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VERSITA

A checklist of the Cymothoidae (Crustacea, Isopoda) recorded from Indian fishes

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Abstract

A checklist of the parasitic Cymothoidae of Indian fishes was compiled from parasitological records published between 1783 and 2011. The checklist is arranged alphabetically, providing valid names, synonyms and authorities of the parasite species, as well as valid names and synonyms of the host fish, its capture sites, author(s) and date of published records. The host list consists of all parasites species listed under the host species. A total of 47 nominal species corresponding to 36 valid species are listed from 74 host species belonging to 34 families. Several parasites not identified to species level and parasite species without the host data or where the parasite was found not associated with a fish are also included in this checklist.

Keywords

Crustacea, Cymothoidae, checklist, fish parasites, India

Introduction

The Cymothoidae (Crustacea, Isopoda) are ectoparasites of fishes, the greatest diversity being in tropical marine environments. Cymothoids are protandric hermaphrodites with a sexual inversion depending on an androgenic and neurohormonal regulation (Trilles 1969, Raibaut and Trilles 1993). Their holoxenic life cycle includes a single host (Ramdane *et al*. 2007). They are hematophagous crustaceans and their feeding is facilitated by an anticoagulant substance (Raibaut and Trilles 1993, Trilles 1994).

Cymothoid isopods have been mentioned in some of the earliest references on natural history, e.g. Belon (1553) and Rondelet (1554) but despite this long history, they are many parts of the world where they are still incompletely known or even completely unknown (Trilles 1994; Hadfield *et al*. 2010). Trilles (1994) provided a world catalogue of the Cymothoidae which highlighted the lack of information of fish parasitic isopods particularly in eastern, Northern Africa, South Africa, South America and Asia.

Marine fish parasitology dealing with Indian cymothoids has a long history, going back to a first record in 1783. However, the Indian cymothoid fauna is still poorly known. Until now, accurate studies of these parasitic isopods were scanty on Indian fishes as already recorded by Rameshkumar *et al*. (2011). Several reports are wrong or doubtful and often published in local journals sometimes not easily accessible.

This study is a start in correcting this deficiency by giving an updated checklist of the Cymothoidae parasites of Indian fishes, using current and, as far as is possible to determine, correct nomenclature. It may be a useful tool for studying the parasite distribution as well as the general parasite diversity in fish, in a selected host group, a special environment or a restricted locality. It may also be an important tool for planning research activities in Indian marine fish parasitology.

Results and discussion

This checklist was compiled from records published between 1783 and 2011, covering a total of 76 papers. The papers analysed by us recorded 47 nominal species, corresponding to only 36 valid species, from at least 74 host species belonging to 34 families. Reports of nine parasites that had not been identified to the species level were included in this checklist. Parasite species where host data are missing or where the parasite was found not associated with a fish are also included.

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Results are presented as a parasite-host list (Table I) and a host-parasite list (Table II). The specific distribution of species in host fishes is also recorded (Table III).

The parasite-host list is arranged alphabetically, providing parasite valid names and synonyms, author(s), host fish names as recorded in the literature and the current valid names when synonymy, localities as stated in the original literature, author(s), date of the published records. Material deposited is also specified when available. Indeed, for many biological and ecological papers there is no deposited material. Parasite species where host data are missing, or where the parasite was found not associated with a fish are also included. Records by different authors of the same parasite species inhabiting the same or different fish species are arranged chronologically. Some records are accompanied by remarks adding information of taxonomic value, or concerning nomenclature or misidentification. The host-parasite list, also arranged alphabetically, use only valid parasite and fish names.The fish taxonomy follows the FishBase (Froese and Pauly 2011). A map of India with the localities cited in the records is produced (Fig. 1).

Fig. 1. Map of India with the localities (current names) cited in the records listed in the text

Table I. Parasite-host list: parasite species, hosts, localities and records. Parasite species valid names are in bold italics and synonyms in italics. Current valid names of fish species are in brackets when synonymy. Current names of some stations are in brackets when new names. For several species some additional details and remarks numbered from 1 to 26 in the species column are provided after the Table I (Appendix 1)

