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Influence of Enzymes, Peroxidase and Phenylalanine Ammonia Lyase (PAL) Activities on the Incidence of Bruchid (*Callosobruchus Theobromae* L.) on Selected Fieldbean Accessions

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ABSTRACT

The activities of enzymes peroxidase and phenylalanine ammonia lyase (PAL) in pods exhibited negative correlation with the infestation of bruchid (*Callosobruchus theobromae* L.) population on fieldbean. The tolerant accession GL-164 showed the highest peroxides (3900 units/g) and PAL (168 units/g) activities followed by GL-187 (peroxides 3200 units/g and PAL 153 units/g) and GL-63 (peroxidase 2420 units/g and PAL 144 units/g). Whereas the susceptible HA-4 accession was recorded lowest peroxides (920 units/g) and PAL (87 units/g) activities followed by HA-3 (peroxidase 920 units/g and PAL 96 units/g) and GL-102 (peroxidase 960 units/g and PAL 103 units/g).

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Keywords: *Callosobruchus theobromae* L. fieldbean, peroxidase, phenylalanine ammonia lyase (PAL).

INTRODUCTION

Fieldbean, *Lablab purpureas* L. is also called dolichos bean, native of India is grown in the southern states like Karnataka, Andhra Pradesh, Tamilnadu, Kerala and Maharashtra. More than 150 species of insect pests are known to cause damage to this crop in field and storage. Among these insect pests, bruchids assume greater importance as they damage the final produce in the field and store house. Increased activities of two important disease-related enzymes such as peroxidase (Ishaaya and Sternlight, 1971) and phenylalanine ammonia lyase (PAL) (Bhatnagar *et al.*, 2000) have also been reported upon insect attack. In fieldbean there are more than 350 germplasm available but there was no resistant germplasm available against this pest and also the information on field infestation is rather scanty. Keeping this in mind the present study was undertaken

MATERIAL AND METHODS

The present investigation was conducted during 2009-2010 at the All India Co-ordinated Research

project on pigeonpea, University of Agricultural Sciences, GKVK, Bangalore. Forty accessions were collected and sown in two lines of three meter length as unreplicated. All the agronomic practices were followed as per the package of practices except the plant protection measures. Per cent pod infestation of fieldbean was recorded by taking pods from five plants randomly from each accession after harvest of the crop. Per cent pod infestation was computed by using the standard formula

$$\% \text{ Pod infestation} = \frac{\text{Number of pods damaged}}{\text{Total number of pods in Sample}} \times 100$$

Estimation of biochemical constituents were done as per standard procedure followed by Chance and Maehly, 1952 for enzymes peroxidase and Saunders and McClure, 1975 for Phenylalanine ammonia lyase (PAL).

RESULTS AND DISCUSSION

The bruchid incidence in 40 test accessions ranged

from 1.25 to 36.84 per cent. Ten accessions were selected (which had shown some sort of tolerance/susceptibility to the bruchid) for the analysis of peroxidase and Phenylalanine ammonia lyase (PAL) activity. The correlation between bruchid infestation and activities of peroxidase and Phenylalanine ammonia lyase (PAL) enzymes in the pods of different accessions was negatively significant (Table 1) which indicating that increase in enzyme activities resulted in less infestation.

The data presented in Table 2 shown a significant variation in the peroxidase activity among the different accessions. In the tolerant group, the peroxidase activity was higher. The peroxidase activity was highest in pods. GL164 recorded 3900 units, GL187 (3200), GL 63 (2420), GL195 (2400 units/g) while GL127 recorded 2240 units per g of peroxidase activity in pods. In the susceptible group, the peroxidase activity was lower. The peroxidase activity was low in pods of GL36 (1600 units/g), GL46 (1040 units/g), GL102 (960 units/g), HA4 (920

units/g) and HA3 (900 units per g). Girish (2005) reported higher activities of peroxidase in the resistant varieties of fieldbean and pigeon pea suggesting its possible defensive role in plants against *Adisura atkinsoni* and *Helicoverpa armigera*, respectively.

There was a significant variation in the PAL activity of pods among the accessions. In the tolerant group, the PAL activity was higher in GL164 (168 units per gram) followed by GL187 (153 units/g), GL63 (144 units/g), GL195 (136 units/g) and GL127 (127 units per g) in pod. In susceptible accession groups, lower PAL activity was recorded. Among which the highest PAL activity was recorded in GL36 (121units/g), GL46 (114 units/g), GL102 (103 units/g), HA3 (96 units/g) and HA4 (87 units/g). Similarly Girish (2005) reported that the resistant variety had higher PAL activity as compared to the susceptible one in leaf, pod wall and mature seed due to pod borer attack in pigeonpea and fieldbean.

Table 1: Correlation between enzymes and pod damage in selected fieldbean accessions

Enzymes	Pods
Total peroxidase activity	-0.9397*
PAL activity	-0.9252*

*Correlation is significant at 0.05 levels

Table 2: The activities of enzymes, peroxidase and phenylalanine ammonia lyase (PAL) in selected fieldbean accessions

	Sl. No	Accessions	Total peroxidase activity (Units/g)	PAL activity (Units/g)
			Pods	Pods
Tolerant groups	1	GL-164	3900 (61.94) ^d	168 (12.98) ^a
	2	GL-187	3200 (56.15) ^d	153 (12.38) ^b
	3	GL-63	2420 (48.89) ^c	144 (12.02) ^c
	4	GL-195	2400 (48.74) ^c	136 (11.68) ^d
	5	GL-127	2240 (47.07) ^c	127 (11.29) ^e
Susceptible groups	6	GL-36	1600 (39.95) ^b	121 (11.02) ^f
	7	GL-46	1040 (32.22) ^a	114 (10.69) ^g
	8	GL-102	960 (30.94) ^a	103 (10.16) ^h
	9	HA-4	920 (30.31) ^a	96 (9.81) ⁱ
	10	HA-3	900 (29.98) ^a	87 (9.33) ^j
Tolerant Group Mean			2832	145.6
Susceptible Group Mean			1084	104.2
Overall Mean			1958	124.9
F'-test			*	*
SEM ±			1.2163	0.0532
CD @ p=0.05			6.2597	0.2696

Figures in parenthesis indicates $\sqrt{x + 0.5}$ transformed values

* Significant at p=0.05

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