First occurrence of *Norileca triangulata* (Crustacea: Isopoda: Cymothoidae) from Indian marine fishes

Ganapathy Rameshkumar · Samuthirapandian Ravichandran

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Abstract An ectoparasitic isopod, *Norileca triangulata* was found in the branchial cavity of *Sardinella gibbosa* at Parangipettai coastal waters. The present findings represent the first record of *N. triangulata* and herein reported. Until now, this species was distributed from Tanimdao Island, Philippines and from Queensland—Eel Reef, Cape York; Michaelmas Cay, near Cairns and Mooloobah, south-eastern Queensland. The range is here extended and now includes to the Southeast coast of India. The materials examined were deposited at the Annamalai University, India (collection Ravichandran). The parasites has been found on 16 out of 16 specimens of *S. gibbosa*. The prevalence of *N. triangulata* on *S. gibbosa* was 7.5 % and mean intensity was 1. The host fish length ranges from 140 to 182 mm. It is further confirmed that the parasites were specific in the selection of host *S. gibbosa*. Previously *N. triangulata* was reported from two hosts *Parexocoetus brachypterus*. Females of *N. triangulata* ranges 12–18 mm but not found in males. As summarized comparative characteristic feature of two species of parasitic isopods of *Norileca indica* and *N. triangulata*. Host species were captured on pelagic region from the coast of Parangipettai. *N. triangulata* can be distinguished from *N. indica* by several characters. A related species *N. indica* has the head to the anterior, and the abdomen facing outwards, pressed against the gill operculum, positioned ventrally in the gill cavity.

Keywords Cymothoidae · Marine fishes · *Norileca triangulata* · *Sardinella gibbosa*

Introduction

Several species belonging to the Genus *Cymothoa* (Isopoda: Cymothoidae) are known to inhabit the mouth and gill chambers of fishes, but most of the known species are marine. Very little is known about the isopod parasites of Indian fishes. Isopods of the genus *Norileca* by two species along the worldwide (Bruce 1990) collected *Norileca indica* from the fishes *Selar crumenophthalmus* and *Herklotichthys* sp. from Arafura Sea, off the northern territory coast. *Alepes apercna*, *Atule malan*, *S. crumenophthalmus*, *Rastrelliger kanagurta*, *Herklotsichthys* sp. and *Coryphaena hippurus* from Southeast Asia off Mozambique (Trilles 1976; Avdeev 1978; Rokicki 1982; Yu and Li 2003; Yamauchi et al. 2005). *Selar crumenophthalmus* in pattani bay Southernmost coast of Thailand, facing the Gulf of Thailand collected from the branchial cavity (Nagasawa and Petchsupa 2009). Gill chamber of *R. kanagurta* from the Parangipettai coastal region (Rameshkumar et al. 2013). *Norileca triangulata* from *Parexocoetus brachypterus* and *Sardinella gibbosa* from Queensland reported (Bruce 1990). The two species of *Norileca* are associated with open water or pelagic schooling fishes (Bruce 1990). The present findings represent the first record of *N. triangulata* and is herein reported.

Materials and methods

Material studied was collected from fresh fish landed along the coast of Parangipettai during September 2011. Isopod

G. Rameshkumar (✉) · S. Ravichandran
Centre of Advanced Study in Marine Biology, Faculty of Marine
Science, Annamalai University, Parangipettai 608 502,
Tamil Nadu, India
e-mail: grkumarcas@gmail.com

Fig. 1 *Norileca triangulata* in the gill chamber of *S. gibbosa*

Table 1 Infestation of parasites on fishes in relation to month (September 2011)

Host species	No. of fishes examined	No. of fishes infested (% prevalence)	No. of parasites collected (mean intensity)
<i>Sardinella gibbosa</i>	212	16 (7.5)	16 (1)

was removed from the host. Data on collection period, location, host fish, site of attachment of the host fish and parasite were recorded. The prevalence (number of infested hosts/number of examined hosts $\times 100$ %) and the mean intensity (total number of parasites/number of infested hosts) were calculated according to Bush et al. (1997). Identification of the cymothoids was performed according to Bruce (1990). All collected *N. triangulata* specimens were preserved in 70 % alcohol and deposited at the Annamalai University, collection Ravichandran (AUCR). Host nomenclature and fish taxonomy are according to fish base (Froese and Pauly 2011). Fish hosts were not preserved. Voucher specimens were deposited at the (AUCR 810–825).

