LARVAL DEVELOPMENT OF HALOCARIDINA RUBRA HOLTHUIS
(DECAPODA, ATYIDAE)

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INTRODUCTION

Halocaridina rubra Holthuis, is a caridean shrimp endemic to the Hawaiian Islands. More specifically, the distribution of this species is restricted to anchialine pools (Holthuis, 1973) mainly in the more recent coastal lavas of Maui and Hawaii Islands (see also Maciolek & Brock, 1974). Previously identified as Caridina brevirostris Stimpson (Rathbun, 1906; Edmondson, 1929, 1935), this species was redescribed as a new genus and species by Holthuis (1963). It is a small, red-colored shrimp, the adults not exceeding 14 mm in total length.

The family Atyidae is represented in Hawaii by species of Atya, Halocaridina, and Antecaridina. (Another Hawaiian atyid species, Ortmania henshawi Rathbun, appears in older literature (e.g., Edmondson, 1929) but is of questionable taxonomic status and a review of the matter is in preparation by the senior author). A cursory study of the larval biology of Atya bisulcata Randall was conducted by Edmondson (1929) and currently is under more intensive investigation in this laboratory. The genus Antecaridina is monotypic, of Halocaridina recently a second species, Halocaridina (Halocaridinidae) trigonophthalma Fujino & Shokita, 1975, was described from the Ryukyu Islands. The larval development of Antecaridina lauensis has not been studied and that of Halocaridina rubra has not been documented heretofore. Abbreviated larval development of Caridina brevirostris Stimpson, the species with which H. rubra was confused originally, was reported by Shokita (1973a). The present study, involving the hatching and rearing of the larvae of H. rubra, was undertaken for the purpose of documenting the development of each larval stage.

Ovigerous females of H. rubra have not been observed or collected in the field (Lenic and Maciolek, unpublished data). In May, 1972, one ovigerous female with 12 eggs attached to the pleopods was noted among the dozens of individuals in our laboratory aquaria. All eggs of this specimen hatched and the first postlarval (postzoeal) stage was reached in 14 days (reported in Holthuis, 1973) but larval stages were not documented.
MATERIALS AND METHODS

Adult specimens of *Halocaridina rubra* were collected from anchialine pools at Cape Kinau, Maui, in June, 1973 (Maciolek, personal communication), and maintained in several laboratory aquaria containing mixohaline water (10-15%o). A variety of substrata (coarse sand, algal-covered rocks, and empty shells of *Achatina fulica*) was provided in some aquaria.

Subsequent to the reported observation of an ovigerous female in this laboratory (Holthuis, 1973), a second berried female with 10 eggs was discovered in December, 1974. However, all eggs were shed after 27 days apparently without hatching.

Larval development was observed from another ovigerous female in our laboratory on 10 February 1975. The gravid female was transferred to a darkened quart jar containing filtered water (15%o) and rock substratum. Darkening of the container was accomplished by covering the sides with a sheet of black plastic to minimize external disturbances. Hatchlings were transferred to a 100 ml glass bowl containing filtered mixohaline water (15%o) and maintained at temperatures between 22° and 23° C. Only one larva survived.

At each stage, the surviving larva was observed and photographed through a binocular dissecting microscope. Complete descriptions of meristic characters (details of the smaller paired appendages) were prevented by the lack of specimens for dissection. However, some details were described from the exuvium of each developmental stage using a compound microscope with phase-contrast illumination. Body lengths were measured in a straight line from the base of the eye to the tip of the telson. Carapace lengths were measured in a straight line from the base of the eye to the dorsal posterior edge of the carapace. Larval development terminology used in this paper follows that of Williamson (1969).

SIZE, NUMBER AND DEVELOPMENT OF EGGS

The ovigerous *Halocaridina rubra* upon which this report is based initially carried 12 eggs. Most of these were lost gradually during the next 5½ weeks. The eggs, which dropped before complete embryogenesis, were oval, reddish-brown, and measured 0.93-1.01 mm X 0.71-0.75 mm. Fifteen days after oviposition, differentiation was observed under a dissecting microscope as an opaque area at one pole. Appendage buds, optic lobes and pigmentation were apparent after 25 days and the alimentary canal became obvious after 29 days of development. A brooding period of 38 days was required for complete embryogenesis and three larvae hatched as free-swimming lecithotrophic zoeae. Two of these larvae died within 24 hours but the third completed development sustained by a rich supply of yolk.

LARVAL DEVELOPMENT

First Zoeal Stage (fig. 1a, b).

Size: Total length: 2.58-2.61 mm, carapace length: 0.83 mm.
Duration: Three days.