Species (valid names and synonyms)	**Hosts**	**Localities**	**Authors, records and deposited material**
Agarna malayi Tiwari, 1953	*Nematalosa nasus*	Bay of Bengal	Tiwari (1953); holotype female, n° C 3121/1, paratypes females n° C 3122/1 zoological survey of India, Indian Museum, Calcutta
Indusa malayi (Pillai, 1964) **1**	*Mugil ophueseni* (= *Valamugil cunnesius*)	Kayamkulam Lake (Kerala, Southwest Coast of India)	Pillai (1964)
Indusa ophueseni Pillai, 1954 **1**	*Mugil ophueseni* (= *Valamugil cunnesius*)	Travancore, India	Pillai (1954, 1964)
Agarna pustulosa (Pillai, 1954)	not reported	India	Kensley (2001)
Indusa pustulosa Pillai, 1954 **2**	*Dorosoma chacunda (= Anodontostoma chacunda)*	Travancore	Pillai (1954); holotype female, Indian Museum, Calcutta
"	*Anodontostoma chacunda*	Kayamkulam Lake (Kerala, Southwest Coast of India	Pillai (1964)
***Agarna* sp.**	*Escualosa thoracata*	Bombay (= Mumbai), Gollapalem, Goa Mangalore, Calicut, Tuticorin	Seshagiri Rao (1981)
***Agarna* sp.**	*Glossogobius giuris*, *Glossogobius biocellatus* (= *Psammogobius biocellatus*), *Oligolepis acutipinnis* (= *Oligolepis acutipennis*)	Ennore Estuary, Chennai	Raghunathan and Rema Devi (1998)
Amblycephalon indicus Pillai, 1954	*Sphyraena obtusata*	Travancore (Southwest Coast of India)	Pillai (1954)
"	*Sphyraena obtusata*	Vizhingom, Kerala	Pillai (1963)
Anilocra dimidiata Bleeker, 1857	*Lactarius lactarius*	Travancore	Pillai (1954)
"	*Sardinella longiceps*, *Leiognathus* sp.	Vedaranyam Coast, Southeastern India	Rameshkumar *et al*. (2011); 5 females, n° AUCR C23 and AUCR C24, Annamalai University, collection Ravichandran
Anilocra leptosoma Bleeker, 1857	*Pellona brachysoma* (= *Ilisha melastoma*)	Travancore	Pillai (1954)
Anilocra lepcosoma [sic]	*Carangids malabaricus* (= *Carangoides malabaricus*)	Parangipettai, Southeast Coast of India	Ravichandran *et al*. (2010a)
Anilocra longicauda Schioedte et Meinert, 1881	*Polynemus tetradactylus* (= *Eleutheronema tetradactylum*)	Pulicat Lake	Jayadev Babu and Sanjeeva Raj (1984)
Ceratothoa imbricata (Fabricius, 1787)	not identified	Calcutta (= Kolkata)	Miers (1884); British Museum of Natural History, as *Cymothoa approximans* White, 1847
Ceratothoa banksii (Leach, 1818) [sic] **3**	not identified	Madras (= Chennai)	Heller (1868); Schioedte and Meinert (1883)
Not *Codonophilus imbricatus* Fabr. **3**	*Exocoetus brachypterus* (= *Parexocoetus brachypterus*)	Travancore	Pillai (1954)
Ceratothoa retusa (Schioedte et Meinert, 1883)	*Hemiramphus far*	Coast of Kerala State, Southwestern India	Bruce and Bowman (1989)

Continuation of Table I

Codonophilus hemiramphi Pillai, 1954 **4**	*Hemiramphus far*	Travancore	Pillai (1954)
Cymothoa assymetrica Pillai, 1954	*Sphyraena jello*	Travancore	Pillai (1954)
Cymothoa cinerea Bal et Joshi, 1959 **5**	*Stromateus cinereus* (= *Pampus cinereus*)	Bombay Coast (= Mumbai)	Bal and Joshi (1959)
Cymothoa cinerius [sic]	"	"	Joshi and Bal (1960)
Cymothoa eremita (Brünnich, 1783)	*Coryphaena apus* (= *Parastromateus niger*), *Stromateus paru* (= *Peprilus paru*)	Madras (= Chennai)	Brünnich (1783)
"	*Mugil seheli* (= *Moolgarda seheli*), *Stromateus niger* (= *Parastromateus niger*), *Chirocentrus dorab*, juvenile fish of the genus *Caranx*	Krusadai Island, Gulf of Mannar	Kuriyan (1952)
"	*Parastromateus niger*	Southwest Coast of India	Radhakrishnan and Nair (1983)
Cymothoa leschenaultii, Leach, 1818 **6**	not identified	Pondicherry (= Puducherry)	Miers (1880); holotype, Bristish Museum of Natural History, 1979: 406
Cymothoa stromatei Bleeker, 1857 **6**	*Parastromateus niger*	Travancore	Pillai (1954)
Cymothoa krishnai Jayadev Babu et Sanjeeva Raj, 1984 **7**	*Polynemus tetradactylus* (= *Eleutheronema tetradactylum*), *Lutjanus johnii*, *Lutianus argentimaculatus* (= *Lutjanus argentimaculatus*), *Mystus gulio*, *Arius nenga* (= *Nemapteryx nenga*), *Nematalosa nasus*, *Chanos chanos*, *Platycephalus insidiatrix* (= *Platycephalus indicus*)	Pulicat Lake	Jayadev Babu and Sanjeeva Raj (1984)
"	*Etroplus suratensis*	Goa coast	Parveen Rattan and Parulekar (1998)
Cymothoa indica Schioedte et Meinert, 1884	not identified	India	Hale (1926)
"	*Glossogobius giuris*	Chilka Lake	Chilton (1924); Berlin Museum
" **8**	*Etroplus maculatus*, *E. suratensis*, *Glossogobius giuris*	Madras Coast (= Chennai), Adyar backwaters	Panikkar and Aiyar (1937)
"	*Strongylura strongylura*	Hooghly estuary, Bakkali and Sagar Island, Sundarbans, West Bengal	Misra and Nandi (1986)
"	*Sphyraena obtusata, Trachinocephalus myops*	Parangipettai, Southeast Coast of India	Veerapan and Ravichandran (2000)
"	*Strongylura stongylura*	Parangipettai, Southeast Coast of India	Rajkumar *et al*. (2004)
"	*Stigmatogobius minima*	Parangipettai, Southeast Coast of India	Rajkumar and Ravi (2005)
"	*Mystus gulio*	Parangipettai, Southeast Coast of India	Rajkumar *et al*. (2005a)

