

on the columellar region. The operculum is absent and foot is large with greyish-ash colour. Outer edge of lip is light brown, grey rim and serrated; and the inner lip is white.

The tentacles measured about 10 to 12.5 mm in length. They are situated on either side of the snout, long and pointed. The proboscis protrudes from below the tentacles, has mouth at the tip.

The present material measured 22.1 mm in height, 14.02 mm in width; 21.95 mm in aperture height and 3.94 mm in aperture width, indicating that shell height and aperture height is more or less equal. The present observations on this species agree well with that made by Oliver<sup>1</sup>.

Only six animals were collected from Porto Novo waters. The associated molluscan species were *Babylonia spirata* L., *M. angustata* sowerby, *Tudicula spirillus* (Linne) and *Hemifuses pugilinus* (Born).

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#### VARIATIONS IN CARBOXYLIC ESTER HYDROLASE ACTIVITY IN *HELIOTHIS ARMIGERA* HÜBNER LARVAE

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AT global level, *Heliothis* complex is a major polyphagous agricultural pest and is reputed to cause heavy losses<sup>1</sup>. On Indian sub-continent *Heliothis armigera* Hübner is the dominant species, and is a serious pest of a number of crops including cotton and pulses (both

pigeonpea, *Cajanus cajan* L., and chickpea, *Cicer arietinum* L.)<sup>2</sup>. It has been suggested that *H. armigera* populations occurring in different regions of the country may differ significantly in various biological parameters including response to pesticides<sup>3</sup>. Since, the presence of carboxylic ester hydrolase (CE; EC 3.1.1.1) from the fifth instar larvae of this species has already been reported<sup>4</sup>, the present communication reports the titres of this enzyme and its response to various inhibitors in the populations of *H. armigera* collected from widely separated regions of the country on chickpea; the *Heliothis* populations were collected from Hyderabad (Andhra Pradesh), Pantnagar (Uttar Pradesh) and Hissar (Haryana). Our results show that both the titres as well as the response of the enzyme to various organophosphate and carbamate inhibitors differ significantly in the 3 populations studied. Further an interesting correlation between the titres of CE levels and  $I_{50}$  values (molar concentration of inhibitor to give 50% inhibition of the enzyme activity) was seen in various *Heliothis* populations; higher the CE activity lower the  $I_{50}$  value for the inhibitors.

The CE activity was assayed in the homogenates of whole larvae spectrophotometrically<sup>5</sup> using *ortho*-nitrophenylacetate (NPA) as substrate<sup>5</sup>. The insects were homogenized in 0.1 M, pH 8.0, phosphate buffer at the rate of 10 mg larvae/ml buffer, using an all glass Potter-Elvehjem type homogenizer. The homogenate was centrifuged at 6500 g for 20 min and the supernatant used for enzyme assay. A typical assay for enzyme activity contained homogenate equivalent to 10 mg fresh weight of larvae, 300  $\mu$ mol phosphate buffer and 3  $\mu$ mol NPA in a total volume of 3 ml at  $30^{\circ}\text{C} \pm 1^{\circ}\text{C}$ . The rate of NPA hydrolyzed was estimated by following the increase in absorbance with time at 415 nm using an Uvikon 810 double beam spectrophotometer. The extinction coefficient of the *ortho*-nitrophenate ions produced was taken as  $4.95 \times 10^3$ , for estimating the amount of NPA hydrolyzed<sup>6</sup>. The larvae of *H. armigera* of approximately the same size and age were collected from field crops of chickpea only so as to avoid the effects of host plant on enzyme activity. A minimum of 15 observations replicated 5 times were taken. The CE activity was observed to be highest in the populations collected from Hyderabad followed by those from Pantnagar and least in the populations from Hissar (table 1).

The response of the CE to the inhibitors sumioxon (*O, O*-dimethyl, *O*-3 methyl, 4-nitrophenyl phosphate), carbaryl (N-methyl-1-naphthyl carbamate) and eserine showed that  $I_{50}$  was highest for the enzyme obtained from *Heliothis* larvae collected from Hissar followed

**Table 1** Levels of CE from *Heliothis* larvae from various locations

Locations	$\mu\text{mol NPA hydrolyzed/g tissue/min}$
Hyderabad	$10.5 \pm 1.6^*$
Pantnagar	$8.1 \pm 2.4$
Hissar	$3.7 \pm 1.3$

Note: For conditions of reaction see text.

\*  $\pm$  values are standard deviations of the mean.

**Table 2**  $I_{50}$  values of the CE of *Heliothis* larvae from various locations

Locations	Sumioxon $\times 10^{-5}$ M	Carbaryl $\times 10^{-5}$ M	Eserine $10^{-5}$ M
Hyderabad	0.477	0.256	7.594
Pantnagar	1.895	0.495	89.352
Hissar	7.703	2.105	113.963

Note: The activity of the enzyme was measured after it was incubated with the inhibitors for 2 min with sumioxon and 5 min with carbaryl and eserine.

by Pantnagar and least from Hyderabad. This was true for all the three inhibitors tested. The differences in the  $I_{50}$  values between the most susceptible population (Hyderabad) and the most resistant population (Hissar) ranged between 10 to 15-fold for all the 3 inhibitors tested (table 2). The results also suggested that carbaryl was the best inhibitor for the CE occurring in *Heliothis* populations obtained from various regions of the country.

Since the above differences are significant, one can speculate about their origin. Firstly these differences might just be due to the different biotypes or subspecies occurring in different parts of the country. Secondly, it is also likely that the inhibitor response reflects the resistance/susceptibility status of the species since the carboxylesterases have been shown to be implicated in the metabolism of both organophosphates and carbamates<sup>7-9</sup>. Further these differences can also be explained on the basis of the "mutant aliesterase" theory<sup>10</sup>. Extensive studies are under way to elucidate the reasons for these differences.

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## SUMMER WEATHER DIE BACK OF COFFEE IN KARNATAKA

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THE Arabica coffee selections S 795 showed pronounced die-back in Ossoor Coffee Estate in Saklespur (Karnataka State) during March 1985. These are typical symptoms of summer weather die-back. Acervuli of *Colletotrichum* sp were found in great abundance on the bark of the mature twigs.<sup>1</sup> Later in the season, in May we came across several bushes including apparently healthy ones showing green new shoots dying backwards from the tips with darkened nodes and scorched leaves. Some of them had goose-neck symptoms and in some there was involvement of blossom also suggesting a bacterial plant pathogen.

*Pseudomonas syringae* van Hall was identified from the cultures based on tests suggested by Fahy and Persley<sup>2</sup>. The bacterial isolates were obtained using the