INFLUENCE OF REARING CONDITIONS ON INITIAL SHELL ENTERING BEHAVIOR OF A HERMIT CRAB (DECAPODA, PAGURIDEA) 1)

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INTRODUCTION

In an earlier paper (Hazlett & Provenzano, 1965), it was reported that many individual hermit crabs which had been reared in the laboratory, made 'mistakes' in their initial attempts to enter gastropod shells. This was in some contrast to the results of Reese (1963), who reported no essential difference between the shell entering behavior of young crabs and that of adults. Reese (1963) did not feel that previous experience was important for the normal sequencing of the motor patterns involved in shell entry, while Hazlett & Provenzano felt experience was of importance. Hazlett & Provenzano (1965) suggested that the differences between the two studies could be due either to species differences (since the authors used crabs of different species) or to differences in the conditions under which the crabs were reared.

The following experiments were designed to test the influence of rearing conditions on initial shell entering behavior of young hermits.

MATERIALS AND METHODS

All of the individuals used in this study were obtained from one female of Clibanarius zebra Dana on July 15, 1969. C. zebra is a very common hermit crab, family Diogenidae, found in upper inter-tidal waters around Hawaii. The first zoeae were placed in two types of containers filled with filtered sea water. The sea water was treated with 50,000 units of penicillin per liter. Room temperature was held at approximately 27°C, and the light-dark cycle was 12L-12D. All containers were sterilized with boiling water and UV light before being used. All larvae were fed to excess with recently hatched Artemia nauplii daily, after being transferred to clean sea water. Further details of rearing techniques can be found in the papers of Provenzano (1961) and Reese & Kinzie (1968).

The two types of containers used were (1) culture dishes, 20 cm in diameter, filled with about 750 ml of filtered, treated sea water and initially containing

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about 100 Stage I zoeae; a bubbler was supplied to these bowls at all times. The other larvae were reared in (2) compartmented plastic trays with just one larva per compartment. The plastic trays were placed on an Eberbach shaker.

Twenty-three glaucothoes were obtained after the four zoeal stages, 14 reared in "social conditions" and 9 reared in isolation. One week after the moult to glaucothoe, socially reared animals were transferred to individual compartments of plastic trays. After 10 to 14 days in the glaucothoe stage, piles of sand grains were added to the compartments of five socially-reared animals and three isolation-reared animals.

After the animals had had the sand grains in their compartments for three days, all were placed, one at a time, with appropriate size empty gastropod shells. The gastropod shell and glaucothoe were picked up with a wide diameter glass tube with squeeze bulb and placed on a flat piece of pelecypod shell, in treated sea water and were observed with a binocular dissecting microscope. No special lighting was used. Notes were taken concerning the sequence and form of the behavior patterns shown by each glaucothoe.

Similar observations on just a few first crab Calcinus elegans (H. Milne Edwards) reared under the two types of conditions were also carried out, with results similar to those obtained for Clibanarius zebra. In connection with other studies, the shell entering behavior of adult C.zebra was observed a large number of times in order to characterize the behavior of experienced animals. The pattern of shell entry of adult C. zebra appeared basically similar to that described for Calcinus laevimanus (Randall) (cf. Reese, 1963).

Judging from other rearings of this species (Hazlett, in prep.), these glaucothoe would have metamorphosed to the first crab stage within several days.

RESULTS

The mistakes made by the glaucothoe were mostly of two kinds: (1) failure to orient correctly before attempting to enter the shell and (2) failure to execute the proper sequence of the acts making up shell entering behavior. Both kinds of mistakes resulted in animals not being able to enter a shell on their first (or subsequent) try. The most common sequence errors were (1) omitting the lifting of the body prior to pulling the abdomen forward (thus the telson hit against the shell below the aperture), (2) failure to move forward before depressing the abdomen, and (3) twisting the abdomen too late (thus getting stuck in the aperture). All of these 'mistakes' are very rare in normal adults as they change from one shell to another in the field or the laboratory.

The number of mistakes made by the glaucothoe reared under the different conditions is presented in table I. The three mistakes by "socially-reared, given sand grains" animals were by three different glaucothoe. The average number of mistakes per animal, as described above, for the socially-reared group was 1.1 per animal, compared with 2.2 per animal for the isolation-reared animals. The average number of mistakes per animal for the animals given sand grains three