



ASSOCIATION BETWEEN THE ZEBRA CRAB *ZEBRIDA ADAMSII* WHITE, 1847 AND THE COLLECTOR SEA URCHIN *TRIPNEUSTES GRATILLA* (LINNAEUS, 1758): REPORT FROM KERALA COAST, INDIA

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Abstract: *Zebrida adamsii* White, 1847, the zebra crab of the family Pilumnidae is reported for the first time from a new host, the collector sea urchin *Tripneustes gratilla* (Linnaeus, 1758), along the rocky shores of Kovalam, Kerala State, India.

Key words: Pilumnidae, zebra crab, association, symbiosis, new host

Many species of decapod crustaceans form symbiotic relationships with a diversity of echinoderm hosts (Williams, 1984; Hendler *et al.*, 1995). Most of these crustacean symbionts spend a considerable part of their lives on their hosts, with some remaining on the same host throughout their lives (Kropp, 1987; Hamel *et al.*, 1999) and others frequently moving between different host individuals (Bell, 1984; Patton, Patton and Barnes, 1985; Thiel *et al.*, 2003). The intraspecific association pattern of crustaceans on their hosts is likely to depend on the host size, morphology, distribution and abundance (Thiel and Baeza, 2001).

All eumedonines are considered as obligate symbionts of Indo-West Pacific echinoderms (Castro, 2015). The symbiotic crab *Zebrida adamsii* White, 1847 (Eumedoninae: Pilumnidae) has been associated with 10 echinoid species from different parts of the world: *Diadema setosum*, *Tripneustes gratilla* (cf. Yamamoto, 1973; Suzuki and Takeda, 1974), *Toxopneustes elegans*, and *Asthenosolma ijimai* (cf. Doki, 1972), *Salmacis virgulata* (cf. Daniel and Krishnan, 1979), *Toxopneustes pileolus* (cf. Saravanan *et al.*, 2015), *T. pileolus* and *Salmacis bicolor* (cf. Rathbun, 1910), *Anthocidaris crassipina* (cf. Urita, 1926), *Acanthocidaris* sp. (cf. Balss, 1956) and *Pseudocentrotus depressus* (cf. Rathbun, 1910; Urita,

1926a; Balss, 1956; Doki, 1972; Yamamoto, 1973; Suzuki and Takeda, 1974). Henderson (1893), Alcock (1895) and Laurie (1906) are the earliest to report *Zebrida adamsii* from Indian waters, with subsequent record by Daniel and Krishnan (1979), Dev Roy & Nandi (2007), Kathirvel & Gokul (2010) and Saravanan *et al.* (2015). *Zebrida adamsii* was reported from the Kerala coast by Alcock (1895) and Dev Roy (2013) but the host species was not mentioned.

Zebrida adamsii has a wide Indo-West Pacific distribution, occurring throughout the Indo-West Pacific (Ng and Chia, 1999). Three species of *Zebrida* were recognized by Ng and Chia (1999): *Zebrida adamsii* White, 1847, *Z. longispina* Haswell, 1880 (from Queensland and Western Australia) and *Z. brevicarinata* (from Western Australia), all being obligate symbionts on sea urchins. The three species are easily distinguished. Following Chia and Ng (1999), the rostrum of *Z. adamsii* is sharp and of medium length, the obliquely directed lateral carapace tooth is of medium length, there is a very small lamelli form expansion on the anterior margin of eyestalk, the merus and carpus of the first to fourth ambulatory legs have spines which are medium in length, there is no spine on the propodus of the ambulatory legs. In *Z. brevicarinata*, the tip of the rostrum is rounded and short, the lateral carapace

tooth is short and flat, there is no lamelliform expansion on the anterior margin of eyestalk, the meru and carpus of the first to third ambulatory legs and the merus of the last ambulatory leg lacks spines; while in *Z. longispina*, the rostrum is very long and sharp, the lateral carapace tooth is long, there is a large lamelliform expansion near the anterior margin of the eyestalk, and there are very long spines on the merus and carpus of the first to fourth ambulatory legs and the propodus of the ambulatory legs also have distinct spines (see Ng and Chia, 1999).

