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ORIGINAL ARTICLE

Seasonal variation of the prevalence of cymothoid isopod *Norileca indica* (Crustacea, Isopoda), parasitizing on the host fish *Rastrelliger kanagurta* collected from the Southwest coast of India

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Abstract Parasitological investigations on the occurrence of isopod parasites in fishes collected from off Cochin coast along Southwest India was carried out for a period of 1 year from January 2018 to December 2018. Altogether 20 species of fishes were analysed from 12 families including Scombridae, Carangidae, Clupeidae, Nemipteridae, Hemiramphidae, Belonidae, Menidae, Priacanthidae, Sphyraenidae, Stromateidae, Coryphaenidae. Infestation of *Norileca indica* was noticed only in the host fish *Rastelliger kanagurta.* Totally 619 specimens of *R. kanagurta* were examined for the presence of isopod parasite, *N. indica*. Among those, one hundred and seventy five specimens were found to be infested by *N. indica.* Overall prevalence, mean intensity and abundance were found to be 28.27%, 1.21, and 0.342 respectively. Highest prevalence of infestation, mean intensity and abundance were recorded in the month of August 2018.

Keywords Cymothoidae · *Norileca indica* · Munambam harbour · *Rastrelliger kanagurta*

Introduction

Parasitic isopods can cause several physical damages to their host fishes. Generally cymothoid isopods are ectoparasites of fishes that found on skin, but they may also be found in branchial cavity and buccal cavity. The Indian mackerel, *Rastrelliger kanagurta* (Cuvier 1817) can act as the potential host for the cymothoid parasite *N. indica* (Milne Edwards 1840) that widely distributed in Sumatra, Indonesia, Philippines and New Guinea (Trilles 1976), north-western Australia (Avdeev 1978), off Mozambique (Rokicki 1982), eastern Australia (Bruce 1990), Pakistan (Ghani 2003), China (Yu and Li 2003), the Philippines (Yamauchi et al. 2005), Thailand (Nagasawa and Petchsupa 2009) and India (Rameshkumar et al. 2013b).

Major documentations of the genus *Norileca* (*N. indica*, *N. triangulata*) in India are from the Parangipettai coastal waters along the Southeast coast (Rameshkumar et al. 2013a, b; Rameshkumar and Ravichandran 2015; Rameshkumar et al. 2015). From India, *N. indica* was first reported by Rameshkumar et al. (2013b) from the Parangipettai coastal waters in the branchial cavity of *R. kanagurta*. Its presence has also been reported from West Bengal (Ray et al. 2016) on *R. kanagurta*, Visakhapatnam (Behera et al. 2016) on *Secutor insidiator*, *Nemipterus randalli*, *R. kanagurta*, from off Mumbai coast (Neeraja et al. 2014) on *Selar crumenophthalmus*, from off Goa and Mumbai coast (Kudtarkar et al. 2018) on *Alepes kleinii* and from the Andaman Islands (Praveenraj et al. 2019) on *Selar crumenophthalmus*. However, very few reports are available on the presence of *N. indica* along Southwest coast of India especially from Kerala (Aneesh et al. 2016; Rameshkumar et al. 2015) on *R. kanagurta*. Munambam is a large fishing area along the Cochin Backwaters (India) that famous for captured and farmed fish diversity. *Rastrelliger kanagurta* is a commercial important fish and it plays an important ecological role. Moreover, inclusive study on *N. indica*, one of the major threats to this edible fish has not been attempted yet from this area. Hence the present paper communicates here on the variations of the

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ecological aspects such as prevalence, mean intensity and abundance of *N. indica* on *R. kanagurta* that captured in Munambam harbour at different seasons.

Materials and methods

Fishes were collected from a fish landing centre at Munambam (Lat. 10° 10′ 965 N, Long. 76°10′ 258 E), of Kerala coast along Southwest coast of India. Sampling for present study was conducted for 1 year (January 2018 to December 2018). Host fish identification was according to Fish Base (Froese and Pauly 2018) and total length (TL) was measured by meter rule. After thorough examination, isopod was removed with forceps from branchial cavity. The number, site of attachment and their orientation of isopod on host were recorded. Photographs of isopods that attached in skin and gill chamber of the host fishes were taken by digital camera (Canon power shot SX710 HS). Total length and width of parasite was measured in millimeters and fixed in 70% ethanol for further analyses. Identification of isopod specimen was done by observation of morphological characteristics by using descriptions of Bruce (1990). The parasitological terms prevalence, mean intensity and abundance were followed from Margolis et al. (1982) and Bush et al. (1997). Intensity (I) is total number of a particular parasite species collected from a single infested host (expressed as a numerical range). Mean intensity is the total number of individuals of a particular parasite species in a sample of host divided by number of infected individuals of the host species in the sample. Abundance is the total number of individuals of a particular parasite species in a sample of host divided by total number of the host species in the sample. The graphs were obtained using Microsoft Excel spread sheet version 2007.

