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NOTE ON AN INVASION OF INTERTIDAL ZOANTHID COLONIES BY A CHAETOPTERID POLYCHAETE AT PARK RYNIE BEACH, KWAZULU-NATAL, SOUTH AFRICA

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At Park Rynie Beach on the KwaZulu-Natal coast, South Africa, four species of zoanthids were invaded by a sand-tube building polychaete *Mesochaetopterus minutus*. It is a small polychaete about 15 mm long, which occurs gregariously in dense masses of sandy tubes. *M. minutus* is an opportunistic species that exploits zoanthid colonies mainly for support and protection from heavy wave action because of the inability of the fragile sandy tube to survive in exposed habitats. Population density studies of the polychaete were undertaken to quantify the degree of invasion of the different zoanthid species. Highest polychaete density was recorded for *Zoanthus sansibaricus,* the number of polychaetes exceeding 3 500 m^{-2}, followed by *Palythoa nelliae*, with a density of 2 200 m^{-2}. Polychaete densities were comparatively low in *Z. durbanensis* and *Z. natalensis* (<1 000 m^{-2}). No polychaete tubes, however, were seen among the polyps of *Isaurus spongiosus*.

Key words: invasion, polychaete, zooanthids

At Park Rynie Beach (31°19´S, 30°44´E), KwaZulu-Natal, South Africa, several species of zoanthids occupy extensive areas on exposed rocks of the lower Balanoid zone. They are all colonial, the polyps being linked together by a fleshy coenenchyme. During a collecting trip to this locality during February 1998, colonization and invasion of zoanthid colonies by a tube-dwelling polychaete were observed in some areas of the intertidal zone. Dense clusters of the tubes were visible protruding from among the polyps.

Space on which to live is often the most important limiting resource for sessile marine invertebrates (Dayton 1971, Stebbing 1973, Jackson 1977, Russ 1982, Sebens 1986, Walters and Wethey 1986, Turner and Todd 1994, Griffith 1997). Although a great deal of work has been done on colonization of hard substrata by a wide variety of sessile marine organisms, there is very limited information on the colonization and invasion of one organism by another. Some of the more recent investigations on marine invasion biology are on alien or exotic species that have been introduced into one coastal region of the world from another (Carlton 1989, 1996, Griffiths *et al.* 1992, Carlton and Geller 1993). Other studies report on responses by organisms to unexploited habitats after environmental disturbance (Grassle and Grassle 1974, Shull 1997). The colonization and invasion of zoanthid colonies by a tubiculous polychaete, as described in the present report, has, to the authors' knowledge, not been documented previously. The aims of this study are to identify the polychaete and the different species of zoanthids that have been invaded and to quantify the degree of invasion of the different zoanthid species.

MATERIAL AND METHODS

The intertidal rocky shore at Park Rynie Beach was visited on several occasions during February and March 1998. Population density studies of the polychaetes were conducted during spring low tide to quantify the degree of invasion of the different zoanthid species. Random samples were taken and the worms were counted, with the aid of a hand lens, using quadrats measuring 0.5×0.5 m. As the number of polychaetes was too large, a small portion of the quadrat (0.1×0.1 m) was used. Polychaete density was then calculated and expressed as the number of worms per square metre. For each species of zoanthid, 10 samples were used to estimate polychaete density.

Small clusters of the different species of zoanthids, with the worms, were removed from the rock surface with a wall scraper. Specimens were placed in buckets containing seawater and brought back live to the laboratory. The behaviour of the polychaetes was observed under a dissecting microscope. The coenenchyme of small clusters of the different species of zoanthids

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Fig. 1: Tubes of *Mesochaetopterus minutus* projecting from among zoanthid polyps

was also examined. All the zoanthid species invaded by the polychaete were photographed.

The polychaetes were carefully removed from their tubes and identified according to Day (1967). For the identifications of the zoanthids and for other details on their morphological features, the keys by Day (1974) and Branch *et al.* (1994) were used.

RESULTS

The polychaete was identified as *Mesochaetopterus minutus* (Family: Chaetopteridae). According to Day (1967), it is a tropical Indo-West-Pacific species that ranges in distribution from KwaZulu-Natal to Moçambique. The description provided by that author mentions that it is a small polychaete about 15 mm long, which occurs gregariously in dense masses of fragile sandy tubes. The buccal segment bears a pair of long grooved palps. The tubes are branched and form a tangled mass on the surface of the substratum, but the distal ends are orientated vertically, projecting a few millimetres above the polyps (Fig. 1).

When immersed in containers of seawater in the laboratory, the worms extended out of their tubes either to feed or repair the distal ends of their tubes. From this observation, it was evident that the vast majority of the tubes contained worms. Living specimens were seen actively adding to the tubes with sand grains that were transported along the ciliated grooves of the long palps. In this way, they spaced themselves out among the polyps and orientated towards open water. It seems that the exposed distal ends of the tubes are frequently damaged by wave action and are continuously being repaired.

