Parasites as indicators of feeding behaviour in gobies

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Abstract

In the present study the appearance of some unusual parasites of gobies, *Pomatoschistus microps* and *P. minutus,* is discussed. The occurrence of plerocercoids of *Ligula intestinalis* in the body cavity of these fish and of *Proteocephalus* sp., excysted metacercariae and adult of *Timoniella* spp., excysted metacercariae of *Bucephalus baeri*, the excysted metacercariae of *Podocotyle atomon* and progenetic adult of *Prosorhynchoides gracilescens* in their gut indicate host anadromous, cannibalistic and scavenging habits.

Introduction

Parasites have been used as a biological indicators, tags or markers to provide information on their fish host population biology, migration, diet and phylogeny (Kabata, 1963; MacKenzie, 1980; Bouillon & Dempson, 1989; Williams *et al*., 1992). Parasites of the common goby, *Pomatoschistus microps*, and the sand goby, *P. minutus*, are well studied (see Malek, 1997). The comparatively high host and / or site specificity, exhibited by some parasites of *P. microps* and *P. minutus* indicates that they can be used as tags for host identification (Malek, 1997). In the present study, some unusual parasites of *P. microps* and *P. minutus* are used as indicators of host behaviour.

Materials and methods

Specimens (798) of *P. microps* and *P. minutus* were taken from two sites in South-west Wales. Specimens of *P. microps* were caught in the estuary at Pennard Pill, Three Cliffs, Gower Peninsula but both *P. microps* and *P. minutus* were caught from an open coast location at West Cross, Swansea Bay.

Fish were caught by pushnet, transferred to tanks of seawater and maintained alive for few days. Skin, gills, body cavity and visceral organs were examined for helminth parasites. Most parasites were identified as living specimens which were placed on a microscopic slide in a drop of seawater covered with a cover slip supported by petroleum jelly to prevent damage. Identification of encysted metacercariae (Digenea) was aided by excystment, in 1% (w/v) pepsin at pH 5 for 30 minutes followed by 1 % (w/v) trypsin at pH 9 at 38°C (McDowall, 1985), or in diluted seawater (30 - 60%) at 38°C. Similarly to Zaben (1988), the best results were obtained at a 40% dilution of seawater at 38°C. Some specimens were fixed at 70°C in FAA (formalin-acetic acid-alcohol). Sometimes adult digeneans and metacercariae were stained by Gower's carmine followed by fast red salt B or catecol, washed in acid alcohol, dehydrated, cleared in histoclear and mounted in DPX to aid identification, but usually examination of living material was adequate. Nematoda were cleared in lactophenol and mounted in glycerine jelly for identification.

Parasite species	Duration of captivity (days)	No. parasites per fish	No. infected fish
Excysted metacercariae of *Timoniella* sp. in the gut	14-25 (4 in one case)	1-4	6
Adult Timoniella sp. in the gut	13	1	1
Excysted metacercariae of *Podocotyle atomon*	1-16	1-8	22

Table1. Unusual gut parasites of *Pomatoschistus microps* and *P. minutus*, possibly infected during captivity.

Results

Eighteen species of parasites were found in three populations of gobies. These included: *Cryptocotyle concavum*, *C. lingua*, *C. jejuna*, *Timoniella* spp., *Bucephalus baeri, Labratrema minimus*, *Prosorhynchoides gracilescens*, *Lecithaster gibbosus*, *Podocotyle atomon, Paratimonia gobii* (Digenea); *Bothriocephalus scropii*, *Acanthobothrium* sp., *Echeneibothrium* sp., *Proteocephalus* sp. and *Ligula intestinalis* (Cestoda); and *Hysterothylacium* sp., *Dichelyne minutus* and acuariid larvae (Nematoda).

Unusual parasites found in *P. minutus* and *P. microps* during the present study include the plerocercoid of *Ligula intestinalis* in the body cavity together with *Proteocephalus* sp., the excysted metacercariae and adult of *Timoniella* spp. (Table 1) the excysted metacercariae of *Bucephalus baeri*, the excysted metacercariae of *Podocotyle atomon* (Table 1) and the progenetic adult of *Prosorhynchoides gracilescens* in the gut.

Discussion

Only *Ligula intestinalis* and *Proteocephalus* sp. have been previously recorded from gobies (Markowski, 1935, Koter, 1962; Chappell & Owen, 1969; Gharbawi, 1994; Claridge, et al. 1985; Mustafa, 1996)

The metacercariae of *Prosorhynchoides gracilescens* are very specific to the brain and spinal nerves of gadoid fish (Matthews, 1974) and the adult stage to the gut of the angler fish (Halton & Johnston, 1982a). The presence of the progenetic adult of *P. gracilescens* in the gut of *P. microps* and *P. minutus* from West Cross could be due to the scavenging behaviour of gobies, the metacercariae of this parasite being taken from the brain of a dead gadoid fish. After infection the metacercariae develops into the progenetic adult. Since the goby appears not to be a suitable final host, full development of adult *P. gracilescens* is not possible and progenetic adults are produced. However, Halton & Johnston (1982b) observed some progenetic egg producing *P. gracilescens* in the mature final host.

The appearance of excysted metacercariae and progenetic adults of *Timoniella* spp. in the gut of captive *P. microps* and excysted metacercariae of *Bucephaloides baeri* in the gut of captive *P. minutus* are evidence for the cannibalistic behaviour of these fish. Encysted metacercariae of these parasites have been found abundantly in the muscles of gobies (Malek, 1997). The gobies in the aquarium were observed to feed on weakened or moribund conspecific specimens. Living gobies with missing flesh, including tails, were frequently observed in the aquarium.

The occurrence of excysted metacercariae of *P. atomon* suggests that (i) the parasites may not have enough time in the gut to develop into adults or (ii) there are not enough nutri-

ents in the gut of captive gobies for metacercariae to develop to the adult stage. *P. atomon* is one of the most common marine fish parasites, with a very long list of hosts including gobies (Zander, 1993; Mustafa, 1996). Experimental infection by Hunninen & Cable (1943) indicated that adults develop from metacercariae in final hosts within six days post-infection. Therefore, those fish which were kept in the aquarium for over 10 days (Table 1) should have adult parasites if the metacercariae were acquired from amphipods eaten prior to capture. The most likely explanation for lack of the development seems to be the shortage of nourishment in the gut of captive fish.

Proteocephalus sp. and *L. intestinalis* are normally parasites of freshwater fish and they use freshwater copepods as intermediate hosts. Bailey *et al*. (1989) suggested that *Proteocephalus* sp. is a potentially useful indicator in those fish which migrate from freshwater into the sea because of the long-term survival of this parasite. Thus, presence of these parasites in *P. microps* and *P. minutus* from West Cross indicated that these fish might occasionally migrate into the freshwater streams which run into the Bay. The alternative possibility, that the copepod hosts migrate from freshwater into the sea or get washed downstream seems less likely.

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