MULTIPLE MECHANISMS OF RESOURCE ACQUISITION IN HERMIT CRABS: SCRUMS AND ODOR-INDUCED GRASPING (DECAPODA, DIOGENIDAE)

BY

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ABSTRACT

Two behavioral mechanisms shown by hermit crabs (brief grasps of shells and scrum formation) which increase their chances of obtaining new gastropod shells were examined. Individuals of Clibanarius vittatus which smell odors from the snail Littorina irrorata show brief grasps of L. irrorata shells occupied by hermit crabs but long grasps of empty shells. The brief grasp allows identification of the species of shell and whether or not it is occupied. Hermit crabs which are attracted to and closely attend a pair of crabs engaged in shell exchange behavior (scrummage formation) sometimes obtain a shell vacated by the initiating crab as it moves into the shell vacated by the non-initiating crab. These behaviors minimize the time spent by crabs on shells that are not available for easy occupation.

INTRODUCTION

Gastropod shells are a very important resource for hermit crabs (Hazlett, 1981) thus it is not surprising that there are a number of ways that crab behavior increases the chance of individuals obtaining an empty shell. Hermit crabs may
obtain a new shell by exchange with another crab (Hazlett, 1968) or by visual orientation to shells (Hazlett, 1982) as well as by other behavioral mechanisms. Two sources of chemical cues can initiate behaviors which may increase the probability of obtaining a new gastropod shell: snail odors and conspecific haemolymph. When the flesh of a snail is being digested by a predatory snail (McClean, 1974), hermit crabs in poor quality shells (Hazlett & Herrkind, 1980) and shells that are too small (Rittschof, 1980a) are attracted to such a predation site. Crabs are attracted by the polypeptides released by the action of proteolytic enzymes on snail muscle proteins (Rittschof, 1980b) and grasp shells they encounter. Molecules in the haemolymph of a conspecific individual also cause crabs to grasp shells around them (Rittschof et al., 1992), especially if they occupy shells that are much too small for them (Katz & Rittschof, 1993). Presumably these shell grasping behaviors increase the chances of crabs in poor shells finding and assessing new shells.

Recent observations conducted as part of an experiment on how multiple inputs influence behavior (Hazlett, in press) indicated that in the diogenid hermit crab *Clibanarius vittatus* (Bosc, 1802), the type of shell grasps executed by crabs differed as a function of odor type. When snail odor was introduced the grasping of other shells tended to be very brief (less than one second for a grasp) whereas when conspecific haemolymph was introduced the grasps of shells tended to last longer and lead to more extensive shell investigation. The following set of experiments were conducted to investigate the conditions under which brief grasps are executed and to infer the function of the brief grasps executed when crabs are stimulated by snail odor.

Another phenomenon that could be related to shell acquisition in hermit crabs is the formation of “scrum”s” (Rittschof, 1980a; Small & Thacker, 1994). These are aggregations of hermit crabs on both sides of a pair of crabs involved in a shell exchange attempt, which are in the opposed (Hazlett, 1968), aperture-to-aperture position which last for many minutes. Crabs hold on to one of the shells of the interacting crabs with their ambulatory legs or on to the shell of a crab holding one of the interactants. These have been observed in the crab *Clibanarius vittatus* both in the field (Rittschof, unpubl. observ.) and in the laboratory (Hazlett, unpubl. observ.). However, the function of this behavior is unknown. Thus a second purpose of this paper was to examine whether this type of scrum formation behavior is shell-related.