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Short report on the effect of a parasitic isopod on the reproductive performance of a shrimp

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Abstract

The present work studied the degree of inhibition caused by the bopyrid isopod *Eophryxus lysmatae* (Caroli, 1930 [Caroli, E., 1930. Notizia di tre specie nuove ed una poco nota di Bopiridi addominali, parassiti di Caridei del golfo di Napoli. (Contributo alla conoscenza del genere Phrixus Rathke). Boll. Soc. Nat. Napoli 41, 258–269]), an abdominal parasite, on the reproductive performance of its host, the protandric simultaneous hermaphrodite shrimp *Lysmata seticaudata* (Risso, 1816). Parasitized shrimp (PS) was not able to produce embryos, although they could successfully fertilise the eggs of unparasitized shrimp (US). All US paired with PS were able to fertilise eggs when paired with other US. The average number of larvae (±S.D.) produced by US shrimp paired with US and PS (344±27 and 346±23, respectively) was not significantly different (p=0.73). The average intermolt period duration (±S.D.) for US and PS (10±1.2 and 11±0.8 days, respectively) was not significantly different (p=0.82), with bopyrid parasites molting synchronously with their host. No PS lost its parasite during ecdysis. Although only three parasitized shrimp were used in the present work, parasitic castration induced by *E. lysmatae* seems to only affect the female sexual system of the simultaneous hermaphrodite *L. seticaudata*, and therefore parasite-induced "reproductive death" does not occur in this species as in other gonochoric and sequencial hermaphroditic caridean shrimp. Nutritional drain and disruption of endocrine mechanisms possibly caused by the bopyrid parasite are discussed.

Keywords: Bopyrid ispods; *Eophryxus lysmatae*; Hermaphroditism; *Lysmata seticaudata*; Parasitic castration

1. Introduction

Bopyrid isopods are known to be holoparasites, with their definitive hosts being decapod crustaceans (Markham, 1986). Bopyrids are known to cause parasitic castration, which involves two associated, but according O'Brien and Van Wyk (1985) perhaps

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distinct, phenomena: gonads of female host do not mature and parasitized males are feminised. Despite the variable degree of inhibition that these two phenomena cause on host reproductive potential (Van Wyk, 1982), it always suffers a substantial reduction and generally causes the "reproductive death" of the host. Apart the preliminary studies by Fiedler (2000), the works addressing parasitic castration in decapods have only dealt with gonochoric species.

Eophryxus lysmatae (Caroli, 1930) is a member of the subfamily Hemiarthrinae, a group of bopyrids characterized by having caridean shrimp as their main host and by being abdominal parasites (Markham, 1986). This species is known to occur in the Mediterranean and only parasitizes the Monaco shrimp *Lysmata seticaudata* (Risso, 1816) (Caroli, 1930). Bauer and Holt (1998) and Fiedler (1998) demonstrated the existence of a unique sexual system among decapod crustaceans in the genus *Lysmata*, protandric simultaneous hermaphroditism. The existence of this puzzling sexual system has been recently confirmed in *L. seticaudata* by Udekem d'Acoz (2003), validating the idea that this may be a common feature to all members of the genus (Bauer, 2000).

The objective of the present work is to study the degree of inhibition caused by parasitic castration by the bopyrid isopod *E. lysmatae* in the reproductive performance of its host, the protandric simultaneous hermaphrodite caridean shrimp *L. seticaudata*.

2. Materials and methods

Monaco shrimp were collected during spring tides at Cape Raso, 30 km west of Lisbon, Portugal, in the month of May of 2001 using baited traps described by Calado and Narciso (2004). The single three specimens of *L. seticaudata* (out of 680 captured) carrying bopyrid isopods were isolated. Nine unparasitized shrimp with total length (TL, distance between the rostrum anterior end and the telson posterior edge) similar to that of parasitized shrimp (47±2 mm) were also isolated.

The selected 12 shrimp were kept in six 30 l aquariums at 23 °C, 35‰ salinity and with a photoperiod of 12 h light:12 h dark. Shrimp were daily fed ad libitum minced shrimp, mussel and fish roe.

The same 12 shrimp were used sequentially in the four trials. In trial 1, each parasitized shrimp (PS) was randomly paired with an unparasitized shrimp (US), the remaining six unparasitized shrimp were randomly divided into three pairs, resulting in three PS/US and three US/US pairs. In trial 2, each PS was paired with a shrimp used in the three US/US pairs in trial 1, with the remaining US paired in three US/US pairs. In trial 3, the three US not previously paired with PS were each paired with a PS, with the remaining US paired in three US/US pairs. In trial 4, each PS was sequentially paired with each other (see Table 1). The reproductive performance of each shrimp was evaluated by counting the number of hatched larvae from the first three embryo batches produced after pairing.

The molts of PS and US were collected during all trials for morphological comparison and the average intermolt period duration of each shrimp recorded. A *t*-test was used to compare the intermolt period duration and the number of larvae produced by shrimp paired with PS and US. The results were considered statistically significant at the 0.05 probability level (Zar, 1996).

After performing the reproductive trials, parasitized shrimp were stored in ethanol for morpho-

Table 1
Random pairs of *Lysmata seticaudata* shrimp carrying the bopyrid isopod *Eophryxus lysmatae* (PS) and unparasitized shrimp (US) formed during trials to evaluate their reproductive performance

	Randomly formed shrimp pairs					
Trial 1	PS_1	PS_2	PS_3	US_5	US_3	US_2
	0	0	0	386±42	352±7	321±22
	US_4	US_1	US_8	US_6	US_7	US_9
	333±30	348±12	304±5	321±14	331±24	370±14
Trial 2	PS_1	PS_2	PS_3	US_1	US_2	US_8
	0	0	0	304(±11)	352±9	372±21
	US_5	US_3	US_6	US_7	US_9	US_4
	330±12	384±21	363±19	341±24	326±27	354±17
Trial 3	PS_1	PS_2	PS_3	US_1	US_3	US_5
	0	0	0	302±14	381±41	392±24
	US_9	US_2	US_7	US_4	US_6	US_8
	347±42	364±23	348±10	334±23	339±12	325±36
Trial 4	PS_1		PS_1		PS_2	
	0		0		0	
	PS_2		PS_3		PS_3	
	0		0		0	

Values are averages (±S.D.) of three batches of larvae produced by each shrimp.