PREDISPOSITION OF A POMACENTRID FISH, *CHROMIS MULTINEATUS* (GUICHENOT) TO PARASITISM BY A CYMOTHOID ISOPOD, *ANILOCRA CHROMIS* WILLIAMS AND WILLIAMS

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ABSTRACT: *Anilocra chromis* Williams and Williams selectively parasitizes the brown chromis, *Chromis multilineatus* (Guichenot), in the northeastern West Indies and the blue chromis, *C. cyaneus* (Poey) in the northwestern West Indies, never both at one location, although these fishes occur sympatrically throughout the West Indies. To test host suitability, *A. chromis* naturally infecting the brown chromis were transferred to previously uninfected brown and blue chromis that were tagged and then released at their original site of capture at St. Croix, U.S.V.I. *Anilocra chromis* were better able to survive on the brown chromis than on the blue chromis. The blue chromis reacted violently to the presence of the isopod whereas the brown chromis did not. The brown chromis seemed to be behaviorally predisposed to infection by this parasite. This predisposition may determine which species of chromis is parasitized in a geographic area.

Williams and Williams (1981) described *Anilocra chromis* from the brown chromis, *Chromis multilineatus* (Guichenot) (Fig. 1) in Puerto Rico, Mona Island, and the British and U.S. Virgin Islands; and from the blue chromis, *C. cyaneus* (Poey) in the Bahamas and the Dominican Republic (Fig. 2). This isopod also occurs on the blue chromis in south Florida (Waldner, unpubl. data). Brown and blue chromis occur sympatrically in all of these areas, but the isopod infects only one species of fish in a particular locality, never both.

Nair (1950) made successful, short-term transfers of male and female gill-dwelling cymothoid isopods to experimental hosts in aquaria. Females of *Anilocra* spp. have been successfully transferred to experimental hosts in aquaria (Williams and Williams, unpubl. data). Experimental transfer of isopods between hosts in the field has never to our knowledge been attempted. This technique was used to determine the suitability of the brown and blue chromis as hosts for *Anilocra chromis* in an area where only brown chromis were infected.

MATERIALS AND METHODS

The authors worked as "aquanauts" from the NOAA NULS-I Hydrolab Undersea Habitat located at Salt River Submarine Canyon, St. Croix, U.S.V.I. Chromis were collected at Habitat depth (14.2 m) with the aid of quinaldine fish anesthetic and hand nets, and were held in individual plastic bags inside mesh diving bags until transfers were made. Brown chromis with natural infections of adult female isopods (donors) were captured 100 to 200 m away from the Habitat (west wall). Noninfected brown and blue chromis (recipients) were collected from the reef area adjacent to the Habitat (east wall). A donor fish and a recipient fish of approximately the same standard length (≤ 2-mm difference) were placed in a shallow plastic aquarium within the lockout chamber of the Habitat. The recipient was tagged by injecting acrylic paint under several scales (Thresher and Gronell, 1978). The isopods were removed with forceps from the donor fish and gently placed in an identical position and allowed to attach on the recipient. Pressing the isopod against the recipient discouraged attachment. No isopod separated from its donor for more than 3 min would attach to a recipient and even within this time limit some would not attach. The artificially infected recipient was then placed in a plastic bag filled with seawater, returned, and released at the original capture site in the reef area adjacent to Hydrolab. Fish were held for no more than 2 hr before the transfers, and infected recipients were held 45 to 90 min before release. A census of infected recipients was taken as many times (4–10) per day as conditions and transfer work permitted. The term "isopod" will refer to *Anilocra chromis* unless otherwise noted.

RESULTS

Isopods were transferred to 22 specimens of brown chromis and 22 specimens of blue chromis, which were randomly collected and released from day 1 through day 5 of the experiment. Reaction to isopods during transfers contrasted sharply in the two species of hosts. Blue chromis swam vigorously forwards and