Continuation of Table I

"	*Lates calcarifer*	Parangipettai, Southeast Coast of India	Rajkumar *et al*. (2005b)
"	*Etroplus suratensis*	Parangipettai, Southeast Coast of India	Rajkumar *et al*. (2006)
"	*Oxyurichthys microlepis*	Parangipettai, Southeast Coast of India	Ravi and Rajkumar (2007)
Not *Cymothoa indica* (Schioedte et Meinert, 1884) **9**	*Tilapia mossambica* (= *Oreochromis mossambicus*)	Vellar estuarine environment (lat. 11°29′N, 79°46′E), Parangipettai, Southeast Coast of India	Rameshkumar and Ravichandran (2010b)
Elthusa raynaudii (Milne Edwards, 1840)			
Livoneca raynaudi Bleeker, 1857 **10**	on a number of species of fish, primarily *Pellona brachysoma* (= *Ilisha melastoma*) and *Stolephorus commersonnii*	Travancore	Pillai (1954)
Elthusa samariscii (Shiino, 1951)	*Samaris cristatus*	Kerala, Southwest Coast of India	Biju Kumar and Bruce (1997); Zoologisk Museum, University of Copenhagen, Denmark, n° ZMUC-CRU-1975
Joryma brachysoma (Pillai, 1964)			
"	*Ilisha melastoma*	Parangipettai, Southeast Coast of India	Ravichandran *et al*. (1999)
"	Clupeidae	Parangipettai	Veerapan and Ravichandran (2000)
"	*Rastrelliger kanagurta*	Colachel Environment, Southwest Coast of India	Ravichandran *et al*. (2009)
"	*Rastrelliger kanagurta*	Parangipettai, Southeast Coast of India	Ravichandran *et al*. (2010b)
Agarna brachysoma Pillai, 1964 **11**	*Pellona brachysoma* (= *Ilisha melastoma*)	Kerala Coast, Trivandrum (= Thiruvanathapuram), Southwest Coast of India	Pillai (1964); holotype female, Indian Museum Calcutta
Not *Joryma brachysoma* **12**	*Carangids malabaricus* (= *Carangoides malabaricus*)	Parangipettai, Southeast Coast of India	Ravichandran *et al*. (2010a)
Joryma hilsae Rameshkumar, Ravichandran et Trilles, 2011	*Stolephorus commersonnii, Hilsa kelee, Sardinella* sp.	Muttam, Southwestern Coast of India	Rameshkumar *et al*. (2011); holotype female, MNHN 6289, Museum National d'Histoire Naturelle, Paris; paratypes, Annamalai University, Collection Ravichandran, AUCR C19 and AUCR C20
Joryma engraulidis (Barnard, 1936)			
Agarna engraulidis Barnard, 1936 **11**	*Engraulis setirostris* (= *Thryssa setirostris*)	of mouth of Devi River, Orissa Coast	Barnard (1936)
"	*Thryssa dussumieri*	Parangipettai	Veerapan and Ravichandran (2000)
Livoneca engraulidis (Barnard, 1936) **13**	*Anchoviella zollingeri* (*Engraulis japonicus*)	Kerala Coast	Pillai (1964)
Joryma tartoor (Pillai,1954)			
"	*Parastromateus niger*	Parangipettai, Southeast Coast of India	Ravichandran *et al*. (2007)

