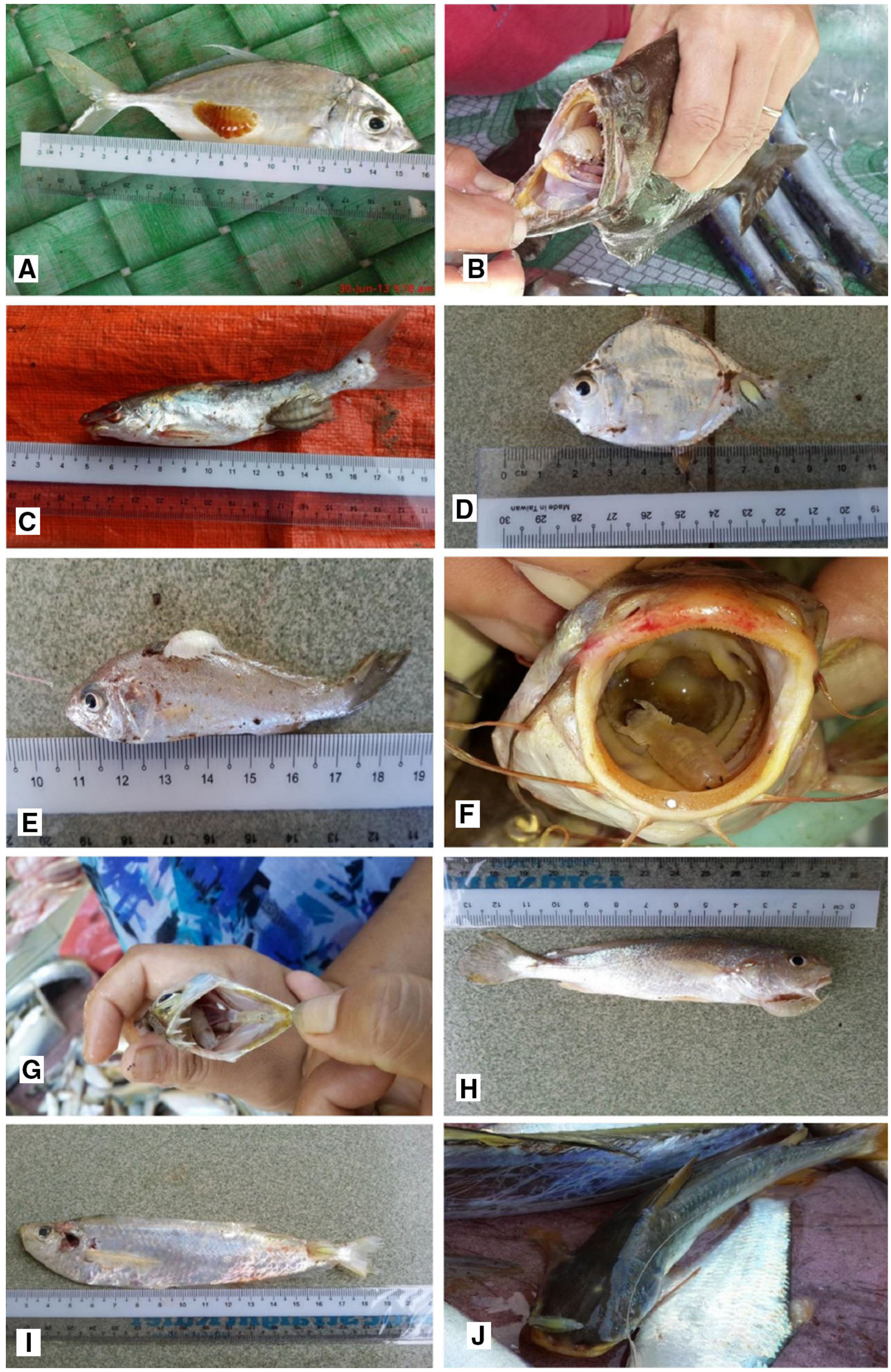

Fig. 2 **a** *Norileca indica* on *Carangid malabaricus*. **b** *Cymothoa eremita* in *Psettodes erumei*. **c** *Nerocila arres* on *Netuma bilineata*. **d** *Nerocila depressa* on *Alectis indicus*. **e** *Nerocila sigani* on *Johnius dussumieri*. **f** *Netuma bilineata* in *Joryma brachysoma*. **g** *Trichiurus lepturus* in *Lobothorax typus*. **h** *Nerocila longispina* on *Otolithes ruber*. **i** *Nerocila depressa* on *Setipinna tenuifilis*. **j** *Nerocila depressa* in *Netuma bilineata*

prevalence (14.2 and 50 %) and intensity range (1–1.5) were observed in the month of October. In the present study, *N. depressa* was attached in *Setipinna tenuifilis*, *A. indicus* and *N. bilineata*. In Thailand, 54 % of this isopod parasites were attached to the bodies of white sardines, *Sardinella albella* collected from an estuary in the Trat province (Printrakoon and Purivirojkul 2011). Previously, the distribution of Nerocila species have been reported from Nagappattinum coast (i.e. *N. Serra*, *N. loveni*, *N. sundaica* and *N. arres*), Vedaranyam coast (i.e. *N. longispina* and *N. poruvae*) and Pazhaiyar region (i.e. *N. depressa* and *N. loveni*), India (Trilles et al. 2013). In the present study *N. sigani* was attached in the body surface of *J. dussumieri* and nine *N. Sigani species* were collected from 38 numbers of host fishes. *N. sigani* has been previously reported on *Siganus oramin* from Mudasalodai, Southeastern coast of

India (Trilles et al. 2013). Similarly, *N. arres* was attached in the body surface of the *N. bilineata* and one of the ten host fishes was infested due to this parasite.

