CHEMICAL ATTRACTION OF HERMIT CRABS AND OTHER ATTENDANTS TO SIMULATED GASTROPOD PREDATION SITES

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Abstract—Simulated gastropod predation sites were observed in the gulf intertidal near the Edward Ball Marine Laboratory, Sopchoppy, Florida. Fundulus similis, Callinectes sapidus, Melongena corona, Clibanarius vittatus, and Pagurus longicarpus were attracted to the sites by small molecules released passively from the flesh of wounded or dead animals. Flesh consumers (F. similis, C. sapidus, and M. corona) were attracted to molecules released from the flesh of bivalves, gastropods, and crabs. Shell users (C. vittatus and P. longicarpus) were attracted only to small molecules from gastropod flesh, with P. longicarpus attending P. duplicatus sites while C. vittatus preferentially attended M. corona, Busycon contrarium, and Busycon spiratum sites. Flesh consumers and shell users may be attracted to the sites by different sets of small molecules. The addition of proteolytic enzymes to the flesh increased the attendants at a site, indicating that the attractant molecules might be amino acids or small peptides. Flesh consumers were attracted to the sites primarily in the first 12 hr while the shell users were attracted from 2 hr to several days postinitiation. New shells were attractive to hermit crabs up to 12 hr after entry by a hermit crab. The shell species of the attendant C. vittatus were in different proportions than the general C. vittatus population, and the shell fit of the P. longicarpus attendants was not as good as the general population of P. longicarpus. Significantly more C. vittatus attended than P. longicarpus, and it was speculated that there were more C. vittatus in the area with a poor shell fit than P. longicarpus.

Key Words—Chemical signals, hermit crabs, gastropod predation sites, Fundulus similis, Callinectes sapidus, Melongena corona, Clibanarius vittatus, Pagurus longicarpus, P. duplicatus, Busycon contrarium, B. spiratum.

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The study of chemoreception in higher aquatic organisms has been restricted mainly to certain aspects of feeding attractants (Bardach, 1975), sex attractants (Bardach, 1975; Ameya-Akumpfi and Hazlett, 1975; Hazlett, 1975; Atema and Engstrom, 1971), alarm signals (Atema and Stenzler, 1977; Stenzler and Atema, 1977; Atema and Burd, 1975; Gore, 1966). However, the myriad of highly specialized chemoreceptors found in virtually every marine organism (for examples see Atema, 1978; Bardach, 1975; Jahan-Parwar, 1975; Laverack, 1975) makes it seem highly probable that many more functions are mediated by chemoreception.

Data presented below are preliminary observations of chemical signals associated with the gastropod shell habitat web (McLean, 1974, 1975). The gastropod shell habitat web includes predators upon gastropods, prey gastropods, several organisms which feed upon prey tissue, and several species of hermit crabs which use emptied gastropod shells as habitats. In the intertidal web studied, one species of fish (*Fundulus similis*), one species of predatory gastropod (*Melongena corona*), the blue crab (*Callinectes sapidus*), and two hermit crab species (*Clibinarius vittatus* and *Pagurus longicarpus*) were involved in responses to small molecules released passively from four species of wounded gastropods (*Busycon contrarium*, *Busycon spiratum*, *M. corona*, and *Polinices duplicatus*). *F. similis*, *M. corona*, and *C. sapidus* responded by feeding on the wounded gastropod, while *C. vittatus* and *P. longicarpus* attended the site in order to obtain the gastropod shell. The work reported here substantiates many observations of McLean (1974, 1975) and extends the analysis of predation site components in preparation for purifying and characterizing the signalling chemicals.

**METHODS AND MATERIALS**

*Study Area.* A region of the intertidal of the Gulf of Mexico 5–20 m wide and 350 m long was the study area. It was located on the east side of a point of land approximately 1.5 km east of the Edward Ball Marine Laboratory near Sopchoppy, Florida, and 1.0 km west of Turkey Point. Characteristics of this area which dictated its choice were: (1) Preliminary surveys from the marine laboratory to 2 km east of Turkey Point indicated that the study area had relatively large numbers of both common intertidal hermit crabs (*P. longicarpus* and *C. vittatus*). (2) The site was protected from wind and wave action except directly from the south. (3) The substrate was a lightly silted sand bottom not easily disturbed by walking. The site was bounded on the land side by *Spartina alterniflora* and *Salicornia perrenis* and on the gulf side by *Halodule wrightii* beds. The area where predation sites were simulated was