Continuation of Table I

"	*Ilisha melastoma*	Parangipettai, Southeast Coast of India	Ravichandran *et al*. (2008, 2009, 2010b) Ravichandran (2009)
"	*Carangids malabaricus* (= *Carangoides malabaricus*)	Parangipettai, Southeast Coast of India	Ravichandran *et al*. (2010a)
Agarna tartoor Pillai, 1954 **14**	*Opisthopterus tartoor* (= *Opisthopterus tardoore*)	Travancore	Pillai (1954)
"	*Opisthopterus tardoore*	Kerala Coast, Trivandrum (= Thiruvanathapuram)	Pillai (1964); holotype female, Indian Museum, Calcutta
***Joryma* sp.**	Clupeidae	Parangipettai	Veerapan and Ravichandran (2000)
Mothocya plagulophora (Haller, 1880)	*Hemiramphus far*	Madras (= Chennai), Mandapam Camp, India	Bruce (1986); female, Madras, coll. J.R. Henderson, British Museum of Natural History, BMNH 1892.vii.15: 429-434; female and male, Mandapam Camp, United States National Museum, USNM 216271
"	*Hemiramphus far*	Pazhayar, Southeast Coast of India	Gopalakrishnan *et al*. (2010)
Irona far Nair, 1950 **15**	*Hemiramphus far*	Madras (Chennai)	Nair (1950, 1956); holotype female and allotype male, Indian Museum, Calcutta; paratypes, Zoological Laboratory, Madras
"	*Hemiramphus far*	Travancore	Pillai (1954)
"	*Hemiramphus far*	Madras (= Chennai)	Abraham (1966)
"	*Hemiramphus far*	Southwest Coast of India	Radhakrishnan and Nair (1983)
Mothocya renardi (Bleeker, 1857)	*Strongylura leiura, Tylosurus crocodilus* (= *Tylosurus crocodilus crocodilus*)	Cochin, Palk Bay, Pondichery (= Puducherry), India	Bruce (1986); United States National Museum, respectively USNM 216387, USNM 216219 and USNM 216388
Irona renardi Bleeker, 1857 **16**	not identified	India	Hale (1926)
Irona robusta Nair, 1950 **16**	*Tylosurus leiurus* (= *Strongylura leiura*)	Madras (= Chennai)	Nair (1950, 1956); holotype female and allotype male, Indian Museum, Calcutta; paratypes, Zoological Laboratory, Madras
"	*Tylosurus Lieurus* [sic] (= *Strongylura leiura*)	Madras (= Chennai)	Abraham (1966)
Not *Lironeca puhi* Bowman, 1960 **17**	*Strongylura leiura*	Parangipettai, Southeast Coast of India	Ravichandran (2007)
***Mothocya* sp.**			
Codonophilus sp. **18**	*Hemiramphus* (= *Hyporamphus*) *xanthopterus*	Trivandrum (= Thiruvanathapuram), Southwest Coast of India	Radhakrishnan and Nair (1983)
Nerocila depressa Milne Edwards, 1840			
Nerocila pigmentata Bal et Joshi, 1959 **19**	*Opisthopterus turtoor* (= *Opisthopterus tardoore*)	Bombay Coast (= Mumbai)	Bal and Joshi (1959) Parimala (1984)
Nerocila pigmenta [sic]	not specified	not specified	Joshi and Bal (1960)
Nerocila exocoeti Pillai, 1954	*Exocoetus brachypterus* (= *Parexocoetus brachypterus*)	Travancore	Pillai (1954)

