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Evaluation of Indian bean genotypes against insect pests

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Abstract
An experiment was conducted during rabi 2015-16, in randomized block design with eight treatments (six genotypes namely 2013 DOLVAR-1, 2013 DOLVAR-2, 2013 DOLVAR-3, 2013 DOLVAR-4, 2014 DOLVAR-3 and 2014 DOLVAR-4 and two standard check varieties Swarna Utkarsh and PEP) and three replications. Lablab genotypes were evaluated against insect pests by recording their incidence in each weather week. Seasonal mean population level of each insect species on different genotypes was subjected to analysis of variance at 5% level and considered to describe the genotypic preference of insect-pests. Major insect-pests recorded on different genotypes included aphid (*Aphis craccivora* Koch), jassid (*Empoasca fabae* Harris), whitefly (*Bemisia tabaci* Gennadius) and pod borer (*Helicoverpa armigera* Hubner).
Lowest seasonal mean populations (16.11 and 17.22 insects / 10 cm twig) of *Aphis craccivora* were recorded on genotypes 2013 DOLVAR-4 and 2013 DOLVAR-3, respectively which may be further evaluated and used in breeding programmes for developing resistant lines

Keywords: Lablab, screening of genotypes, resistance, *Aphis craccivora*

Introduction
Indian bean *Lablab purpureus* (L.) Sweet is an important vegetable crop of India mainly grown for its fresh pods and dry seeds which have a very important place in dietary schedule and belongs to family Fabaceae. It is known by different names like hyacinth bean, lablab-bean, bonavist bean, dolichos bean, seim bean, Egyptian kidney bean, Indian bean, bataw and Australian pea. Green pods of field bean have high nutritive value containing small amount of vitamin A, vitamin C, proteins, iron and calcium in raw state. The ripe seeds contain 20 to 28 percent of protein. In India, *Lablab* is a field crop mostly confined to the peninsular region and cultivated to a large extent in Karnataka and adjoining districts of Tamil Nadu, Andhra Pradesh and Maharashtra. Karnataka contributes a major share, accounting for nearly 90 percent in terms of both area and production in the country [1].
Lablab bean is an important vegetable crop of Madhya Pradesh. The crop suffers from damage by a number of insect pests that include sucking pests namely bean aphid (*Aphis craccivora* Koch), jassid (*Empoasca fabae* Harris) and whitefly (*Bemisia tabaci* Gennadius). Pod borer complex includes hairy caterpillar (*Spilarctia obliqua* Walker), pod borer (*Helicoverpa armigera* Hubner, *Maruca vitrata* (Geyer) and pod bug (*Riptortus pedestris* (Fabricius), *Clavigralla gibbosa* (Spinola), *Nezara viridula* (Linnaeus). Govindan [2] has recorded as many as 55 species of insects and one species of mite feeding from seedling stage to the harvest of this crop.
Losses to the crop due to pod borer complex have been reported to be very high. Among the pod borer complex, the pod damage due to *Helicoverpa armigera*, *Maruca vitrata* and *Lampides boeticus* were to the tune of 20.43, 16.66 and 10.20 percent, respectively [3]. *Helicoverpa armigera* to be the predominant pod borer and its incidence was as high as 80.50 larvae per 10 plants during third week of November [4].
Several genotypes have been reported in the past by various scientists at different locations to exhibit tolerance to insect pests of *Lablab purpureus*. Substantial variability among the accessions of *Lablab purpureus* has been reported [5] for quantitative traits, bruchid and pod borer infestation. Tolerant or resistant plant types constitute an important element of IPM programmes. Hence it was considered important to evaluate some genotypes for their comparative performance against insect pests. There is a need to select high yielding genotypes coupled with tolerance to insect pests as the yields of different genotypes differ

widely [6]. Development periods of sucking pests like *Bemisia tabaci* differs on different plants. The shortest developmental period of *Bemisia tabaci* was reported on *Lablab purpureus* [7].

Materials and Methods

The experiment was conducted at Horticulture farm J.N.K.V.V. Jabalpur (M.P.) during the *Kharif-Rabi* season of 2015-16. Jabalpur represents the agro-climatic region of "Kymore Plateau and Satpura Hills" and lies in rice-wheat crop zone of the state. The soil of the experimental field was medium black with good drainage and uniform texture.

The experiment was laid out in RBD (Randomized Block Design) with eight treatments (six genotypes namely 2013 DOLVAR-1, 2013 DOLVAR-2, 2013 DOLVAR-3, 2013 DOLVAR-4, 2014 DOLVAR-3 and 2014 DOLVAR-4 and two varieties Swarna Utkarsh and PEP) and three replications. The plot size was 4.60 × 3.00 m. The plant to plant and row to row distance was maintained at 30 cm and 60 cm, respectively. The crop was sown in the month of August' 2015 using standard agronomical practices. Evaluation of lablab genotypes involved the recording of incidence of insect-pests in each weather week starting at the vegetative stage of the crop. Sampling unit was 10 cm twig, for recording the population of aphid, (*Aphis craccivora* Koch). Population of whitefly (*Bemisia tabaci* Gennadius) and jassid (*Empoasca fabae* Harris) were recorded on six leaves per plant (2 upper, 2 middle and 2 lower leaves). Four such samples were recorded in each replication and treatment. Population of other insect-pests and natural enemies were also recorded on different genotypes. Mean population level was considered to describe the genotypic preference of insect-pests. During poding stage the damage to the pods was recorded and expressed in terms of percentage pod damage.

