

A NEW HOST AND NOTES ON THE BEHAVIOR OF *TULEARIOCARIS
NEGLECTA* CHACE, 1969 (DECAPODA, PALAEMONIDAE,
PONTONIINAE), A SYMBIONT OF DIADEMATID SEA URCHINS

BY

PETER CASTRO

Department of Biological Sciences, California State Polytechnic University,
Pomona, California 91768, U.S.A.

Tuleariocaris neglecta was described from specimens found in association with the diadematid sea urchin, *Diadema antillarum* Philippi, from various locations in the West Indies and Florida (Chace, 1969). It has also been reported on the same host from Madeira (Chace, 1972) and possibly from the Salvage Islands (A. J. G. Figueira, personal communication). Additional collections and observations in Puerto Rico have shown that the shrimp is also found living on another diadematid, *Astropyga magnifica* Clark.

Shrimp were observed living among the spines of *A. magnifica* found at a depth of approximately 13 meters near Crashboat Landing, Aguadilla, N.W. Puerto Rico. The sea urchins were living on a sandy substratum and typically aggregated in groups of five to fifteen individuals. The larger, most conspicuous shrimps were observed individually or in pairs in approximately 70% of the sea urchins examined. Smaller individuals were more common, especially when the sea urchins were in close aggregations. The shrimp usually swam around the distal end of the primary spines of the host's ambitus. Orientation during swimming was always with the anterior end directed toward the test. When disturbed the shrimp would rapidly shift position within their particular host or swim to adjacent sea urchins. Small apogonid fish (similar to those referred to as *Apogon* sp. by Kier & Grant, 1965) were also found living above and between the primary spines, especially the aboral ones.

A. magnifica is characterized by a conspicuous radiating color pattern on the aboral surface of the test. In the specimens collected the darker ambulacra varied from light orange brown to dark reddish brown. Most spines had reddish brown bands which became thicker and darker on the distal ends. Some spines were completely dark brown.

The smallest shrimp were light pink. Color became darker with increasing size until the largest individuals were dark reddish purple with a thin white line running along the lower third of the body from just below the eye to the end of the abdomen. There seemed to be no apparent correlation between the coloration of the shrimp and the color variations observed in the host.

Various specimens of the shrimp were kept alive with sea urchins for periods of up to four months. The animals were maintained in large aquaria supplied with running sea water. The shrimp always swam between the spines of *A. magnifica*. Most shrimp showed a preference for the spaces between the distal end of primary spines. The smallest individuals typically swam close to the test. Physical contact with the host was usually limited to the touching of the antennae with the surface of the adjacent spines. Rotation of the body, partially by the movement of the abdomen against the cephalothorax, followed slow spine movements. A more direct contact of shrimp with the spines triggered a strong reaction of adjacent primary and secondary spines. Shrimp readily shifted position and were never observed to leave the host when disturbed.

A reversal in the normal host orientation behavior of the shrimp was found to take place under dark conditions during the night. The shrimp abandoned their host and freely swam in the aquaria, usually oriented perpendicularly to the sandy bottom. Their color was almost transparent pink with the largest individuals showing concentrated pigment along the dorsal surface of the body. Color gradually changed to red after exposure to light. All shrimp gradually returned to sea urchins when exposed to artificial light. This characteristic behavior was always observed in shrimp kept under laboratory conditions.

A change of host was observed when one *Diadema antillarum* individual was introduced in an aquarium containing shrimp living on *A. magnifica*. The shrimp moved from their normal host to the spines of *Diadema* during the night. Contact with *Diadema* was permanent. No shrimp moved from their host during the night or to other individuals of *Diadema*, *Astropyga*, or three other species of sea urchins [*Echinometra lucunter* (Linnaeus), *Lytechinus variegatus* (Lamarck), and *Tripneustes ventricosus* (Lamarck)]. Shrimp usually remained attached to the distal end of the long primary spines of *Diadema*. There were no visible reactions by the sea urchin like in the case of direct contact of shrimp with *Astropyga*.

Host orientation in a very close Indo-West Pacific species, *Tuleariocaris zanzibarica* Bruce, has been analyzed by Fricke & Hentschel (1971). Preference was shown for colors, shapes, and other visual stimuli similar to its *Diadema* host. A nocturnal change in color was also reported for this species. The same pheno-

menon has been observed in a second Indo-West Pacific associate of diadematids, *T. holthuisi* Hipeau-Jacquotte (Castro, 1971).

The nocturnal departure of shrimp living on *Astropyga* is difficult to explain. Feeding away from the host may be a possible explanation. The direct contact with the spines of *Diadema* may suggest the utilization of host tissue (epidermis, pigmented amoebocytes) as a food source. This apparent diurnal rhythm in the association with *Astropyga* has not been observed in the other species of *Tuleariocaris* or in any other pontoniid shrimp.

LITERATURE CITED

- CASTRO, P., 1971. The natantian shrimps (Crustacea, Decapoda) associated with invertebrates in Hawaii. *Pac. Sci.*, **25**: 395-403.
- CHACE, F. A., 1969. A new genus and five new species of shrimps (Decapoda, Palaemonidae, Pontoniinae) from the western Atlantic. *Crustaceana*, **16**: 251-272, figs. 1-11.
- , 1972. The shrimps of the Smithsonian-Bredin Caribbean Expeditions with a summary of the West Indian shallow-water species (Crustacea: Decapoda: Natantia). *Smithsonian Contrib. Zool.*, **98**: 1-179, figs. 1-61.
- FRICKE, H. W. & M. HENTSCHEL, 1971. Die Garnelen-Seeigel-Partnerschaft — eine Untersuchung der optischen Orientierung der Garnele. *Z. Tierpsychol.*, **28**: 453-462, figs. 1-5, tab. 1.
- KIER, P. M. & R. E. GRANT, 1965. Echinoid distribution and habits, Key Largo Coral Reef Preserve, Florida. *Smithsonian misc. Coll.*, **149** (6): 1-68, text-figs. 1-15, pls. 1-16, tab. 1.