Results and discussion

During the investigations on *S. gibbosa*, Cymothoid parasites were found in the branchial region (Fig. 1). Sixteen numbers of *N. triangulata* (females 12–18 mm; Fig. 2A and B). The number of fishes examined and those infected were given in the following (Table 1). The parasites have been found on 16 out of 16 specimens of *S. gibbosa*. It would be seen from the table that the prevalence of *N. triangulata* on *S. gibbosa* was 7.5 % and mean intensity 1.

Fig. 2 **A** Dorsal view. **B** Ventral view

The host fish length ranges from 140 to 182 mm. It is further confirmed that the parasites were specific in the selection the hosts of *S. gibbosa*.

Norileca triangulata can be distinguished from *N. indica* by several characters, the easiest to observe being the nearly straight body, larger eyes, pleonite 5 narrower than 1 and the proportionally longer uropods (Bruce 1990). Host and capture data indicate that *N. indica* and *N. triangulata* species occur on surface schooling fishes (Bruce 1990). In the present study host species were captured on pelagic region from the coast of Parangipettai. Previously *N. triangulata* was reported from two hosts *P. brachypterus* and *S. gibbosa* (Bruce 1990). Results of the present study also the isopod was collected from *S. gibbosa*. *Livoneca triangulata* was originally described by Richardson (1910) and this species was redescribed by Bruce (1990). A comparative characteristic feature of two species of parasitic isopods of *N. indica* and *N. triangulata* reported by Bruce 1990 (Table 2).

The size of *N. triangulata*, Ovigerous females from 9.2 to 17.5 mm, males 7.5 to 9.0 mm (Bruce 1990). In the present study females of *N. triangulata* ranges 12–18 mm but not found in males. Until now, this species was distributed from Tanimdao Island, Philippines (Richardson 1910) and from Queensland—Eel Reef, Cape York; Michaelmas Cay, near Cairns and Mooloobah, south-eastern Queensland (Bruce 1990). The range is here extended and now includes to the Southeast coast of India.

In the present study specimens of the Cymothoid isopod *N. triangulata* is collected from the branchial cavities of host fishes. A related species *N. indica* an ovigerous female of the ectoparasitic isopod was found in the stomach contents of the common dolphin fish *C. hippurus* collected at

Table 2 Comparison on characteristic feature of two species of the genus *Norileca* (Bruce, 1990)

Species	Body	Pereonite	Cephalon	Antennule	Antenna	Mandibular palp	Maxilliped recurved spines	Uropods rami
<i>N. indica</i>	2.4–2.5 times as long as wide, twisted to one side	Widest at pereonite 4	Not deeply immersed in pereonite 1, anterior margin subtruncate; eyes 0.47–0.52 width of cephalon.	Extending to pereonite 1, bases set wide apart, composed of 8 articles	Slightly longer than antennule, with 9 articles	With large palp, article 2 flattened, expanded; article 30.35 as long as article 2	Article 3 with 4 large	Subequal
<i>N. triangulata</i>	2.2–2.5 times as long as wide, weakly twisted	Widest at pereonite 4 or 5	Not deeply immersed in pereonite 2; eyes 0.6–0.7 width of cephalon	Bases set widely apart; extends to pereonite 2, composed of 8 articles	Slightly longer, with 9 articles	Large, article 2 expanded; article 30.77 as long as article 2	Article 3 with 3 large	Subequal

the fishing port of Philippines (Yamauchi et al. 2005). Their stomach contents may be an effective collection filed of Cymothoid isopod as well as other crustacean groups (Takeda and Kurata 1976, 1977, 1984; Nunomuram 1992). *N. indica* was found on all big eye scad specimens examined ($N = 70$) from off Mozambique (Rokicki 1982). *Norileca indica* has the head to the anterior, and the abdomen facing outwards, pressed against the gill operculum, positioned ventrally in the gill cavity (Bruce 1990). This is a position similar to that figured by (Tiwari 1952) for *Agarna malayi*. Despite such high prevalence of infection, nothing is known about its life cycle, ecology and associations with hosts (Nagasawa and Petchsupa 2009). In this study, the prevalence of infestation of *N. triangulata* on *S. gibbosa* was 7.5 % and infestation intensity ranged was one per fish including parasite occurred on fishes.

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