Host–parasite relationships: *Mothocya plagulophora* parasitizing *Hemiramphus far* in the Southeast coast of India

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Abstract Totally 384 *Mothocya plagulophora* were collected in the branchial cavities of *Hemiramphus far* from the Southeast coast of India during the study period (from July to September 2013). 204 parasites were found in the left branchial cavity and 180 in the right one. The maximum prevalence was observed in July 2013 and the minimum in September 2013. The intensity ranged from a minimum value (1.3) in July and August to a maximum (1.4) in September 2013. In most cases, the parasite was located between the second and the third branchial arch, attached either to the vomerine arch or to the internal wall of the branchial operculum.

Keywords Cymothoidae · *Mothocya plagulophora* · *Hemiramphus far* · Host parasite relationships · India

Introduction

Parasitic Cymothoidae are an important group of crustacean ectoparasites of fish. Most cymothoids are highly host and

site specific (Trilles 1964; Rokicki 1985). Host specificity is the tendency of a parasite to occur on one or few host species and it follows from the co-existence between both parasite and host lineages (Poulin 2007). Although about 450 species of cymothoid isopods have been described from marine and freshwater fish (Moller and Anders 1986; Trilles 1994), information about the biology and the host–parasite relationships for most of them are very limited.

The genus *Mothocya* was described firstly by Costa (1851), while Schioedte and Meinert (1884) described a similar genus, *Irona*, without considering the genus *Mothocya* (Monod 1971). Now *Mothocya* and *Irona* are regarded as synonymous genera (Bruce 1986). *Mothocya plagulophora* was first reported by Haller (1880). Later, this species has been described as *Irona vatia* by Schioedte and Meinert (1884) and as *I. far* by Nair (1950) and Bruce (1986). Until now, this species was only collected from *Hemiramphus far* (Bruce 1986; Trilles 1994). It was reported from the Comoro Islands, Mauritius, Kenya, Somalia, Indonesia, Australia Great Barrier Reef, Sri Lanka and India (Mandapam Camp, Madras) (Bruce 1986), Pazhayar coast (Gopalakrishnan et al. 2010), Parangipettai, South-eastern India (Ravichandran et al. 2011).

Materials and methods

The study was conducted from July 2013 to September 2013. Fishes were collected directly from the trawlers landed at Parangipettai, Southeastern coast of India. All isopod specimens were collected from the branchial cavities of the fish hosts using fine needles and forceps. The specimens were fixed and preserved in 70 % ethanol. The total length of the fish hosts and isopods was measured and all measurements are in centimeters. The prevalence and

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intensity were calculated according to Margolis et al. (1982) and Bush et al. (1997). The location of isopods in the branchial cavity and host parasites relationship were

Fig. 1 Collected specimens (males and females) of the species *M. plagulophora* parasitizing *Hemiramphus far*

Table 1 *Mothocya plagulophora* parasitizing *Hemiramphus far*: Prevalence and Mean intensity according to the different months

Months	Number of fishes examined	Number of fishes infested (%) prevalence)	Number of parasites collected (mean intensity)
July	249	87 (34.9)	114 (1.3)
August	304	92 (30.2)	127 (1.3)
September	366	101 (27.5)	143 (1.4)
Total	919	280 (30.4)	384 (1.3)

Fig. 2 Two pairs of *M. plagulophora*, female and male being in opposite gill chambers of the host

analyzed. Host nomenclature and fish taxonomy are according to Fish Base (Froese and Pauly 2013).

Results

During the study period about 919 marine fish *Hemiramphus far* were examined. Among these, 280 fish were infested by the parasite *M. plagulophora*. From these infested fish 384 parasites (overall prevalence = 30.4 %) were collected (Fig. 1). 204 parasites were collected from

Fig. 3 Two male specimens of *M. plagulophora* attached between the first and second branchial arches of the host

Fig. 4 *Hemiramphus far*, the parasitic isopod being removed: the internal side of the branchial operculum was damaged

Fig. 5 *Mothocya plagulophora* females at different stages: from the left side to the right side, an ovigerous female with manca in the marsupium, two non ovigerous females and a female during the post-molting process

the left branchial cavity and 180 were from the right one. The parasite infected preferably the left branchial chamber rather than the right. A similar result was also reported in Italy by Bello et al. (1997). The authors reported that in a study of *Mothocya epimerica* populations from the Lesina Lagoon 57.1 % were in the left branchial chamber and 42.9 % were in the right branchial chamber. Likewise, in Venice a statistically significant difference in the parasite's preference was observed (70.5 % in the left chamber and 29.5 % in the right) (Bello et al. 1997).

