STUDIES ON THE OVIPOSITION OF *CALLOSOBRUCHUS MACULATUS*

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THE cowpea pulse beetle, *Callosobruchus* spp is one of the most destructive pests of the seed during storage and often results in enormous losses. Mookherjee *et al*[1] determined the loss in weight of pea seed due to this beetle to the extent of 33%. Keeping in view the economic importance of this pest, considerable work has been done on the oviposition of the pulse beetle[2–11], but the present contribution reports the oviposition of *C. maculatus* at different temperatures and constant humidity and the sites of the seed preferred by the beetle to oviposit their eggs (at 30°C and 70% R.H.).

The experiment was conducted in two phases. In the first phase, the oviposition of *C. maculatus* was made at three different temperatures (27, 30 and 35° with a constant relative humidity of 70%).

For culture studies, the seeds of fodder cowpea (variety 42–1) were sterilized at 60°C for 3 hr in the incubator to free the seeds from insect infestation. Thereafter, the cowpea seeds were kept in a desiccator. For maintaining the culture, 50 pairs of *C. maculatus* were released into the jar containing cowpea seed at 30°C.

Five pairs of freshly emerged adults were released in a separate tube containing 50 g of cowpea seed and the tube was covered with muslin cloth. The tube was placed in a desiccator at 70% R.H. These seeds were removed after 24 hr and the number of eggs counted. Another lot of fresh seeds was introduced in the same tube for oviposition during the next 24 hr and again the seeds were removed and the eggs counted. The same process was continued till the females died. The experiment was replicated 5 times.

In the second phase of the experiment, the sites of oviposition on the seeds were determined on the basis of location of eggs on (i) areas anterior and posterior to the suture of the seed (the place from where plumule and radicle arise) and (ii) right and left flat surfaces, at 30°C and 70% R.H.

A perusal of data in table 1 reveals that the temperature had a marked effect on the oviposition of *C. maculatus*. It is observed that within 24 hr, the maximum rate of oviposition is at 30°C and minimum at 35°C. But from the next day the rate of oviposition decreases as the temperature increases.

It is evident from table 1 that the mean number of eggs laid by a group of five gravid females per day declined gradually during the oviposition period. The maximum number of eggs was oviposited one day after the introduction of males and females and the minimum on the last day. Moreover, the maximum number of eggs was laid at 27°C and it was intermediate at 30°C.

Table 1 *Rate of oviposition by C. maculatus*

Time of the start of experiment (hr)	Mean number of eggs oviposited by five gravid females at 70% R. H.		
	27 ± 1°C	30 ± 1°C	35 ± 1°C
0–24	197.2	212.2	171.4
24–48	135.0	131.6	129.8
48–72	106 4	104.2	92.8
72–96	75.8	64.8	48.0
96–120	54.2	13.2	—
120–144	20.0	—	—

Table 1 also shows that as the temperature increases the egg-laying period decreases being maximum at 27°C and minimum at 35°C. The maximum number of eggs (65.2%) was laid posterior to the suture. The next site in preference being the area anterior to the suture (27.8%) and minimum (6.98%) eggs were oviposited on the right and left flat surfaces.

The present study shows that the temperature (27°C) proved to be more conducive for the oviposition of *C. maculatus*. The maximum number of eggs was laid on the first day and least on the last day. This agrees with Raina[6] and contradicts that reported by Avidov *et al*[12] for a group of *C. chinensis* where the initial rate was low upto 24 hr but registered an increase thereafter and finally declined.

The pulse beetle prefers to oviposit the eggs on posterior and anterior suture of the seed. It may be due to the loosely attached cotyledons; pre-adult stages easily develop and adults get an easy exit on these sites.

The oviposition of *C. maculatus* was studied at 27, 30 and 35°C and 70% R.H. The maximum number of eggs was laid at 27° and minimum on 35°C. The mean number of eggs laid by five gravid females per day declined gradually during the egg-laying period. The oviposition period decreases as the temperature increases. The site posterior to the suture was preferred maximally and right and left flat surfaces minimally.

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SENSITIVITIES OF THE CRAB *SCYLLA SERRATA* (FORSKAL) TO NAPHTHALENE IN DIFFERENT MOULTING STAGES

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OVER the past few years, considerable amount of experimental information has been generated regarding the effect of petroleum hydrocarbons in sea-water on marine organisms. From these studies it is evident that naphthalenes (naphthalene and alkyl naphthalene) are highly toxic to marine animals. It is well known that decapod crustaceans are sensitive to natural environmental stresses during moulting. Factors contributing to a high natural mortality in moulting crustaceans include mechanical, physiological and biological factors[1]. Man made stresses such as pollution from off shore oil production and trans-oceanic transport of crude and refined oil could impose an additional burden on the marine ecosystem. The present work is a study of the responses of premoult, intermoult and postmoult stages of the crab *Scylla serrata* to water borne naphthalenes. *S. serrata* is an intertidal crab forming an important part of the crustacean fishery along the Bombay coast.

From a stock of juvenile crabs of more or less uniform size, crabs of different stages namely, intermoult, premoult and postmoult, were seggregated and kept separately in different aquaria for acclimation. The classification proposed by Drach[2] was followed for identification of the different moulting stages of this crab.

The stages identified and tested in the present work were as follows:

Postmoult stage:	Stage A – immediately after moulting.
	Stage B – paper shell stage.
Intermoult stage:	Shell hard and calcification complete.
Premoult stage:	Advanced stage for subsequent moult with a few cracks in the old cuticle.

After acclimation the crabs were exposed to naphthalene concentrations of 11 mg/l, 5 mg/l and 2.5 mg/l in glass aquaria each containing 3 litre of sea water and 10 crabs of each stage. These three concentrations were selected with reference to 96 hr LC_{50} value of naphthalene (17 mg/l) for intermoult crabs. Acetone was used as the solvent for preparing stock solution of naphthalene. Aliquots of this solution were added in each experimental tank to give the desired concentration of the toxicant. In the case of the control, acetone alone was added to the water. Water was changed after every 24 hr with fresh addtion of the toxicant. The crabs were fed on bivalve flesh on alternate days. The sea water used during the tests had a temperature of 27°C to 29°C, PH 7.6 to 8.00, dissolved oxygen 6.3 to 8.5 mg/l and the salinity 30 to 32‰. The crabs were examined after every 24 hr up to a period of 15 days. After recording the mortality the dead animals were removed from the tanks. To see the sensitivity of postmoult crabs (Stage A), premoult crabs moulted under laboratory conditions were used for experimental purposes. Survival rate of crabs in all the four stages was, however, not studied at the same time.

From figure 1 it is evident that amongst the stages studied the postmoult crabs (Stages A and B) are more sensitive to all the three concentrations of naphthalene tested. Higher concentrations of naphthalene *i.e.* 11 mg/l was found most toxic at all the stages. In this case, more than 50% of the postmoult crabs died within 12 hr while the remaining showed autotomy. Crabs in stage A showed cent per cent mortality by the end of 48 hr and those in stage B by the end of 96 hr. Low concentration of naphthalene is comparatively less toxic to postmoult crabs.

Intermoult and premoult crabs showed more or less