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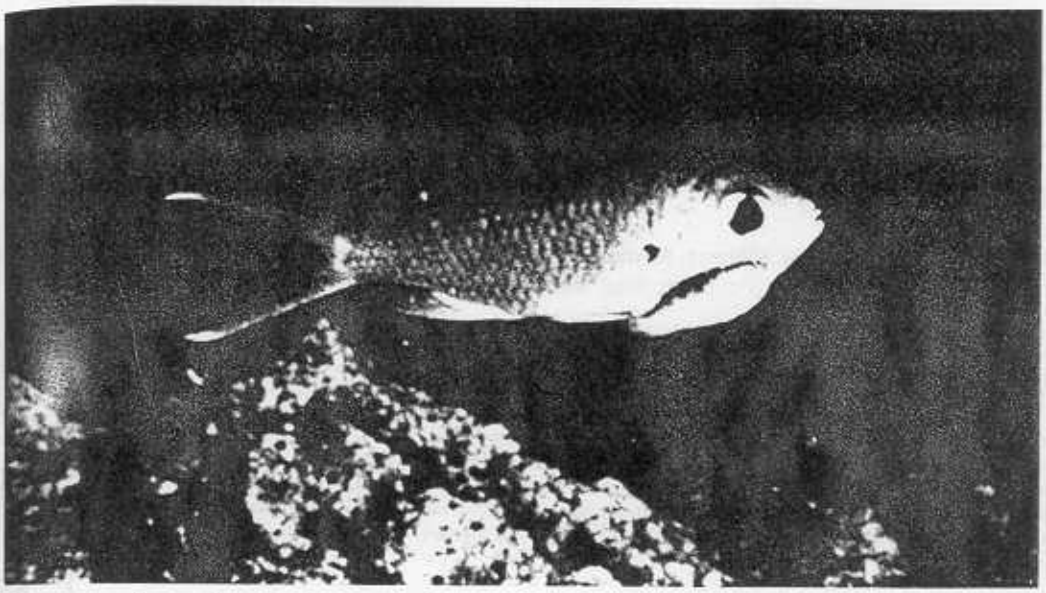

FIGURE 1. Brown chromis, *Chromis multilineatus* (Guichenot) (10 cm in total length), infected with a female of *Anilocra chromis* Williams and Williams.

backwards during exposure to and after attachment of transferred isopods, compared to calmer swimming in the aquarium prior to exposure. Brown chromis showed little or no modification of their swimming after attachment of isopods. Released recipients usually disappeared quickly from sight by swimming into holes in the reef. A few joined other

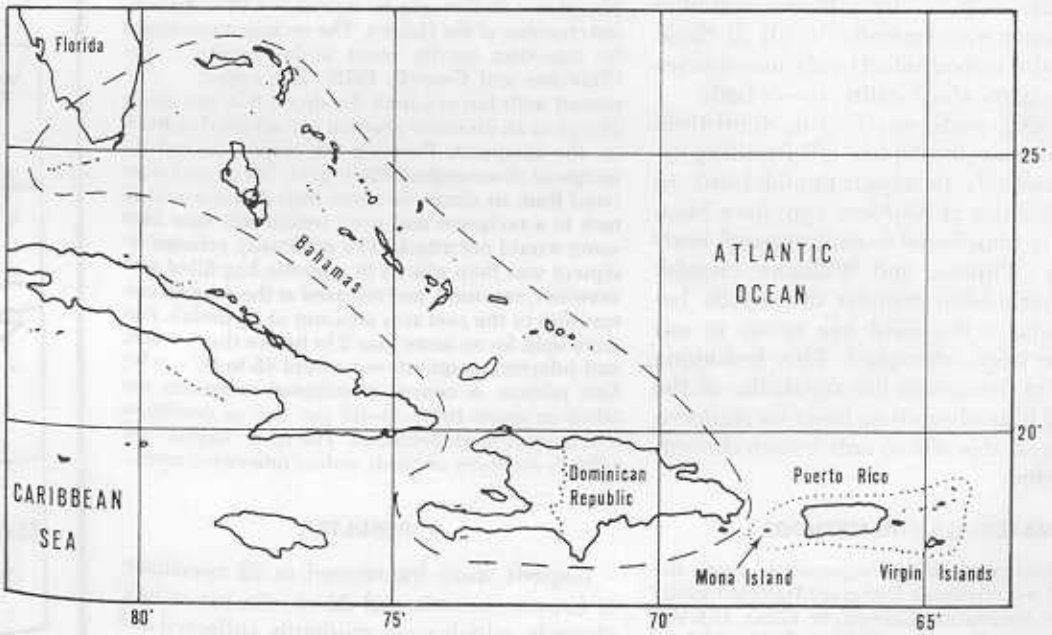

FIGURE 2. The northern West Indies with the general geographic ranges indicated for *Anilocra chromis* Williams and Williams on the brown chromis, *Chromis multilineatus* (Guichenot) (dotted line), and on the blue chromis, *C. cyaneus* (Poey) (dashed line).

