Effect of Copper on the Larval Development of the Estuarine Hermit Crab *Clibanarius olivaceus* Henderson

S. AMALKHAN, K. RAJENDRAN & R. NATARAJAN
Centre of Advanced Study in Marine Biology, Annamalai University, Parangipet 608 502

Received 25 October 1985; revised received 13 August 1986

The 96 h LC$_{50}$ value for Cu was found to be 60 ppb. Larval development was studied in 5 sublethal concentrations (1, 5, 10, 30, 50 ppb) and 60 ppb. Survival rate of larvae decreased with increase in test concentration but in the higher sublethal concentrations the overall time required for the completion of zoeal development was shorter.

Vellar estuary (lat. 11° 29' N; long. 79° 49' E) is bordered with paddy fields on both the sides. To maximise rice production, increased quantities of pesticides are used which in turn are washed into the estuary. The heavy metal copper is the most common ingredient in these chemicals and presently an attempt is made to elucidate the effect of this heavy metal on the nontarget larval stages of the most abundant hermit crab *Clibanarius olivaceus*. This species is important in the food chain and because of its ecology both the larvae and adults are likely to encounter polluted conditions.

*C. olivaceus* for toxicological study was collected from the Vellar estuary. In order to assess the ovigerous condition, the shells were carefully cracked with the help of a mechanical vice. Ovigerous animals were separated, offered new shells for inhabitation and kept in aquarium containing filtered seawater until hatching. As soon as the larvae were liberated, they were separated in clean beaker containing filtered seawater (sal. 35 ± 1 x 10$^{-3}$ and temp. 29 ± 1°C). Stock solution containing 3.925 g.l$^{-1}$ CuSO$_4$ 5 H$_2$O in deionised water was prepared and serially diluted to get required concentrations.

The 96 h LC$_{50}$ value determined was 60 ppb. In the present study the effect of 5 sublethal concentrations (1, 5, 10, 30, 50 ppb) besides the 96 h median lethal concentration was studied on the larval development. In control and in each test concentration 25 larvae were reared from 1 zoea to glaucothoe.

*Larval survival rate*—In the control 80% of the larvae reached the glaucothoe (post larval) stage (Fig. 1). Mortality occurred in I, II and III zoeal stages and there was no mortality in zoeal stages IV and V with all the larvae molting to subsequent stages. Survival rate in other test concentrations was < 80% and as the concentration increased, the survival rate decreased and the lowest survival rate (32.8%) was found in 60 ppb conc. Of the I Zoea, 70% moulted to II stage. Mortality was noted in each stage and the survival rate decreased from 56.6% in stage II to 33.3% in V stage. In the present study with increase in test concentration of Cu, survival rate of larvae decreased as reported for Hg$^{1,2}$ and Cd$^3$.

*Mean days of moulting*—Mean days of moulting of each zoeal stage in different test concentrations is given in Fig. 2.

---

Fig. 1—Average percent survival of *C. olivaceus* zoeal stages I-V from hatching to glaucothoe in different concentrations of Cu.
II, III and IV Zoeae: In these stages, shortest mean day of moulting was noticed in 50 ppb concentration. Mean days of moulting in higher concentrations (50 and 60 ppb) differed significantly from that of control and other 3 lower concentrations (1, 5 and 10 ppb).

V Zoea: As in the first zoeal stage, here also shortest mean day of moulting was noticed in 60 ppb concentration. Mean days of moulting in concentrations 30, 50 and 60 ppb differed significantly from that of control and other lower concentrations.

In the present study, the overall time required for the completion of zoeal development increased up to 5 ppb and then declined; minimum duration was found in the highest concentration of 60 ppb. The time taken for zoeal development in 30, 50 and 60 ppb concentrations was significantly shorter than that of control and other lower concentrations. On the contrary, Shelay and Sandifer reported delayed moulting and extended development time in the larvae of *Palaemonetes vulgaris* when the Hg test concentration increased. Faster moulting and shorter development time observed presently is attributed to stress. Stress in higher concentrations of Cu may exert action on the mechanism which regulates morphological changes and leading to speedy development of larvae as observed elsewhere.

The authors are thankful to the Director, and the authorities of Annamalai University for the facilities.

**References**