The present paper reports the presence of *Zebrida adamsii* from the urchin *Tripneustes gratilla* [(Linnaeus, 1758), family: Toxopneustidae] for the first time from India. From India, *Z. adamsii* has previously been reported from *S. virgulata* [L. Agassiz in L. Agassiz & Desor, 1846, family: Temnopleuridae] along Madras sea coast (Daniel and Krishnan, 1979) and *T. pileolus* [(Lamarck, 1816), family: Toxopneustidae] from the Gulf of Mannar (Saravanan *et al.*, 2015).

The sea urchins were collected from the rocky shore areas of Kovalam, Thiruvananthapuram, on the southwest coast of India (08°39'N; 76°97'E) during February 2016. A total of 15 specimens of *T. gratilla* were collected from a depth of 2 meters, out of which one of the sea urchin harboured a male *Zebrida adamsii* on its aboral side.

Zebrida adamsii has an unusual appearance, with its long spines and distinctive coloration of longitudinal stripes of liver colour on cream, resembling the spines of *T. gratilla*, their present host. The crab's appendages were holding onto to the spines of the urchin when collected. Some of the spines of the host appeared to have been damaged by the crab. The specimen had smooth, glabrous carapace with the lateral carapace tooth relatively long. The maximum width and length of the carapace of the crab was 7.2mm and 8.6 mm, (DABFUK) respectively (Figs. 1, 2.).

The social behaviour of symbiotic organisms is influenced by the density and distribution pattern of hosts (Thiel *et al.*, 2003). We obtained only a single male from the aboral side of *Tripneustes gratilla*. Yanagisawa and Hamaishi (1986) recorded that solitary individuals of *Z. adamsii* lived on a host from the earliest stage of its benthic life. Suzuki and

Takeda (1974) also observed only one individual crab on each sea urchin. Only in the case of *A. ijimai*, a heterosexual pair of the crab was noticed (cf. Doki, 1972). The larger the symbiotic crustacean in relation to its host, the higher is its potential to monopolise its host: relatively large symbiont species monopolised one host individual as solitary individuals or as heterosexual pairs while small species tended to share a host individual with many conspecifics (Thiel and Baeza, 2001). However an increase in the number of host species decreases host recognition specificity (Stevens, 1990; Poulin, 2007). Saravanan *et al.* (2015) recorded a maximum of four crabs of *Z. adamsii* from *Toxopneustes pileolus* from the Gulf of Mannar. Hence by looking into the associations we may suggest that if a preferred or favoured host is present, infestation may also be higher.

In the present study, naked interambulacral zones could be identified which could have been damaged by the crab. Suzuki and Takeda (1974) found out that the crabs live on the test of the urchin, between the spines and found evidence that urchin tissue was being ingested by *Z. adamsii* and argued that the relationship between crab and urchin is essentially a parasitic one. According to Daniel & Krishnan (1979), *Z. adamsii* was feeding on the tube-feet in the interambulacral zone. Mortenson (1904) believed *Z. adamsii* caused damage to the tube feet of the host echinoid, and treat this as a case of parasitism. Suzuki and Takeda (1974) concluded that this crab is not a commensal of sea urchins but a parasite inflicting minor damage to the hosts. Our present observations support these observations.

Many sea urchin species, which harbour endo- or ecto symbiotic crustaceans show a highly aggregated distribution pattern (Rodriguez and Ojeda, 1993). Sea urchins may form aggregations consisting of tens of individuals, which are in direct contact with each other (Reese, 1966). In these dense aggregations, ectosymbiotic crustaceans may easily move from one sea urchin to the next under the cover of their spines (Bell, 1984; Stebbins, 1988). Yanagisawa and Hamaishi (1986) reported that solitary *Z. adamsii* move between hosts in search of mating partners in the breeding season. *Tripneustes gratilla* from our study sites did not form aggregates but were mainly



Fig. 1. Male crab *Zebrida adamsii* on the surface of *Tripneustes gratilla*



Fig. 2. *Zebrida adamsii* (male)

solitary. According to Yanagisawa and Hamaishi (1986), the sea urchin hosts of *Z. adamsii* were rarely in contact with each other, male crabs in search of receptive females probably need to leave hosts, which may lead to increased male mortality possibly expressed in the strongly female-biased sex-ratio during their breeding season.

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