chromis in the water column. Releasing five or more experimental hosts sequentially attracted large numbers of predators, principally yellowtail snapper, *Ocyurus chrysurus* (Bloch); coney, *Epinephelus fulvus* (Linnaeus); and graysby, *E. cruentatus* (Lacépedè). Released hosts were chased by the predators and were possibly eaten. Releasing experimental hosts in smaller groups seemed to alleviate this problem. Although predation was not observed, a 1.5-m green moray, *Gymnothorax funebris* Ranzani, with yellow acrylic paint on its snout and mouth was photographed in the study area. The paint probably came from tagged chromis. Many of the infected recipients stayed hidden in the reef for one to two days following their release in the field.

Fourteen individuals of each species of the experimental hosts were identified in the field at the close of day seven of the experiment. The majority of the blue chromis lost the experimentally transferred isopods within 24 hr, and all isopods on blue chromis were lost in a little more than 2 days (Fig. 3). Only three of the tag-identifiable brown chromis lost isopods, and these were lost prior to the first observation after release (Fig. 3). *Anilocra chromis* transferred from brown chromis were significantly ($P < 0.05$, χ^2) less able to survive on blue chromis than on brown chromis.

The study area was revisited briefly 22 days after the end of the experiment. One tagged brown chromis with an experimentally transferred isopod was observed. Other brown chromis with isopods had scars which could have resulted from tagging, but the wounds no longer possessed acrylic paint, and therefore could not serve as positive identification of experimental hosts.

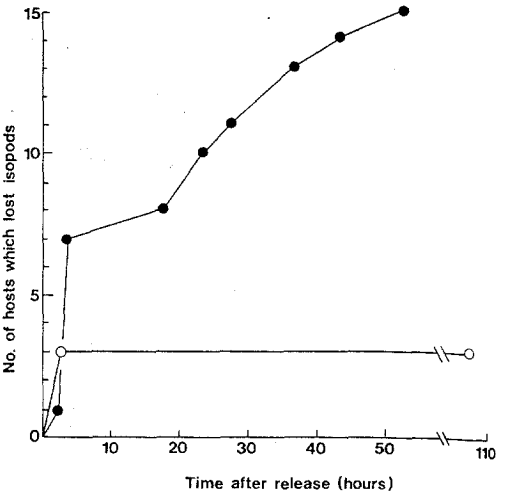

FIGURE 3. Cumulative number of blue chromis, *Chromis cyaneus* (Poey) (●), and brown chromis, *C. multilineatus* (Guichenot) (○) which lost isopods after experimental infection with *Anilocra chromis* Williams and Williams and release in the field.

DISCUSSION

Field transfer of cymothoid isopods between hosts is a new experimental technique that may be used to test the suitability of hosts for an isopod. The major difficulties of naturally parasitizing a host are circumvented in this method, which essentially evaluates the ability of a certain part of the life cycle of the isopod to survive on a host. The method may be focused on a smaller segment of the life cycle and standardized (as in the present study), by selecting a single definable life cycle stage of the isopod for each experiment. The choice of the adult female with oostegites was attractive because its size normally exceeds other life cycle stages, simplifying both transfers and field observations; and its inability to swim or feed simplifies the interpretation of experimental results. Transfers to previously uninfected specimens of the original host species served as a control for experimental transfers to other fish species.

Transferred female *Anilocra chromis* with oostegites survived on brown chromis but not on blue chromis in St. Croix. Yet the blue chromis is a suitable host for this isopod in other areas of the West Indies. The only observed difference in these two species of experimental hosts (besides color) was in their reaction to the presence of the transferred isopod. The blue chromis reacted violently to the presence of the isopod, while the brown chromis did not. The newly attached, experimentally transferred isopods were probably eventually dislodged in the field by the blue chromis, but remained relatively undisturbed on the brown chromis. Individual brown chromis seem to be predisposed behaviorally to the presence of isopods, even though these fishes showed no signs of being previously parasitized by this isopod and even though this involved the totally unnatural and sudden

attachment of a large parasite. Host reaction during experimental conditions suggests that predisposition may be a factor affecting the natural association of these hosts and isopods, and may determine which host species of chromis is parasitized by *Anilocra chromis* in different areas of the West Indies.

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