

NOTES

HABITAT WEB CENTERED ON *HEMIFUSUS PUGILINUS* BORN (GASTROPODA : VOLEMIDAE)

ABSTRACT

In the present study an attempt is made to outline the various invertebrate fauna that found associated with the empty shells of *Hemifusus pugilinus*, a little known marine gastropod and the possible habitat web is drawn out in relation to the associated animals. And the selection of empty shells of *Hemifusus pugilinus* by Hermit crabs in comparison with other gastropod shells has also been discussed.

THE INTER and intraspecific interaction centered on the gastropod shells are termed as habitat web (Breder 1942). Empty gastropod shells are an important habitat for many animals in shallow benthic region. Hermit crabs commonly live and carry about the empty gastropod shells by removing the gastropods that are injured by predatory fishes (Brightwell, 1951). Megelhaes (1948) opined the predation of gastropods by the hermit crabs themselves. Empty gastropod shells are necessary and often a limiting resource for hermit crab population and often there is considerable interspecific overlap in usage patterns (Hazlett, 1984). Gastropod shells serve as a base for the attachment of barnacles sea anemones, annelids, small crabs and a large number of eggs of other marine benthic gastropods. The sea anemones are usually found attached to the entire outer surface of the shells and are able to discriminate between shell surfaces to which they attach (Ross, 1960, 1961). So the species of sea anemones found attached to each gastropod shells is specific. The abundance of tunicates, balanoids, bryozoans, tube worms and algae on gastropod shells have been studied by Rabaud (1937) Stachowitsch (1980) recorded about 110 species of epizoic and endolithic fauna in the shells of some marine prosobranchs. Jenson and Bender (1973) recorded 60 such species on gastropod shells. The empty shells of gastropods also serve as refuge for some fishes and octopus (Breder, 1942; Springer and McErlean, 1961). The animal association

with special reference to gastropod shells have been studied for a long time by several authors (Prasad, 1959; Jones, 1964; Robertson, 1980; Bertness, 1982). The present study is just an attempt to outline various invertebrate fauna that found associated with empty shells of a little known marine gastropod *Hemifusus pugilinus*.

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MATERIAL AND METHOD

For the present study about 125 empty shells of various marine gastropods were collected from the Portonovo waters during 1984 October - 1985 November. They were observed and recorded for the presence of hermit crab association. The length, width and weight of the empty shells of *Hemifusus pugilinus* occupied by hermit crabs were recorded with a vernier caliper and with a two pan balance respectively. For the epizoic fauna that found inside the shells, the shells were immersed in formalin to bring out the animals and they were observed with a binocular microscope.

Results

The number of shells of *Hemifusus pugilinus* occupied by hermit crab in relation to other marine gastropod shells have been given in the Table 1. It was only 23. The morpho-

metry of shells of *Hemifusus pugilinus* occupied by hermit crabs has been given in the Table 2.

TABLE 1. Names and number of marine gastropod shells occupied by hermit crabs

Name of the Shells	Number of hermit crabs associated
<i>Rapana bulbosa</i>	33
<i>Babylonia spirata</i>	28
<i>Hemifusus pugilinus</i>	23
<i>Turritella communis</i>	18
<i>Oliva</i> sp.	13
<i>Murex</i> sp.	10
	125

TABLE 2. Morphometry of empty shells occupied by hermit crabs

Shell length (mm)	Shell width (mm)	Shell weight (gm)
59.8	31.3	43.0
60.3	32.1	39.0
60.9	32.3	39.0
71.2	39.9	33.8
72.1	41.6	41.0
73.6	41.0	40.0
73.8	42.0	39.1
74.1	42.3	40.3
74.3	43.0	40.0
74.9	50.1	41.0
75.1	50.1	33.0
75.2	50.7	31.8
75.3	50.9	33.3
76.1	52.0	31.7
76.7	52.3	51.6
81.6	48.2	60.2
86.7	48.0	78.4
91.0	53.1	76.3
91.0	52.8	66.8
93.0	54.1	87.3
95.0	54.6	84.1
95.0	53.1	78.5
106.0	62.6	80.1