Results and discussion

Altogether 20 species of fishes were analysed (Table 1) from 12 families including Scombridae, Carangidae, Clupeidae, Nemipteridae, Hemiramphidae, Belonidae, Menidae, Priacanthidae, Sphyraenidae, Stromateidae, Coryphaenidae. Infestation of *N. indica* was noticed in the host fish *R. kanagurta* and there was no any infestation by *N. indica* observed in other species of fishes landed at Munambam harbour in present study. Totally 619 specimens of *R. kanagurta* were examined for the presence of isopod parasite, *N. indica*. Among those, one hundred and seventy five specimens were found to be infested by *N. indica* (Fig. 1) in present observation. Overall, 212 *N. indica* specimens were recovered from the host. In many occasions *N. indica* was found in host fish as male–female pairs that one present in each branchial cavity. Similar

Table 1 List of the edible fishes examined for the infestation of parasitic isopod *N. indica* that collected from Munambam harbour during 2018

Sl. no.	Observed fish species	Family	Presence/absence of infestation by *Norileca indica*
1	*Rastrelliger kanagurta* (Cuvier, 1817)	Scombridae	+
2	*Scomberomorus guttatus* (Bloch and Schneider, 1801)	Scombridae	–
3	*Parastromateus niger* (Bloch, 1975)	Carangidae	–
4	*Megalaspis cordyla* (Linnaeus, 1758)	Carangidae	–
5	*Decapterus russelli* (Ruppell, 1830)	Carangidae	–
6	*Caranx ignobilis* (Forsskal, 1775)	Carangidae	–
7	*Escualosa thoracata* (Valenciennes, 1847)	Clupeidae	–
8	*Opisthopterus tardoore* (Cuvier, 1829)	Clupeidae	–
9	*Anodontostoma chacunda* (Hamilton, 1822)	Clupeidae	–
10	*Sardinella gibbosa* (Bleeker, 1849)	Clupeidae	–
11	*Dussumieria acuta Valenciennes* (1847)	Dussumieriidae	–
12	*Nemipterus japonicus* (Bloch, 1791)	Nemipteridae	–
13	*Hemiramphus far* (Forsskal, 1775)	Hemiramphidae	–
14	*Strongylura leiura*(Bleeker, 1850)	Belonidae	–
15	*Strongylura strongylura* (van Hasselt, 1823)	Belonidae	–
16	*Mene maculata* (Bloch et Schneider, 1801	Menidae	–
17	*Sphyraena forsteri Cuvier*, (1829)	Sphyraenidae	–
18	*Priacanthus hamrur* (Forsskål, 1775)	Priacanthidae	–
19	*Pampus argenteus* (Euphrasen, 1788)	Stromateidae	–
20	*Coryphaena hippurus* (Linnaeus, 1758)	Coryphaenidae	–