Continuation of Table I

Nerocila longispina Miers, 1880	not identified	Malabar Coast	Miers (1880)
"	*Therapon puta, Otholites ruber* (= *Terapon puta, Otolithes ruber*)	Vedaranyam, Southeastern Coasts of India	Rameshkumar *et al*. (2011); females, Annamalai University, Collection Ravichandran, AUCR C21 and AUCR C22
Nerocila phaiopleura Bleeker, 1857	*Ilisha melastoma*, *Formio niger* (= *Parastromateus niger*)	Kakinada, Tamil Nadu, Bay of Bengal, India	Bruce and Harrison-Nelson (1988); British Museum of Natural History, 29 April 1977 and circa 1982, BMNH 1983: 54.1
"	*Chirocentrus dorab*, *Sardinella longiceps*, *S. sindensis*, *S. brachysoma*, *Dussumieria acuta*, *Thyrssa dussumieri* (= *Thryssa dussumieri*), *T. mystax*, *Scomberomorus guttatus*	Parangipettai Coast	Veerapan and Ravichandran (2000)
"	*Chirocentrus dorab*	Parangipettai Coast	Ravichandran *et al*. (2001)
"	*Stolephorus commersonii* (= *Stolephorus commersonnii*)	Parangipettai Coast	Rajkumar *et al*. (2007)
"	*Arius jella*	Parangipettai Coast	Rajkumar *et al*. (2008)
Nerocila phaeopleura [sic]	*Histiophorus gladius* (= *Istiophorus platypterus*)	Bay of Bengal	Barnard (1936)
"	*Histiophorus gladius* (= *Istiophorus platypterus*)	Madras (= Chennai)	Ramakrishna and Venkata Ramaniah (1978)
"	*Chirocentrus dorab*	Parangipettai Coast, Mudasalodai, Annankovil, Pudupettai	Ravichandran and Ramesh Kumar (2004)
"	*Stolephorus commersonii* (= *Stolephorus commersonnii*)	Parangipettai Coast, India	Rajkumar and Perumal (2004)
"	*Rastrelliger kanagurta*	Parangipettai, Southeast Coast of India	Rameshkumar and Ravichandran (2010a)
Nerocila pigmentata Bal et Joshi, 1959 **20**	*Nematalosa nasus*	Parangipettai, Southeast Coast of India	Parimala (1984)
"	*Amblygaster sirm*	Parangipettai, Southeast Coast of India	Veerapan and Ramanathan (1997)
Nerocila sp. **20**	*Ilisha filigera*, *I. indica* (= *Ilisha melastoma*)	Kutch, West Coast of India	Meenakshisundaram (1965)
Nerocila sp. **20**	*Ilisha melastoma*	Andhra Coast	Seshagiri Rao (1974)
Nerocila sp. **20**	*Sardinella gibbosa, S. albella*	East Coast of India	Ranjitsing and Padmalatha (1997)
Livoneca sp. **20**	*Nemipterus japonicus*	Southwest Coast of India	Radhakrishnan and Nair (1983)
Nerocila poruvae Rameshkumar, Ravichandran et Trilles, 2011	*Trichiurus lepturus, Thryssa mystax*	Vedaranyam, Southeastern Coast of India	Rameshkumar *et al*. (2011); holotype female, Museum National d'Histoire Naturelle, Paris, MNHN 6288; paratypes females, Annamalai University, Collection Ravichandran, AUCR C17 and AUCR C18
Nerocila priacanthusi Kumari, Rao et Shyamasundari, 1987 **21**	*Priacanthus hamrur*	Waltair Coast, Andhra Pradesh, India	Kumari *et al*. (1987); holotype female, Zoology Department, Andhra University, India and Collection of the survey of India, Indian Museum, Calcutta
Nerocila pulicatensis Jayadev Babu et Sanjeeva Raj, 1984	*Plotosus canius, Mystus gulio*	Karimanal shores of the Pulicat Lake	Jayadev Babu and Sanjeeva Raj (1984)

Continuation of Table I

Nerocila recurvispina Schioedte et Meinert, 1881	not identified	Calcutta (= Kolkata)	Schioedte and Meinert (1881); Berlin Museum
Nerocila serra Schioedte et Meinert, 1881	*Arius sagor* *(= Hexanematichthys sagor)*, *Hydrophis obscurus* (sea snake)	off Devi River, Orissa Coast, Vizagapatam Cost, Canjam Coast (Orissa)	Barnard (1936)
"	on several species of shoal fishes	Travancore	Pillai (1954)
Nerocila trivittata Milne Edwards, 1840 **22**	*Arius nenga* (= *Nemapteryx nenga*)	Musamani Lock area of the Pulicat Lake	Jayadev Babu and Sanjeeva Raj (1984)
"	*Otolithus argenteus* (*Otolithes ruber*)	Trivandrum (= Thiruvanathapuram)	Pillai (1960)
Nerocila sigani Bowman et Tareen, 1983	*Formio niger* (= *Parastromateus niger*)	Tamil Nadu, India, Bay of Bengal	Bruce and Harrison-Nelson (1988); Collection S.K. Baru, British Museum of Natural History, BMNH 1983: 51:1
	not specified	Gujurat, India	Kensley (2001)
Nerocila sundaica Bleeker, 1857	not identified	off Godavari (Sacraments mouth), Ganjam Coast	Barnard (1936)
" 23	*Otolithus ruber* (= *Otolithes ruber*), *Therapon jarbua* (= *Terapon jarbua*), *Engraulis mystax* (= *Thryssa mystax*), *Serranus gilberti* (= *Epinephelus quoyanus*), *Pellona indica* (*Ilisha melastoma*), *Sardinella fimbriata*	West Coast of India	Chidambaram and Devidas Menon (1945)
Nerocila trichiura (Miers, 1877)	*Exocoetus volitans*	South of India, 10°20′S, 70°00′E	Bruce and Harrison-Nelson (1988); Collection A. Brown, United States National Museum 128555
Nerocila madrasensis Ramakrishna et Venkata Ramaniah, 1978 **24**	*Hemiramphus* sp.	Madras (= Chennai) (Tamil Nadu)	Ramakrishna and Venkata Ramaniah (1978); holotype female, C 1680/2 and paratype females C 1681/2, collection P. Venkata Ramaniah, Indian Museum, Calcutta
Nerocila sp. **24**	*Parexocoetus mento*	Madras Coast (= Chennai)	Daniel and Rama Rao (1967)
Ourozeuktes bopyroides (Le Sueur, 1814)			
Ourozeuktes owenii Milne Edwards, 1840 [sic] **25**	not identified	Calcutta (= Kolkata)	White (1847); British Museum of Natural History but probably currently lost
Pseudirona laeopsi Pillai, 1964	*Laeops macrophthalmus*	Anjengo (Kerala), Southwest Coast of India	Pillai (1964); holotype female, Indian Museum, Calcutta
Ryukyua circularis (Pillai, 1954)	*Amblygaster sirm*	Parangipettai, Southeast Coast of India	Veerapan and Ramanathan (1997)
Livoneca circularis Pillai, 1954 **26**	*Clupea leiogaster* (= *Amblygaster leiogaster*)	Travancore, Trivandrum (= Thiruvanathapuram)	Pillai (1954, 1964)

