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NOTE

Cymothoa indica (Crustacea, Isopoda, Cymothoidae) parasitizes the cultured larvae of the Asian seabass *Lates calcarifer* under laboratory conditions

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ABSTRACT: Parasitic disease in fishes is one of the most important factors limiting aquaculture production and its economic viability. *Cymothoa indica*, a cymothoid isopod, is reported here for the first time parasitizing cultured larvae of the Asian seabass *Lates calcarifer* in India. Fourteen-day-old *L. calcarifer* larvae of mean weight 8.73 ± 0.03 mg were fed with wild zooplankton in the laboratory. On Day 14 of rearing, larvae were found parasitized by cymothoids. Infected larvae reached a mean (± SE) weight of 98.86 ± 0.30 mg, while uninfected specimens weighed 117 ± 0.43 mg at the end of the experiment (Day 21). *C. indica* occurred in the branchial and anterodorsal regions of infected fish, where resultant skin lesions were red, hemorrhagic, without scales and with abundant secreted mucus. The cumulative mortality over the 3 wk period was 16.54%. These parasites are transferred to the host via the zooplankton used as food; this could easily be overcome, either by filtering wild zooplankton to remove the infectious swimming larvae of *C. indica* or by using cultured copepods.

KEY WORDS: Cymothoid · Isopod · Parasite · *Cymothoa indica* · *Lates calcarifer* · Larvae · India

INTRODUCTION

Parasitic diseases in fishes seriously limit aquaculture production and its economic viability. Knowledge of fish diseases and parasites is essential for successful aquaculture, particularly in a country like India with long and highly productive coastal waters. However, the tropical coastal and brackish waters, which likely contain many unknown parasites and pathogens, are poorly studied.

Many diverse animal species ranging from protozoans to crustaceans, have important economic impacts as parasites of finfish and shellfish (Reichenbach-Klinke et al. 1968). The pathological conditions resulting from parasitic infection often reach a significant extent under both natural and controlled conditions in aquaculture. Loss of weight, loss of fat content and changes in the water content of various tissues affect growth, metabolism, reproduction and visceral mass, and also result in abnormal behavior of the host (Lester & Roubal 1995).

The commercial aspects of harvesting fishes and crustaceans are greatly influenced by the presence of parasitic isopods on these hosts. As fish and decapod farming become more widespread, the effects of parasitic isopods should become more apparent (Kabata 1984). Loss of weight reduces the volume of the catch without reducing the number of fish; poor quality fish are less acceptable to the customer (Sinderman 1958, Sparks 1972, Murchalam 1980), resulting in economic losses and reduced fish landings in many coastal waters.

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In most cases, parasitic isopods are blood feeders and, thus, nutritionally dependent on their hosts (Pillai 1958, Trilles 1969, Bunkley-Williams & Williams 1998). Cymothoids occur on the body, in the mouth or in the branchial cavity of the host fish; their position is thus often highly specific (Trilles 1969). They cause several pathogenic effects upon the organs and growth rate of the host (Kroger & Guthrie 1972, Sadzikowski & Wallace 1974, Lanzing & O'Connor 1975, Brusca 1978, Romestand 1979, Romestand & Trilles 1977a,b, 1979, Bragoni et al. 1983, 1984, Kabata 1984, Moser & Sakanari 1985, Segal 1987, Thatcher 1988, 2000, Lobos 1994, Adlard & Lester 1995, Lester & Roubal 1995, Sievers et al. 1996, Sarusic 1999, Papapanagiotou et al. 1999, Papapanagiotou & Trilles 2001, Wright et al. 2001, Horton & Okamura 2001, 2003, Östlund-Nilsson et al. 2005).

Rapid increases in infections such as these are often linked to the outbreak of new host–parasite associations, which may result from hosts being reared in new geographical areas or from indigenous hosts being reared under different environmental conditions (Bragoni et al. 1983, 1984, Williams & Bunkley-Williams 1994, Kent 2000, Papapanagiotou & Trilles 2001). The aquaculture system provides a place in which several stages of host and a large sample of both parasitized and unparasitized hosts are readily available. Studies of parasitic cymothoids in aquaculture systems are thus important not only for aquaculture development, but also as studies about interactions between the parasite and wild fishes.