Milne Edwards (1840) made the first identification of the parasitic isopod, *Alitropus typus* from Bay of Bengal, followed by Schioedte and Meinert (1879) from Borneo, Weber (1892) from Indian Archipelagos, Trilles (1975), Veerapan and Ravichandran (2000) and Rameshkumar and Ravichandran (2010) from India. *A. typus* is a common crustacean parasite of the fishes and their distribution are reported from Thailand, Australia, Indonesia, Philippines and Malaysia. These parasites are blood feeding, responsible for causing large wounds and these parasites were found to be attached in body surface of the host or settle in the buccal cavity or gill chamber. A total of 28 fishes (*T. lepturus*) were examined during the month of June, 2013 and one fish was infested by *A. typus*.

According to Martens (1868) *A. typus* were identified in the gills of a Knife fish, *Notopterus hypselonotus* from the Kapuas River nearby Sintang, Borneo. Velasquez (1977) reported that mass infestation of milkfish by *A. typus* caused great mortalities in lloilo fishponds of University of the Philippines in Visayas (UPV) in 1968. Ho and Tonguthai (1992) identified the *A. typus* parasites from the freshwater fishes of Thailand. Del Mundo et al. (1996) reported that Nile tilapia cultured in net-cages at Talisay, Bantangas had suffered mortalities of 40–80 % due to this isopod. Chinabut (2002) identified the isopod infestation in tilapia cage culture under the aquarium conditions in Thailand and found that 15–20 of these isopods can kill a 2–3 in. tilapia within 5–6 h. It was also reported that the infections were more during rainy seasons. Rameshkumar and Ravichandran (2010) also identified and reported the infestations of *A. typus* and *Cumothoa indica* on fresh water fish (*Tilapia mossambica*) from Vellar estuary, SE coast of India. Thus, it is well know that the parasite *A. typus* can cause damage to both fresh and coatal water fishes. The occurrence and distribution of this parasite from the coastal water of Miri is reported for the first time. In the present study, the prevalence of infestation in *T. lepturus* was 7.14 % during June, 2013.