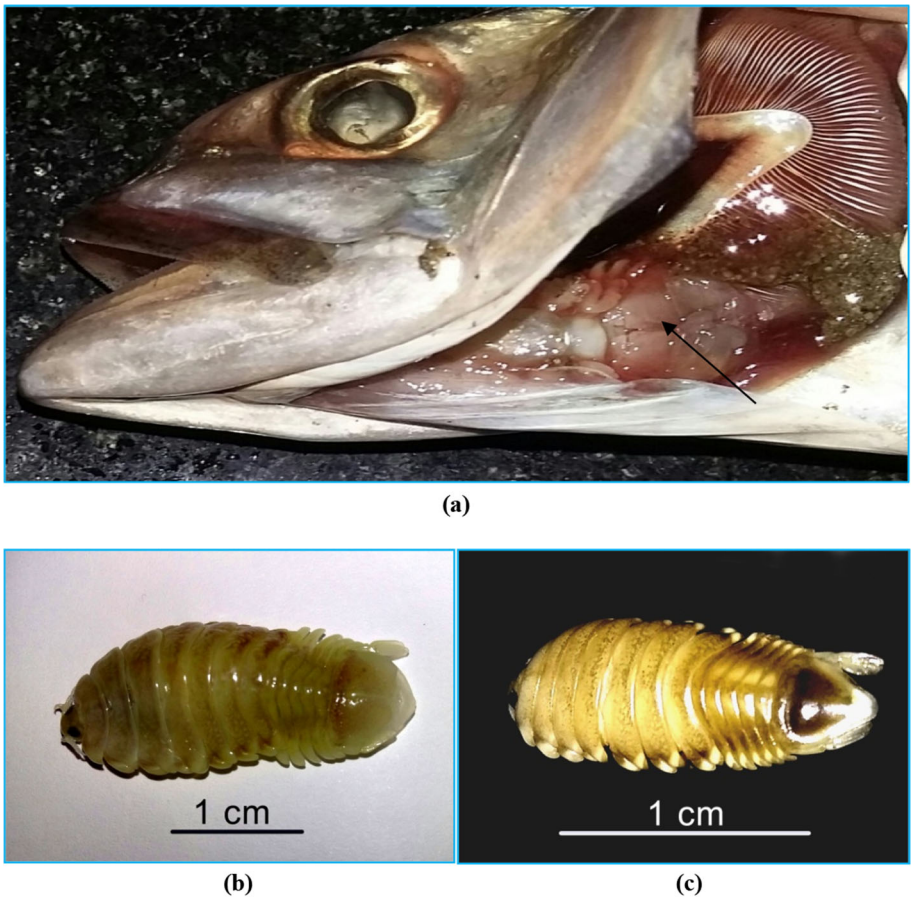

Fig. 1 **a** *Norileca indica* parasitizing on the host fish *R. kanagurta*, **b** *N. indica*-female, **c** *N. indica*-male

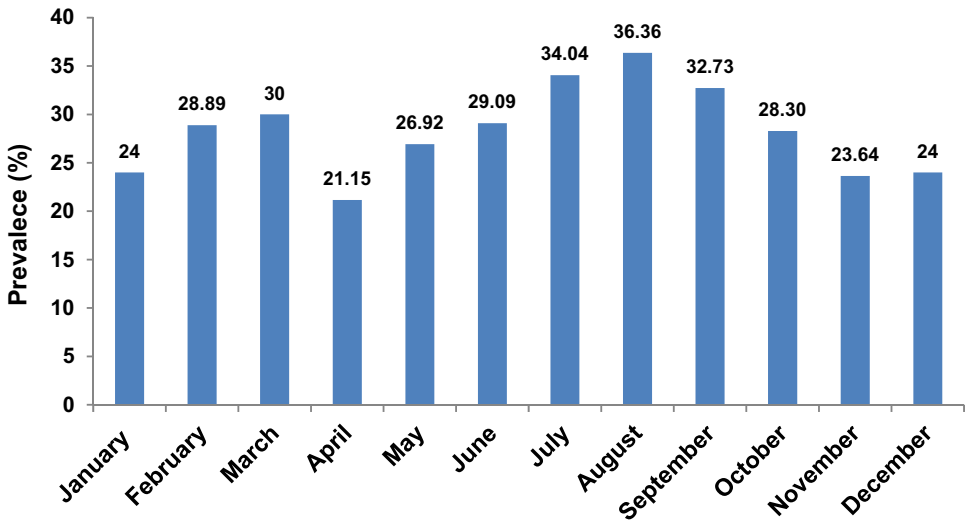

Fig. 2 Prevalence of *N. indica* parasitizing on the host fish *R. kanagurta* collected from Munambam harbour during 2018

happenings were reported by Aneesh et al. (2016) in the same host. Most of the parasites were recovered from the branchial cavity. However Yamauchi et al. (2005) has documented the presence of *N. indica* in stomach of dolphin *Coryphaena hippurus* for first time in Philippines.

Overall prevalence, mean intensity and abundance were found to be 28.27%, 1.22, and 0.342 respectively. Similar observations of more than 25% in the prevalence of infestation by *N. indica* were recorded previously (Aneesh et al. 2016) from Malabar Coast in India. Monthly variation in prevalence was noticed throughout the study (Fig. 2). Highest infestation was recorded in the month of August 2018 (36.36%) followed by July 2018 (34.04%). According to Carvalho-Souza et al. (2009) high prevalence of