Here, *Cymothoa indica* (Schioedte and Meinert, 1884), an isopod of the family Cymothoidae, is reported for the first time parasitizing cultured larvae of the Asian seabass *Lates calcarifer* (Bloch, 1790) (Perciformes, Centropomidae) reared in an Indian laboratory (Fig. 1).

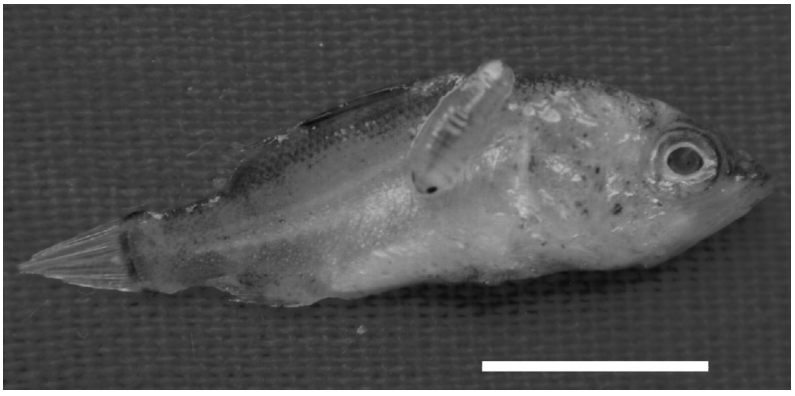

Fig. 1. *Cymothoa indica* settled on the body surface of the cultured seabass *Lates calcarifer*. Scale bar = 50 mm

MATERIALS AND METHODS

Larvae of seabass *Lates calcarifer*, aged 14 d and cultured in the finfish hatchery of the Central Institute of Brackishwater Aquaculture, Chennai, were carefully transported to the laboratory of the Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai, India. The larvae were acclimatized to seawater with the following ranges: temperature, 24 to 28°C; dissolved oxygen, 6.8 to 7.5 ml l^{-1}; salinity, 32 to 33 PSU; pH, 7.8 to 8.2. Growth studies were performed over 21 d in polyethylene vessels (Decoplast) (50 l) filled with seawater that was changed daily. In each vessel, we distributed 50 larvae of *L. calcarifer* with a mean (± SE) initial body length and initial weight of 6.6 ± 0.22 mm and 8.73 ± 0.03 mg, respectively. The cultured specimens were fed with wild zooplankton, especially copepods, given in 3 equal rations daily at 07:30, 14:00 and 20:30 h.

RESULTS

On Day 14 of rearing, the *Lates calcerifer* larvae (28 d old; mean [± SE] 15 ± 0. 02 mm long) were found parasitized by cymothoids. At the end of the experiment (i.e. after 21 d), the cultured specimens of seabass (35 d old) suffered serious mortalities; infected larvae reached a mean body length and weight of 37.13 ± 0.05 mm and 98.86 ± 0.30 mg, respectively, while for uninfected specimens these were 60.18 + 0.03 mm and 134.27 ± 0.01 mg, respectively. The dead or moribund seabass were collected; many parasitic larvae were removed from the body and identified as *Cymothoa indica*, following the description of Veerapan & Ravichandran (2000) (Fig. 2).

Infections extended over 21 d, with a cumulative mortality of 16.54%. Parasitic larvae settle particularly in the branchial and anterodorsal region of the host fish, where red, hemorrhagic skin lesions, without scales and with abundant secreted mucus, were observed. The usual clinical signs include erratic swimming behavior, decrease in growth and loss of weight, with death resulting from severe anaemia and anorexia (Romestand & Trilles 1977a, Horton & Okamura 2003) and osmotic stress (Papapanagiotou et al. 1999). Secondary infections are quite likely, although with reference to some species of *Riggia* and *Artystone*, Thatcher (2000) suggested dubitatively that the isopods secrete an antibiotic substance which inhibits the growth of bacteria and fungi.

