SEX DISCRIMINATION BY FEMALE PROCAMBARUS CLARKII (GIRARD, 1852) (DECAPODA, CAMBARIDAE): USE OF CHEMICAL AND VISUAL STIMULI

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INTRODUCTION

Chemical communication has been demonstrated in a number of decapod crustaceans, including the lobster Homarus americanus H. Milne Edwards, 1837 (cf. Atema & Engstrom, 1971; Atema et al., 1979; Atema & Cowan, 1986), and several species of crayfish (Ameyaw-Akumfi & Hazlett, 1975; Ameyaw-Akumfi, 1976; Tierney & Dunham, 1982; Hazlett, 1985). Visual communication is also important in the decapod crustacean social displays used in fighting (Hazlett & Bossert, 1965; Rubenstein & Hazlett, 1974; Dunham, 1988; Bruski, 1986; Bruski & Dunham, 1987), and courtship (Pippet, 1977; Ameyaw-Akumfi, 1981). Few studies have investigated the interactions of two sensory channels. Rubenstein & Hazlett (1974) discussed both visual and chemical (water current) social stimuli in male crayfish, Orconectes virilis (Hagen, 1870), but their experiments tested only visual stimuli. Ameyaw-Akumfi (1979) reported, for

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O. virilis, that both visual and tactile channels are utilized in appeasement displays. Teytaud (1971) presented evidence that female blue crabs (Callinectes sapidus Rathbun, 1896) require both a chemical and visual stimulus simultaneously to release courtship and mating behaviours. They did not respond to either the visual or chemical stimulus when presented separately. The present study examines responses by crayfish, Procambarus clarkii (Girard, 1852), to chemical and visual stimuli, presented separately and in combination, for evidence of sex discrimination.

METHODS

Mature, nongravid females, and form I (breeding morph.) males, were obtained from suppliers in Louisiana, USA. [Means (cm) ± SEM: male cephalothorax length 5.3 ± 0.05; male chela length 3.8 ± 0.08; female cephalothorax length 5.13 ± 0.05; female chela length 3.4 ± 0.16.] The animals were individually housed in glass jars with 4 L of aerated, filtered water for five days prior to experimentation. They were maintained on a cycle of 12 h dark and 12 h light at 18-20°C, and fed pelleted fish food until the day prior to the experiments. The chemical source animals and visual stimulus animals were housed as above. The 15 male and 15 female chemical source crayfish and 9 male and 9 female visual stimulus crayfish were not used as test subjects.

Single channel stimulus trials

The first experiment tested the response of 15 (female) crayfish to chemical stimuli from conspecific males and females, and the response of 15 different (female) crayfish to the visual presence of conspecific males and females. Three different crayfish were tested each day with a male and female chemical stimulus animal.

The chemical test environment was a 2 × 36 × 22 cm (high) aquarium, which contained a 2 cm gravel substrate, and an airstone at the two ends. Two 50 ml burettes, one holding male chemical stimulus water and one holding female stimulus water, were mounted on stands above the airstones. The chemical stimulus water was gently scooped out of the jar of origin 1 h prior to the experiment. The subject crayfish and 2 L of its own jar water were placed in the aquarium. After 15 min one of the burette valves was opened to allow the chemical stimulus to drip into the bubblestream above one of the airstones. After an additional 5 min had elapsed, the subject was videotaped from an adjacent room for 15 min. The test aquarium was then rinsed three times with distilled water, and the procedure was repeated with the other burette. The order of