Statistical Analysis

The design was RBD (Randomized block design). The data on pest population were transformed to square root ($\sqrt{x} + 0.5$). The data thus transformed were subjected to statistical analysis for knowing the significance of different treatments; similarly, data on grain yield were also subjected to statistical analysis. The data obtained from a set of observation for each character was tabulated and analysed by the method of "Analysis of variance".

Percent pod damage

Percent pod damage was calculated under different treatments as per formula.

$$\text{Percent Pod Damage} = \frac{\text{Damaged Pods}}{\text{Total number of pods}} \times 100$$

Grain yield

Yield was calculated under different treatments as per formula.

Yield / ha = Factor x grain yield / plot

Where,

$$\text{Factor} = \frac{10000}{\text{Net plot size}} \text{ in sq.m.}$$

Results and Discussion

The observations on evaluation of *Lablab purpureus* genotypes against different insect pests; population dynamics and succession of insect pests on variety (Swarna Utkarsh) and the correlation of *Aphis craccivora* and *Bemisia tabaci* population with weather parameters in *Lablab purpureus* are described below.

Evaluation of *Lablab purpureus* genotypes against different insect-pests

Six genotypes and two varieties (check) of *Lablab purpureus* were evaluated against different insect-pests. Major insect-pests recorded on different genotypes included aphid (*Aphis craccivora* Koch), jassid (*Empoasca fabae* Harris), whitefly (*Bemisia tabaci* Gennadius) and pod borer (*Helicoverpa armigera* Hubner). The incidence of these insect-pests during different standard meteorological weeks (SMW) on different genotypes is presented. Seasonal mean population of these insect pests on different genotypes is described below.

Aphid, *Aphis craccivora* (Koch) (Hemiptera: Aphididae)

The incidence of aphids differed significantly among genotypes and ranged between 16.11 and 43.28 individuals per 10 cm twig. Lowest seasonal mean population was observed on genotype 2013 DOLVAR-4, followed by genotype 2013 DOLVAR-3 (16.11 and 17.22 insects, respectively) and both were at par. Highest mean seasonal population (42.49 individuals per 10 cm twig) was recorded on genotype 2014 DOLVAR-3.

Jassid, *Empoasca fabae* (Harris) (Hemiptera: Cicadellidae)

Seasonal mean population of *Empoasca fabae* differed significantly among genotypes and ranged between 0.41 and 0.73 individuals / 6 leaves (Table 1). Lowest population was recorded on varieties PEP (c) and Swarna Utkarsh (c) (0.41 and 0.56 insects per sample, respectively) and both were at par. Highest population was recorded on genotype 2014 DOLVAR-3 (0.73 individuals per sample) that was at par to all the remaining genotypes tested.

White fly, *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae)

Seasonal mean population of *Bemisia tabaci* differed significantly among genotypes and ranged between 0.89 and 1.30 individuals per 6 leaves. Lowest population of *Bemisia tabaci* was observed on variety PEP (c) followed by varieties Swarna Utkarsh (c) and genotypes 2013

Table 1: Seasonal mean population of *Aphis craccivora*, *Bemisia tabaci* and *Empoasca fabae* on *Lablab purpureus genotypes* during August 2015-March 2016

Tr.	Name of genotype	Seasonal mean population (# of insects / sample)			Pod damage (%) by *Helicoverpa armigera*	Pod yield (q/ha)
		Aphis craccivora *	*Bemisia tabaci***	*Empoasca fabae***		
T1	2013 DOLVAR-1	26.74	0.98	0.61	7.88	36.71
		(5.21)***	(1.21)	(1.05)	(13.25)****	
T2	2013 DOLVAR-2	35.56	1.14	0.61	8.34	50.00
		(5.85)	(1.28)	(1.05)	(16.67)	
T3	2013 DOLVAR-3	17.22	1.06	0.61	7.85	67.87
		(4.16)	(1.25)	(1.05)	(16.22)	
T4	2013 DOLVAR-4	16.11	1.30	0.62	8.25	39.97
		(4.06)	(1.34)	(1.06)	(16.67)	
T5	2014 DOLVAR-3	43.28	1.00	0.73	6.73	42.26
		(6.61)	(1.23)	(1.11)	(14.87)	
T6	2014 DOLVAR-4	42.49	1.04	0.58	5.66	75.24
		(6.52)	(1.24)	(1.04)	(13.65)	
T7	Swarna Utkarsh (C)	28.79	0.94	0.56	6.56	37.43
		(5.39)	(1.20)	(1.03)	(14.73)	
T8	PEP (C)	37.20	0.89	0.41	7.78	46.01
		(6.06)	(1.18)	(0.95)	(16.10)	
	SEM±	0.02	0.45	0.03	1.34	11.31
	CD 5%	0.06	1.35	0.08	N. S.	N.S.

