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Effect of Neem Extracts on the Enzyme Levels of *Heliothis armigera* hubner

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Heliothis armigera hubner gram pod borer is one of the world's most destructive crop pests. It is polyphagous and well adapted to several crops such as chickpea, pigeonpea, groundnut, safflower, cotton, tomato, sorghum, maize *etc.* (Regupathy *et al.*, 1989). In India, its damage amounts to more than 300 million dollars for pigeonpea and chickpea crops alone (Anonymous,1989). Bengal gram (*Cicer auretinum*) was taken for the study, as the larvae feeds on all the parts of the plant causing complete destruction (Regupathy *et al.*, 1989).

Neem extracts have been used effectively for protection from many insect pests including *Heliothis* (Sinha and Mehrotra, 1988). These are plant insecticides which do not affect higher organisms. Neem products act as growth inhibitors, potent distruptors of insect morphogenesis, sterilants, inhibitors of ecodysone and juvenile hormone synthesis and release, and also as chitin synthesis inhibitors (schmutterer,1988). Due to one or more of the above said properties, there is a definite change in the insect development for which different enzymes in the insects contribute greatly. The important function of enzymes in various physiological processes of insects such as nutrition, egg maturation and intermediate metabolism (Ludwig *et al.*, 1962), growth, metamorphosis and development (Mathai and Nair, 1982), has been investigated. However, little work has been done on the effect of neem extracts on the enzyme levels in the insect (Naqui, 1986). Hence, in the present study an attempt has been made to correlate acetylcholinestrase, adenosinetriphosphatase and protease levels with the metabolical and morphological changes taking place in the insect on feeding plants treated with neem extracts.

The third instar larvae of *H. armigera* hubner were fed on bengal gram plants treated with three different neem extracts - neem leaf water extract (NLWE), neem seed kernel extract (NSKE) and neem oil water concentrate (NOWC), at four different concentrations (0.5%, 1.0%, 3.0% and 5.0%). The changes in enzyme activity were assayed at three different time intervals

(24 h, 48 h and 72 h) of feeding. The enzymes acetylcholinesterase, adenosinetri phosphatase and protease were assayed according to Metcalf (1951), Lardy and Wellman (1967) and Shanthi and Thangaraj (1989), respectively.

The acetylcholinestrase activity was reduced in *H.armigera* hubner fed on leaves treated with different neem products. The activity was found to be 20.74 units/mg tissue in the larvae that were fed on unsprayed leaves, while reduced activity ranging from 13.55 to 16.30 units/mg tissue was noticed in the larvae that were fed on leaves sprayed with the different conscentrations of the three neem extracts, namely, NSKE, NDWC and NLWE (Table 1). Regarding the duration of feeding and enzyme activity, it was found that 72 h of feeding on leaves sprayed with NSKE significantly lowered the activity to 15.21 units/mg tissue, when compared to 48 h and 24 h (15.81 units/mg tissue and 18.13 units/mg tissue respectively) of feeding. Out of the four concentrations of neem products tested, 5% concentration of neem extracts significantly reduced the activity of acetylcholinestrase .

The increased activity noticed with higher concentration and lesser feeding period would have been due to the starvation of the larvae, because of the antifeedant properties of the neem products. These results are supported by Guillet (1979), who stated that the increase in activity of adenosinetriphosphatase can be attributed to the increased energy demands by the insects. As the neem products act as potent feeding detterrents, the search for site increases the locomotar function, thus demanding energy.

The activity of the digestive enzymes protease was found to be significantly reduced in the larvae that were fed with NOWC (35.29 units/mg tissue), followed by NSKE and NLWE which were on par. The larvae fed on leaves sprayed with 5 % concentration had significantly low activity of 28.42 units/mg tissue. Feeding on leaves sprayed with 3% and 1% concentrations resulted in 31.69 and 33.79 units/mg tissue, respectively. The activity was at the highest level in the larvae fed with unsprayed leaves. According to Teo and Woodring (1988), starvation leads to a great reduction in protease activity. This reduce activity of protease in the present study is due to starvation a resulting from the antifeedant principles present in the neem products.

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