The prevalence and intensity of *M. plagulophora* during the study period (July 2013 to September 2013) is given in Table 1. The maximum prevalence was observed in July 2013 and the minimum in September 2013. The mean intensity ranged from a minimum (1.3) in July, August and a maximum (1.4) in September 2013 (Table 1).

In the study area of Parangipettai, *M. plagulophora* was noticed only with *H. far* ranging from 27.8 to 33.5 cm in length indicating that this parasite is specific in the selection of its host. There was no infestation in the smallest and largest fish. Furthermore, female and male being observed in the opposite gill chambers respectively and we have observed a pair of isopods in the same host (Fig. 2). A *M. plagulophora* gravid female filled to a great extent the available space in a gill chamber and it not allowed attachment of a male in the same space. In all cases, the isopods were attached to the anteroventral part of the host's gill chambers, in most cases between the second and third branchial arches (Fig. 3), either to the vomerine arch or to the internal wall of the branchial operculum (Fig. 4).

As already reported by Bruce (1986), *M. plagulophora* showed a colour pattern of dark bands along the posterior margins of the pleonites and posterior pereonites (Fig. 5). The males were less pigmented (Fig. 3). The colour pattern of this species is characteristic and in Indian specimens immediately identifies the species.

Size of the collected specimens: ovigerous females, from 1.7 to 2.6 cm; non-ovigerous females, from 1.7 to 2.5 cm; males, from 1.2 to 1.4 cm.

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References

- Bello G, Vaglio A, Piscitelli G (1997) The reproductive cycle of *Mothocya epimerica* (Isopoda: Cymothoidae) a parasite of the sand smelt, *Atherina boyeri* (Osteichthyes: Atherinidae) in the Lesina Lagoon, Italy. J Nat Hist 31:1055–1066
- Bruce NL (1986) Revision of the isopod crustacean genus *Mothocya* Costa, (in Hope, 1851) (Cymothoidae: Flabellifera), parasitic on marine fishes. J Nat Hist 20:1089–1192
- Bush AO, Lafferty KD, Lotz JM, Shostak AW (1997) Parasitology meets ecology on its own terms: Margolis et al revisited. J Parasitol 83:575–583
- Costa A (1851) Caratteri di alcuni dei generi e specie nuove segnalate nel presente catalogo. In: Hope FW (ed) Catalogo dei crostacei Italiani e di molti altri del Mediterraneo. Fr. Azzolino, Naples, p 48 (in Italian)
- Froese R, Pauly D (2013) Fish stocks. In: Levin S (ed) Encyclopedia of biodiversity, vol 2. Academic Press/Elsevier, Waltham, pp 477–487 (Updated version of Pauly and Froese's 2001 entry in the 1st edition)
- Gopalakrishnan A, Rajkumar M, Jun Sun, Trilles JP (2010) Occurrence of double parasitism on black-barred halfbeak fish from the southeast coast of India. Chin J Ocean Limn 28(4):832–835
- Haller G (1880) Über einige neue Cymothoïnen. Archiv für Naturgeschichte, Berlin, Jahrsbuch 46:375–395
- Margolis L, Esch GW, Holmes JC, Kuris AM, Schad GA (1982) The use of ecological terms in parasitology (Report of an ad hoc Committee of the American Society of Parasitologists). J Parasitol 68:131–133
- Moller H, Anders K (1986) In: Verlag Moller (ed) Diseases and parasites of marine fishes. German Federal Republic, Kiel, p 365
- Monod T (1971) Sur quelques crustacés de Tulear. Tethys Suppl 1:165–192
- Nair GS (1950) Two new species of *Irona* (Isopoda) parasitic on Madras fishes. J Mad Univ 20B:66–74
- Poulin R (2007) Evolutionary ecology of parasites. Chapman and Hall, London
- Ravichandran S, Rameshkumar G, Trilles JP (2011) New records of two parasitic cymothoids from Indian fishes. J Parasit Dis 35(2):232–234

- Rokicki J (1985) Biology of adult Isopoda (Crustacea) parasitizing fishes of Northern West Africa shelf. *Acta Ichthyology Et Piscatorial* 15(1):95–119
- Schioedte JC, Meinert F (1884) *Symbolae ad Monographiam Cymothoarum Crustaceorum Isopodum familiae*. IV. Cymothoidae. Trib. II. Cymothoinae. Trib. III. *Livonecinae*. *Naturhistorisk Tidsskrift*, series 3:14: 223–454, pp 6–18
- Trilles JP (1964) Specificite parasite chez les Isopodes Cymothoidae Mediterraneens. *Note preliminaire-Vie et Milieu* 15:105–116
- Trilles JP (1994) Les Cymothoidae du Monde. *Prodrome pour une Faune*. *Stud Mar* 21/22:1–288