Sample unit * 10 cm. per twig. ** 6 leaves per plant. ***$\sqrt{x} + 0.5$. **** Angular transformed value. N.S. = Non-significant.

DOLVAR-1, 2014 DOLVAR-3 and 2014 DOLVAR-4 (0.89, 0.94, 0.98,1.0 and 1.04 individuals per six leaves) and all were at par. Highest population of *Bemisia tabaci* was observed in genotypes 2013 DOLVAR-4 (1.30 individuals per sample).

Pod damage by *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae)

Lowest pod damage (5.66%) was observed on genotype 2014 DOLVAR-4 and highest (8.34%) pod damage was recorded on genotype 2013 DOLVAR-2 (Table -). Pod damage among all genotypes was found to be statistically non-significant at 5% level of significance.

Pod yield q/ha

Highest yield of green pods was observed in genotype 2014 DOLVAR-4 (75.24 q/ha) followed by genotype 2013 DOLVAR-3 (67.87 q/ha) and genotype 2013 DOLVAR-2 (50.00 q/ha). However, the differences in pod yield among genotypes were observed to be non-significant at 5% level of significance.

Discussion

The findings of present experiment entitled "Genotypic preference, population dynamics and succession of different insect pests on Indian bean," have been discussed in this chapter in the light of previous work conducted by scientists at various locations.

Evaluation of *Lablab purpureus* genotypes against insect-pests

In present experiment six genotypes and two varieties of *Lablab purpureus* were evaluated against natural population of insect-pests under field conditions. Major sucking insect pests included *Aphis craccivora*, *Bemisia tabaci* and *Empoasca fabae*. In present experiment the major pod borer species recorded was *Helicoverpa armigera* that caused pod damage ranging between 5.66 and 8.34 percent, while Prasad [8] reported *Maruca vitrata*, *Helicoverpa armigera* and *Callosobruchus theobromae* as the major pod borer complex. Malikarjuna [9] recorded eight species of pod borers, with *Helicoverpa armigera* to be the dominant one. In present experiment the incidence of *Aphis craccivora* differed significantly among genotypes and ranged between 16.11 and 43.28 individuals per 10 cm twig with two genotypes namely 2013 DOLVAR-4 and 2013 DOLVAR-3 registering the lowest population indicating lower preference by *Aphis craccivora.* There are no previous references available to compare the present findings, however, Kamau *et al*. [10] reported 3 accessions of *Dolichos lablab* showing moderate resistance against *Aphis craccivora* when evaluated at 14, 40 and 70 days after sowing. It was also reported that its infestation at 14 days after sowing reduced plant height and shoot weight by over 60%. Renuka [11] screened 110 field bean genotypes and reported genotype 'Kadale avare' to be moderately resistant against *Aphis craccivora* under both the green house and field conditions.

In present experiment the lowest population of *Bemisia tabaci* was observed on variety PEP (c) followed by varieties Swarna Utkarsh (c) and genotypes 2013 DOLVAR-1, 2014 DOLVAR-3 and 2014 DOLVAR-4 (0.89, 0.94, 0.98, 1.0 and 1.04 individuals per six leaves). Incidence of *Bemisia tabaci* on different varieties and genotypes of *Lablab purpureus* could not be traced in literature available.

In present experiment the population of *Empoasca fabae* was recorded to be significantly low on variety PEP (c) and Swarna Utkarsh (c) (0.41 and 0.56 individuals per six leaves), however, no previous work is available to compare the findings. No variety or genotype in present experiment indicated resistance against *Helicoverpa armigera* damage, however, the mean pod damage was observed to be moderate (5.66 to 8.34%). A number of workers have evaluated varieties of *Lablab purpureus* against *Helicoverpa armigera* at different places. Parvathy [12] screened forty bean accessions against pod borer complex. The accession EC-92956 was reported to have lowest pod damage (9.58%), while in present experiment the pod damage was below this level in all the genotypes and varieties tested. Naik *et al*. [13] reported mean pod damage value of 27.92 ± 9.25 percent in sixty eight germplasm accessions and found six accessions namely DA-15, DA-36, DA-39, DA-44, DA-63 and Da-65 to be highly resistant to pod borer incidence falling in the range of 0 to 9.42 percent, while in present studies the pod borer incidence remained below this level in all the genotypes

tested. However, the low pod damage in present study seems to be the resultant of low population level of *Helicoverpa armigera* on the crop in general. Prasad [7] has reported two accessions viz. GL 233 and GL 426 to be moderately tolerant to pod borer infestation. Jeer [14] recorded peak incidence of 40.25 *Helicoverpa armigera* larvae per 5 plants during third week of November. Direct comparison of previous results with present genotypes is not possible since there is no resemblance in them.

Conclusion

Lowest seasonal mean populations (16.11 and 17.22 insects / 10 cm twig) of *Aphis craccivora* were recorded on genotypes 2013 DOLVAR-4 and 2013 DOLVAR-3, respectively hence they may be further evaluated and used in breeding programmes for developing resistant lines.

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