Appendix 1. Additional details and remarks

1. *Agarna malayi* was transferred to *Indusa* (lapsus for *Idusa* as in Richardson 1904, 1905) by Pillai (1964). According to Bowman and Tareen (1983), *Agarna malayi* is similar to the type species *Agarna carinata* Schioedte et Meinert, 1884 and should be returned to its original genus. *Indusa ophueseni* was synonymized with *Indusa malayi* by Pillai (1964).
2. Transferred to the genus *Agarna* by Kensley (2001).
3. Synonymy according to Trilles (1994).
4. Synonymized with *Ceratothoa retusa* by Bruce and Bowman (1989).
5. Maybe synonym of *Cymothoa eremita*.
6. Synonymized with *Cymothoa eremita* by Trilles (1994).
7. Maybe synonym of *Cymothoa indica*.
8. According to Panikkar and Aiyar (1937), the specimens were collected "from the Adyar backwaters where the salinity is fairly high (18 to 30 per mile) as well as from about four miles up the river where the water is practically fresh". Maybe the 51 specimens collected by them belonged to several species.
9. Misidentification.
10. Transferred to *Elthusa* by Bruce (1990).
11. Transferred to *Joryma* by Bowman and Tareen (1983).
12. Misidentification.
13. Transferred from *Agarna engraulidis* Barnard, 1936 to *Livoneca engraulidis* by Pillai (1964) and then, transferred to *Joryma engraulidis* by Bowman and Tareen (1983).
14. Transferred to *Joryma* by Bowman and Tareen (1983).
15. Synonymized with *Mothocya plagulophora* by Bruce (1986).
16. Transferred to *Mothocya* and synonymized with *Mothocya renardi* by Bruce (1986).
17. Misidentification. *Livoneca puhi* is a common parasite of *Gymnothorax eurostus*, the most abundant moray eel in the Hawaiian Islands (Bowman 1960). Transferred to *Ichthyoxenus* by Bruce (1990).
18. Transferred to *Mothocya* (present study).
19. Synonymized with *Nerocila depressa* by Bruce and Harrison-Nelson (1988).
20. Provisionally synonymized with *Nerocila phaiopleura* (present study).
21. Most similar to *Nerocila arres.* Maybe a junior synonym.
22. Synonymized with *Nerocila serra* according to Bowman and Tareen (1983) and Trilles (1994).
23. According to Rameshkumar *et al*. (2011), it is likely that some specimens collected by Chidambaram and Devidas Menon (1945) belonged to *Nerocila longispina*.
24. Provisionally synonymized with *Nerocila trichiura* (present study).
25. Synonymy according to Monod (1976).
26. Transferred to the genus *Ryukyua* by Williams and Bunkley-Williams (1994).

Table II. Host-parasite list. All names (fishes and cymothoids) are current valid names