The epizotic fauna associated with the shells of *H. pugilinus* were sea anemones, small bivalves, brittle stars and bryozoans. Sea anemones were found to occur in both alive and dead shells. They seemed to be attached all over the outside of the shell (Pl. I A). The bivalves and sea anemones are restricted only to alive shells. The bivalves that get attached to the alive shells are usually young ones and they establish the association by means of byssus thread (Pl. I B). Only two such associations have been recorded during this study period. The brittle star attachment is very rare and they usually were attached at the suture region with their aboral disc, spreading their arms over the body whorl. The *Membranipora* sp. association was the most abundant among the examined shells. About half the number of examined shells showed their association. They were found of the shell surface where the periostracum had been eroded. The slipper shell *Trochus* sp. was recorded for two times. They were found to be attached to the larger body whorl of the shell (Pl. I C). A number of egg masses of various other marine gastropods were found to be attached to the surface of the shells. The more often recorded egg masses in such relation were of *Comus* sp. and *Murex* sp. (Pl. I D). Barnacles were not seemed to be attached with the alive shells. In certain occasions they were recorded on the outer surface of the operculum alone and they are abundant in dead empty shells where the periostracum had been eroded off. The oysters grow almost on all sides of the empty shells masking even the original shape of the shell. This too has not been observed with alive shells.

The endolithic fauna associated with the shells of *Hemifusus pugilinus* were hermit crabs, polychaets, amphipods, copepods, small bivalves, diatoms, nematods, isopods and the larval forms of nauplius and zoea of various other marine crustaceans.