Of the five species of zoanthids occurring at Park Rynie Beach, four species: *Zoanthus sansibaricus*, *Z. natalensis*, *Z. durbanensis* and *Palythoa nelliae* were colonized by this polychaete. No polychaete tubes,

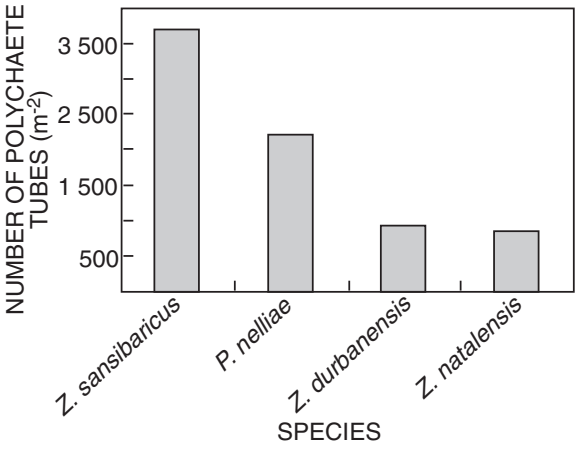

Fig. 2: Polychaete densities in the different zoanthid species

however, were observed among the polyps of *Isaurus spongiosus*. Figure 2 shows polychaete densities in the four zoanthid species. Highest polychaete density was recorded in *Z. sansibaricus* (in excess of 3 500 m^{-2}), followed by *P. nelliae* with a density of 2 200 m^{-2}. Polychaete densities were comparatively low in *Z. durbanensis* and *Z. natalensis* (<1 000 m^{-2}).

Examination of small clusters of the different zoanthid species in the laboratory showed that the tubes of the polychaete had penetrated the coenenchyme.

DISCUSSION

M. minutus appears to be an opportunistic species that exploits zoanthid colonies, mainly for support and protection from strong wave action, a characteristic feature of the lower Balanoid zone. The fragile sandy tubes of these worms would be unable to withstand wave action in exposed habitats. The exploitation of this new habitat by the polychaete is a fairly recent occurrence, because such a phenomenon was not observed during collecting trips undertaken to this locality prior to 1997. What has triggered off such an invasion by this polychaete is uncertain. Whether the invasion has been a result of an environmental disturbance remains to be resolved. It has been well documented that natural disturbances can have a great impact on the structure of populations in a wide range of habitats (Grassle and Grassle 1974, Taylor and Littler 1982, Sousa 1984, Pickett and White 1985, Minchinton 1977, Shull 1997).

High polychaete densities in *Z. sansibaricus* and *P. nelliae* indicate that these two species are preferred for colonization by *M. minutus*. This is probably because the polyps in these two species are taller and the coenenchyme is thinner (Branch *et al.* 1994). Although the polyps of *Z. durbanensis* are also tall (10 mm in length) and hence suitable for colonization, the coenenchyme is thick. Very low polychaete numbers in *Z. natalensis* may be accounted for by the fact that the polyps in this species are short and squat and, as in *Z. durbanensis*, the coenenchyme is thick (Branch *et al.* 1994). Tall polyps, or polyps that correspond more or less with the height of the tubes, would be able to provide better support and protection to the fragile sandy tubes against strong wave action. A thin coenenchyme would also enable the polychaete to gain access to the rock surface for attachment of the tubes. The zoanthid *I. spongiosus* is morphologically very different from all the other species. The colonies are unsuitable for colonization because the polyps are very long (± 30 mm), flexible and curved to one side. Furthermore, unlike all the other species of zoanthids, *I. spongiosus* commonly occurs in deep pools, a habitat in which *M. minutus* is absent.

It seems likely that the mechanism of colonization is through larval recruitment. Many invertebrates that are sessile or sedentary have planktonic larvae that can disperse over great distances (Minchinton 1977, Osman 1977). Whether the larvae are being recruited from indigenous populations of *M. minutus* along the east coast of southern Africa or whether recruitment is taking place from some foreign localities in the Indo-West-Pacific region is uncertain.

The interstices between the polyps would be ideal microhabitats for the settlement and growth of planktonic larvae. Furthermore, material for tube construction is readily available as sand grains are invariably trapped between the polyps. According to Shull (1997), the spionid polychaete *Polydora cornuta* colonized the substratum by larval settlement. Minchinton (1997) found that the larvae of the gregarious tubeworm *Galeolaria caespitosa* showed directed responses to conspecific adults on the substratum. The latter author is of the view that adult *Galeolaria* on the substratum probably exude a chemical cue into the water that stimulates incoming larvae to settle. According to Harris 1990 (p. 310) "the presence of adults or newly settled larvae of the same species is a powerful stimulus and leads to gregarious settlement." Whether larvae of *Mesochaetopterus* are also responding to chemical cues from the adults is not known.

More detailed studies at some other localities are re-

quired in the future to determine if colonization by this polychaete has any deleterious effects on the survival of zoanthids.

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