Order	Host fishes family	Host fishes species	Cymothoids species
Aulopiformes	Sinodontidae	*Trachinocephalus myops*	*Cymothoa indica*
Beloniformes	Belonidae	*Strongylura leiura*	*Mothocya renardi*
		Strongylura strongylura	*Cymothoa indica*
		Tylosurus crocodilus crocodilus	*Mothocya renardi*
	Exocoetidae	*Exocoetus volitans*	*Nerocila trichiura*
		Parexocoetus brachypterus	*Nerocila exocoeti*
		Parexocoetus mento	*Nerocila trichiura*
	Hemiramphidae	*Hemiramphus far*	*Ceratothoa retusa*
			Mothocya plagulophora
		Hemiramphus sp.	*Nerocila trichiura*
		Hyporamphus xanthopterus	*Mothocya* sp.
Clupeiformes	Chirocentridae	*Chirocentrus dorab*	*Cymothoa eremita*
			Nerocila phaiopleura
	Clupeidae	*Amblygaster leiogaster*	*Ryukyua circularis*
		Amblygaster sirm	*Nerocila phaiopleura*
			Ryukyua circularis
		Anodontostoma chacunda	*Agarna pustulosa*
		Dussumieria acuta	*Nerocila phaiopleura*
		Escualosa thoracata	*Agarna* sp.
		Hilsa kelee	*Joryma hilsae*
		Nematolosa nasus	*Agarna malayi*
			Cymothoa krishnai
			Nerocila phaiopleura
		Opisthopterus tardoore	*Joryma tartoor*
			Nerocila depressa
		Sardinella albella	*Nerocila phaiopleura*
		Sardinella brachysoma	*Nerocila phaiopleura*

Continuation of Table II

		Sardinella fimbriata	*Nerocila sundaica*
		Sardinella gibbosa	*Nerocila phaiopleura*
		Sardinella longiceps	*Anilocra dimidiata*
			Nerocila phaiopleura
		Sardinella sindensis	*Nerocila phaiopleura*
		Sardinella sp.	*Joryma hilsae*
	Engraulidae	*Engraulis japonicus*	*Joryma engraulidis*
		Stolephorus commersonnii	*Elthusa raynaudii*
			Joryma hilsae
			Nerocila phaiopleura
		Thryssa dussumieri	*Joryma engraulidis*
			Nerocila phaiopleura
		Thryssa mystax	*Nerocila phaiopleura*
			Nerocila poruvae
			Nerocila sundaica
		Thryssa setirostris	*Joryma engraulidis*
	Pristigasteridae	*Ilisha filigera*	*Nerocila phaiopleura*
		Ilisha melastoma	*Anilocra leptosoma*
			Elthusa raynaudii
			Joryma brachysoma
			Joryma tartoor
			Nerocila phaiopleura
			Nerocila sundaica
Gonorynchiformes	Chanidae	*Chanos chanos*	*Cymothoa krishnai*
Mugiliformes	Mugilidae	*Valamugil cunnesius*	*Agarna malayi*
		Moolgarda seheli	*Cymothoa eremita*
Perciformes	Carangidae	*Carangoides malabaricus*	*Anilocra leptosoma*
			Joryma tartoor
		Parastromateus niger	*Cymothoa eremita*
			Joryma tartoor
			Nerocila phaiopleura
			Nerocila sigani
	Cichlidae	*Etroplus maculatus*	*Cymothoa indica*
		Etroplus suratensis	*Cymothoa indica*
			Cymothoa krishnai
		Oreochromis mossambicus	*Cymothoid* sp.
	Gobiidae	*Glossogobius giuris*	*Agarna* sp.
			Cymothoa indica
		Oligolepis acutipennis	*Agarna* sp.
		Oxyurichthys microlepis	*Cymothoa indica*
		Psammogobius biocellatus	*Agarna* sp.
		Stigmatogobius minima	*Cymothoa indica*
	Istiophoridae	*Istiophorus platypterus*	*Nerocila phaiopleura*
	Lactariidae	*Lactarius lactarius*	*Anilocra dimidiata*
	Latidae	*Lates calcarifer*	*Cymothoa indica*
	Leiognathidae	*Leiognathus* sp.	*Anilocra dimidiata*
	Lutjanidae	*Lutjanus johnii*	*Cymothoa krishnai*
		Lutjanus argentimaculatus	*Cymothoa krishnai*
	Nemipteridae	*Nemipterus japonicus*	*Nerocila phaiopleura*
	Polynemidae	*Eleutheronema tetradactylum*	*Anilocra longicauda*
			Cymothoa krishnai
	Priacanthidae	*Priacanthus hamrur*	*Nerocila priacanthusi*
	Sciaenidae	*Otolithes ruber*	*Nerocila longispina*
			Nerocila serra
			Nerocila sundaica
	Scombridae	*Rastrelliger kanagurta*	*Joryma brachysoma*
			Nerocila phaiopleura
		Scomberomorus guttatus	*Nerocila phaiopleura*
	Serranidae	*Epinephelus quoyanus*	*Nerocila sundaica*
	Sphyraenidae	*Sphyraena jello*	*Cymothoa assymetrica*
		Sphyraena obtusata	*Amblycephalon indicus*
			Cymothoa indica
	Stromateidae	*Pampus cinereus*	*Cymothoa cinerea*
		Peprilus paru	*Cymothoa eremita*