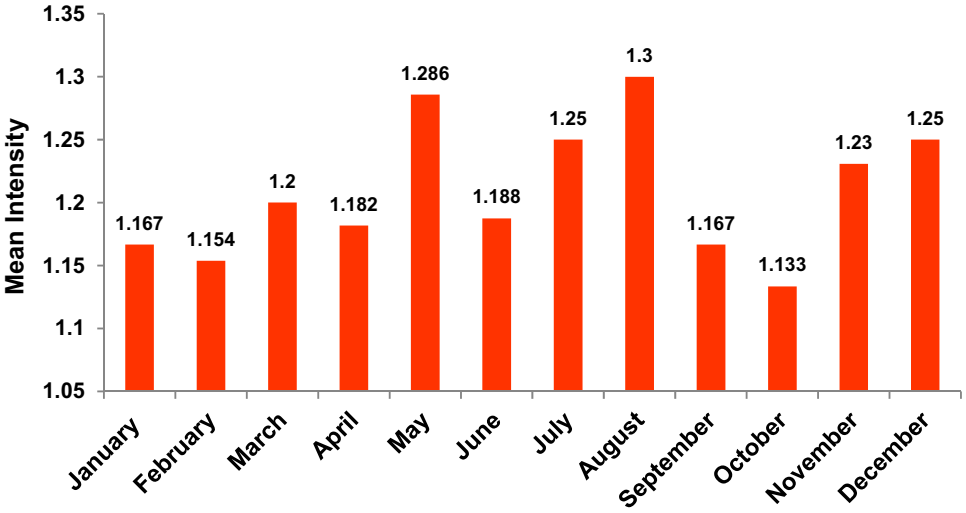

Fig. 3 Mean intensity of *N. indica* parasitizing on the host fish *R. kanagurta* collected from Munambam harbour during 2018

infestation coincides with high abundance of hosts. Investigations of Yohannan and Nair (2002) suggested that major breeding season of *R. kanagurta* along the Southwest coast has happened during May to July; which agreed the similar results of Ganga (2010) that the breeding occurred during the late pre-monsoon and early monsoon period (May–June) and a small minor peak happened during November which would support the fish abundance of the following season. Reports showed that (CMFRI 2019) the total marine fish landings during 2018 in Kerala was 6, 42,081 tonnes; of which the major contribution in the catch by Indian mackerel (12.6%) and the high recruitment of them has observed in July–August period. The maximum prevalence of infestation during Southwest monsoon after trawl ban may be due to the abundance of host fishes (FRAD, CMFRI 2019) at that time; it may help parasites to find the host easily due to higher host availability. Lowest infestation was observed in the month of April 2018. A very low prevalence of infestation (4.5%) has also recorded from the Parangipettai coastal waters along the Southeast coast (Rameshkumar et al. 2013b). Mean intensity was also comparatively high in August (1.3) and low in October 2018 (1.133) which shows in (Fig. 3). Abundance was varied from (.473) to (.25) which showed higher in August and lower in April (Fig. 4). Observations of higher prevalence of infestation as well as the higher abundance of parasite during August were in accordance with the findings of (Behera et al. 2016).

Most of the parasites were recovered from branchial cavity and a lesser numbers from the skin. In present study numbers of female parasites were relatively high; of which many of them were ovigerous. They showed remarkable bending either towards left or right each branchial cavity. The deleterious effects of infestation by *N. indica* were the formation of a pit like appearance in the branchial chamber. The pit formation was more pronounced in the gill chamber of host fishes where the ovigerous females occurred which has also reported by Aneesh et al. (2016).

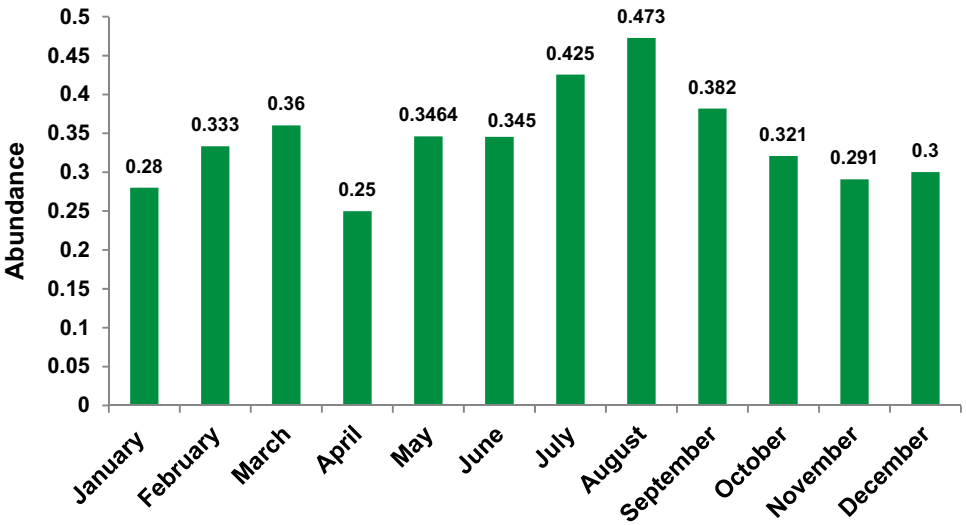

Fig. 4 Abundance of *N. indica* parasitizing on the host fish *R. kanagurta* collected from Munambam harbour during 2018

Conclusion

Present study reveals that *N. indica* is a major parasite that infests *R. kanagurta* throughout the year. Its prevalence of infestation, intensity and abundance becomes high during Southwest monsoon period that may coincide with the peak landing of fishes at that time.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interests.

Ethical approval For the examination of parasitic infestation, we used captured fishes (dead ones) that were collected from the nearby fishing harbours. So the ethical committee approval was not needed in this study.

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