Distribution of the following species such as *Catoessa gruneri*, *Catoessa ambassae*, *C. boscii* and *Catoessa scabricauda* of the genus Catoessa were reported elsewhere in which, *C. boscii* are commonly distributed (Rameshkumar et al. 2013). In the present study, *C. boscii* was attached in the buccal cavity of *A. indicus* and *S. guttattus*. The prevalence and the mean intensity range were 22.2–33.3 % and 1–1.25 respectively during the month of june. *C.bascii* isopods were widely distributed throughout year, reported from Parangipettai, Southeast coast of India (Trilles et al. 2012) Indonesia and it is now reported from the Malaysian waters.

Norileca indica was first reported by Milne Edwards (1840). Later, this species was reported by several authors (Heller 1868; Trilles 1976; Avdeev 1978; Bruce 1990; Yamauchi et al. 2005; Rameshkumar et al. 2013). It has been previously reported from several host species, such as *Atule malam* and *R. kanagurtaI* (Avdeev 1978), *S. crumenophthalmus* and *Herklotichthyes* sp. (Bruce 1990), *Coryphaena hippurus* (Yamauchi et al. 2005) and *R. kanagurta* (Rameshkumar et al. 2013). In the present study *N. indica* was attached to *R. kanagurta* and *C. malabaricus*. Out of 45 numbers of *R. kanagurta*, seven *N. indica* parasites were observed from the branchial cavity. In addition, three parasites were attached to the branchial cavity of *C. malabaricus*. Rameshkumar et al. (2015) collected 41 specimens (32 males and 9 females) of *N. indica* out of 220 numbers of *R. kanagurta* from the Cochin Fisheries Harbour, West coast of India. *N. indica* is a common cymothoid isopod and their distribtution has been reported from Sambelong (Heller 1868), Sumatra, Indonesia, New Guinea (Trilles 1976), North Western Australia (Avdeev 1978), Arafura Sea, off the Northern Territory coast (Bruce 1990), Philippines (Yamauchi et al. 2005), Thailand (Nagasawa and Petchsupa 2009) and East and west coasts of India (Rameshkumar et al. 2015). The distribution of *N. Indica* in *R. kanagurta* is also recorded in the present study and observed that seven out of 45 fishes were infested with the prevalance of 13.3 %.

In the present study, the cymothoid isopod, *Joryma brachysoma* were noticed in the buccal cavity of *N. bilineata*. Previously, Ravichandran et al. (2009) studied the infestation of *R. kanagurta*, and observed that out of 823 specimens, 196 fishes were infested with cymothoid isopod, *Joryma brachysoma* in the Colachel environment of southwest coast of India. In the present study, *Cymothoa eremita* and *Lobothorax typus* were attached in the buccal cavity of *P. erumei*, and *T. lepturus* and the dual parasitism was also noticed which was similar to the previous studies conducted in the Miri coast and south east coast of India. These isopod parasites were widely distributed in Australia, Singapore, Mauritius, Jakarta, Java, Indonesia (as Batavia, Bleeker 1857; Schioedte and Meinert 1883), Ubay, Philippines (Schioedte and Meinert 1883; Trilles 2008), South China Sea (Yu and Bruce 2006), and Southeast coast of India (Rameshkumar et al. 2013).

The prevalence and mean intensity range of the isopod parasites from the marine fishes of the Miri coast indicated that the higher infestations were found in the month of October, 2013. These cymothoids isopods enter the skin with their mouthparts and pereopods, and the tissue-inhabiting forms maintain a small opening to the outside, where the secondary infections occur. According to Ravichandran et al. (2010) this infection leads to microbial diseases due to the presence of these parasites in the branchial cavity of the host fishes and they produce pressure on the gill surface which affects the respiration process of the host. If this situation continues, there will be a loss in the fish population. Also, parasitic infection of fishes mostly depends on several factors such as age, sex, size, behavior, feeding and breeding stage and life cycle of the host species.

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