Continuation of Table II

	Terapontidae	*Terapon jarbua*	*Nerocila sundaica*
		Terapon puta	*Nerocila longispina*
	Trichiuridae	*Trichiurus lepturus*	*Nerocila poruvae*
Pleuronectiformes	Bothidae	*Laeops macrophthalmus*	*Pseudirona laeopsi*
	Samaridae	*Samaris cristatus*	*Elthusa samariscii*
Scorpaeniformes	Platycephalidae	*Platycephalus indicus*	*Cymothoa krishnai*
Siluriformes	Ariidae	*Arius jella*	*Nerocila phaiopleura*
		Hexanematichthys sagor	*Nerocila serra*
		Nemapteryx nenga	*Cymothoa krishnai*
			Nerocila serra
	Bagridae	*Mystus gulio*	*Cymothoa indica*
			Cymothoa krishnai
			Nerocila pulicatensis
	Plotosidae	*Plotosus canius*	*Nerocila pulicatensis*
Unidentified and Miscellaneous			
Pisces	Clupeidae	Unidentified	*Joryma* sp.
	Unidentified	Unidentified	*Nerocila recurvispina*
	Unidentified	Unidentified	*Ourozeuktes bopyroides*
Reptilia	Hydrophiidae	*Hydrophis obscurus*	*Nerocila serra*

Table III. Specific distribution of parasite species in host fishes

Branchial parasites	Buccal parasites	Body surface parasites
Agarna malayi	*Ceratothoa imbricata*	*Amblycephalon indicus*
Agarna pustulosa	*Ceratothoa retusa*	*Anilocra leptosoma*
Elthusa raynaudii	*Cymothoa assymetrica*	*Anilocra longicauda*
Elthusa samariscii	*Cymothoa cinerea*	*Anilocra dimidiata*
Joryma brachysoma	*Cymothoa eremita*	*Nerocila depressa*
Joryma engraulidis	*Cymothoa krishnai*	*Nerocila exocoeti*
Joryma hilsae	*Cymotha indica*	*Nerocila phaeopleura*
Joryma tartoor		*Nerocila poruvae*
Mothocya plagulophora		*Nerocila longispina*
Mothocya renardi		*Nerocila priacanthusi*
Pseudirona laeopsi		*Nerocila pulicatensis*
Ryukyua circularis		*Nerocila recurvispina*
		Nerocila serra
		Nerocila sigani
		Nerocila sundaica
		Nerocila trichiura
		Ourozeuktes bopyroides

To know accurately the Indian fauna of Cymothoidae, adequate examinations in sufficient localities throughout the country are still missing. Indeed, until now, most reports on Indian cymothoids have focused on the Kerala and Tamil Nadu states, respectively South West Coast and South East Coast of India (Fig. 1). There are only few studies about the remaining regions. This was certainly not due to low diversity of cymothoids in these areas but rather to the lack of researchers working in this topic.

Indian cymothoids already reported were collected from 74 host species belonging to 34 families. Clupeiformes species belonging to the families Chirocentridae, Engraulidae, Pristigasteridae and particularly Clupeidae, are more of them with at least 21 species. It will be useful that future studies deal with more species from the remaining families.

Several host fish are infested by a single species of Cymothoidae. Some other fishes are parasitized by two or more species of parasitic isopods as follows: *Ilisha melastoma* (6), *Parastromateus niger* (4), *Mystus gulio*, *Nematalosa nasus*, *Otolithes ruber*, *Stolephorus commersonnii* and *Thryssa mystax* (3), *Amblygaster sirm*, *Carangoides malabaricus*, *Chirocentrus dorab*, *Etroplus suratensis*, *Glossogobius giuris*, *Hemiramphus far*, *Opisthopterus tardoore*, *Rastrelliger kanagurta*, *Sardinella longiceps*, *Sphyraena obtusata* and *Thryssa dussumieri* (2). Some cymothoid species characterized by an oïoxenic parasitic specificity were found on a sin-

gle host fish. Many other species characterized by a euryxenic specificity were collected on several host fishes species. However, in some cases, it will be useful to check identifications of parasites and hosts by modern standards to avoid mistakes and wrong relationships.

Indian cymothoids were collected from the body surface, the branchial chamber and the buccal cavity of the host fishes. A maximum of species were until now found on the body surface (17), 12 were attached in the branchial chamber and only 7 in the buccal cavity. Some buccal or branchial parasites were often reported moving out of their normal localization, particularly after the capture of host. However, curious localisations were sometimes observed for some species such as for instance for *Nerocila phaiopleura* (as *Nerocila pigmentata*) reported by Parimala (1984) attached inside the opercular chamber of *Nematalosa nasus*. In future, it will be necessary to report exactly the standard localization of the collected cymothoids.

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