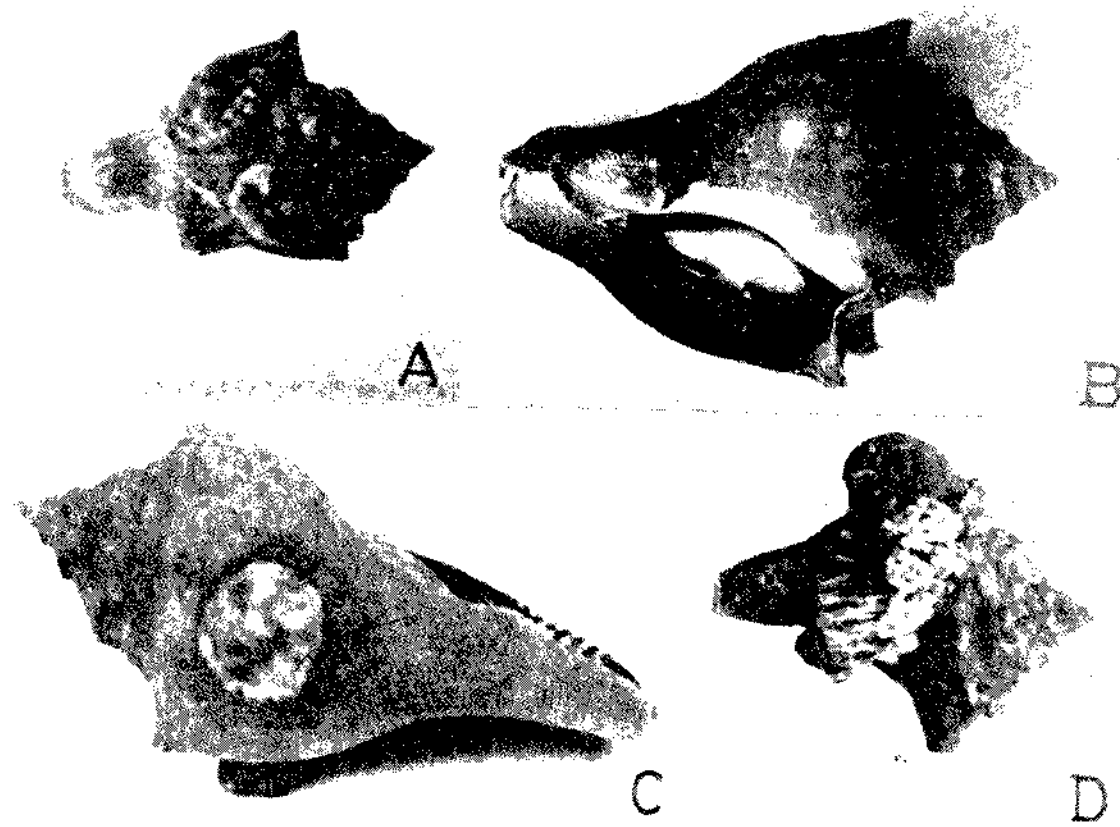


PLATE I. A. Sea anemone attachment on the shell of *H. pugilinus*. B. bivalve attachment with byssus thread. C. *Trochus* found attached to the larger body whorl and D. egg masses of benthic molluscs on the shell.

Discussion

The importance of empty gastropod shells in the habitat web has been well documented by several authors (Kellogg, 1976). The availability of empty gastropod shells shapes the hermit crab population. Usually the hermit crabs prefer shells that are not too heavy to carry about. This has been well proved by the avoidance of the shells by the hermit crabs when the crepidula and endolithic form attached to the shell exceeds the weight of the shell (Conover, 1976). Further the sea anemones attached to the shells occupied by the hermit crab may offer protection to the crab by way of camouflage (Berner, 1953; Mclean and Mariscal, 1973). The sea anemones show specific adherence to gastropod shells. Crowell (1945) pointed that the hydroid on the shells of *Littorina littorea* inhabited by the hermit crab were nearly always *Hydractinia bechinata*. As the hermit crabs in smaller shells are more vulnerable to predators (Vance, 1972) the larger crabs usually seek larger shells like the shells of *Hemifusus pugilinus* which they are capable to carry about. Moreover to win more shell fights the hermit crabs have to occupy the shells that are looking larger to other crabs. (Hazlett, 1970). Further as the hermit crabs use the shells as a receptacle for extruded eggs while fixing them to the pleopods (Coffin, 1960) the shells of *Hemifusus pugilinus* will serve this function well, as they are hard and heavy capable of protecting the eggs of the crabs.

The other symbiotic epizoic forms like sea anemones receive benefit of free transport to wherever the gastropod moves and hence receive nutrient benefit also while the gas-

tropod or the hermit crab feeds. The sea anemones feed on other larvae and smaller organisms that settle down on the shell, thus preventing the shell surface from borers and encrusting organisms (Fotheringham, 1976). The nonoccurrence of barnacles and oysters on live shells which are covered with periostracum reveals the periostracum as a natural inhibitor of boring, fouling and encrusting organisms (Bottjer, 1981). The occurrence of one or two barnacles only on the opercule which are devoid of periostracum confirms this fact.

The egg masses while attached to the live shells are being kept benthic, facilitating their proper development. The preference of empty shells of *Hemifusus pugilinus* by hermit crabs clearly shows that only larger hermit crabs prefer this shells as portable inhabitations.

The shell height of most of the shells selected by the hermit crabs comes under the length group of 70 - 80 mm. Their weights come under the weight group of 33.00 - 51.60 gms. This clearly shows that these shells are preferred only by larger crabs which are capable of carrying about such heavy shells.

This clearly shows that the smaller crabs occupy smaller *Babylonia* shells and lighter *Rapanas* shells. The larger crabs carry about the heavy *Hemifusus* shells. The less number of *Murex* shells occupied by the crabs may be due to its spiny nature which may hinder the free movement of the hermit crabs. *Turritella* and *Oliva* ranked last and it may be due to their reduced shell volume, which is also an important trait based on which the hermit crabs select their shells.

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* Original not referred.