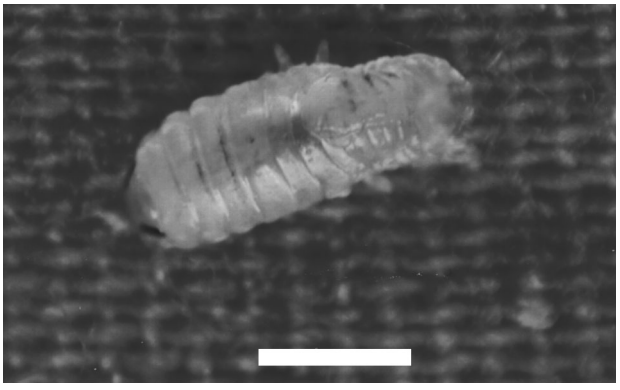

Fig. 2. A larva of *Cymothoa indica;* dorsal view. Scale bar = 0.75 mm

DISCUSSION

Prior to this study, *Nematolosa nasus* (Clupeiformes, Clupeidae) and *Siganus javus* (Perciformes, Siganidae) fed with wild food were found parasitized by *Cymothoa indica* (M. Rajkumar pers. obs.). Veerapan & Ravichandran (2000) reported a similar parasitic infection of wild populations of *Sphyraena obtusata* (Perciformes, Sphyraenidae) and *Trachinocephalus myops* (Aulopiformes, Synodontidae). Rajkumar et al. (2004) observed a severe infection by *Cymothoa indica* in the buccal cavity of the spot-tail needlefish *Strongylura strongylura* (Beloniformes, Belonidae). Recently, this isopod has been reported parasitizing the long-whiskered catfish *Mystus gulio* (Siluriformes, Bagridae) cultured in experimental cages in India (Rajkumar et al. 2005). Therefore, no other reports about cymothoid infection of *L. calcarifer* and on such parasitic infection of fish larvae in general were available at the time of this study.

Under culture conditions, modified specificity is exhibited by some parasites (isopods, copepods, monogeneans); these parasites are never present on wild populations of host species, whereas reared individuals of the same species are infected (Raibaut et al. 1980, Euzet & Raibaut 1985, Cabral & Raibaut 1987, Cassier et al. 1998). Optimal management of the system (low stocking density, chemical and physical surveillance of sites, optimum farming practices) should be applied to reduce handling stress and unsuitable conditions that inevitably increase the susceptibility to pathogens and induce immunosuppression. It is common knowledge in the aquaculture industry that under stressful conditions ubiquitous parasites become major pathogens.

The first report of a cymothoid infection in an aquaculture system is that of *Nerocila orbignyi* infecting the seabass *Dicentrarchus labrax* (Perciformes, Moronidae) reared in Diana pond in Corsica (Bragoni et al. 1983, 1984). Subsequently, several species were found to infect many cultivable fishes, inducing severe mortalities and consequent economic losses in commercial farming facilities (Bragoni et al. 1983, 1984, Roa 1992, Cassier et al. 1998, Papapanagiotou et al. 1999, Papapanagiotou & Trilles 2001, Rajkumar et al. 2005).

Several management practices to control the parasitic cymothoids on cultured fishes have been discussed (Bragoni et al. 1983, 1984, Roa 1992, Papapanagiotou et al. 1999, Papapanagiotou & Trilles 2001, Rajkumar et al. 2005). Parasites are transferred to cultured specimens from wild populations of fishes. Thus, for example, transfer from wild mullet to cultured seabass *Dicentrarchus labrax* is possible under some conditions, as reported by Bragoni et al. (1983, 1984). In the case of *Cymothoa indica* parasitizing cultured larvae of *Lates calcarifer*, infectious larvae are certainly transferred to the Asian seabass through wild zooplankton used as food. Therefore, in place of wild zooplankton, it is desirable and recommended to use cultured copepods to prevent parasites from reaching the larval culture system in this way. Alternatively, wild zooplankton can be filtered through a net with a mesh size of 500 µm to retain the infectious swimming larvae of *C. indica*, which are more than 1.5 mm long and 600 µm wide.

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