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Screening of Indian bean, *Lablab purpureus* var. *Typicus* (L.) sweet varieties for resistance against major sucking insect pests

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Abstract

The studies were conducted to screen Indian bean, *Lablab purpureus* var. *typicus* (L.) sweet varieties for resistance against major sucking insect pests viz., aphid, *Aphis craccivora* (Koch); leafhopper, *Empoasca fabae* (Harris) and whitefly, *Bemisia tabaci* (Genn.) during kharif, 2019. The experiment was laid out in randomized block design with eight varieties each replicated thrice. The observations on the population of major sucking insect pests were recorded soon after appearance on all the varieties at weekly interval. Out of eight varieties of Indian bean screened for relative resistance against sucking insect pests, none was found free from the infestation of pests. The varieties Pusa Early Prolific and Arka Jay were categorized as highly resistant to leafhopper and whitefly whereas, Arka Jay and Pusa Early Prolific to aphid. The varieties Pariry, Bauni, G. Local and Diana were categorized as moderately resistant and J. K. SPL and K. Bhusan were categorized as least resistant to aphid, leafhopper and whitefly. The total phenols had significant negative and free amino acid had significant positive effect on the population of sucking insect pests on Indian bean.

Keywords: Indian bean, resistance, screening, sucking insect pests, variety

Introduction

Indian bean, *Lablab purpureus* var *typicus* (L.) Sweet commonly known as hyacinth bean, Egyptian bean, dolichos bean or *Sem* belongs to family Fabaceae, is one of the important pulse cum vegetable crops grown in fields as well as in kitchen gardens throughout the tropical regions in Asia and Africa. The crop provides silage, green manure and excellent source for soil Nitrogen fixation. It is also grown for medicinal and ornamental purposes. It helps in relieving constipation and weight loss due to good fibre content (Bose *et al.*, 1993) ^[1]. The crop is invaded by number of insect pests, but sucking insect pests viz., aphids, leafhoppers and whitefly have been reported as the major pests. The nymphs and adults of these pests cause damage by sucking the cell sap from tender parts of the plant including lower side of the leaves. In case of severe infestation, these insect pests attack all parts of the plants including pods which result in stunted growth and decreased yield. The resistant varieties are an important part of integrated pest management strategies because they bear no extra costs to minimize the damage and use as a prophylactic control measure against insect pests. Hence, in the present study some varieties of Indian bean were screened for resistance against major sucking insect pests.

Materials and Methods

The present investigations were conducted at Research Farm of S.K.N. College of Agriculture, Jobner, Jaipur (Rajasthan) on Indian bean crop under field conditions during *Kharif*, 2019. The experiment was laid out in a simple Randomized Block Design (RBD) with eight treatments (varieties), each replicated thrice. The observations on the population of major sucking insect pests viz.; aphid, leaf hopper and whitefly were recorded soon after appearance on all the varieties, exposed to natural infestation. The observations were taken on five randomly selected and tagged plants in each plot at weekly interval. The data recorded on population of aphid, leaf hopper and whitefly were subjected to analysis of variance after transformation in to $\sqrt{X+0.5}$ values. The mean insect populations of Indian bean varieties recorded during the crop season were categorized on the basis of formula given below:

$\bar{X} \pm \sigma$ Where,

\bar{X} = Mean of peak insect population

σ = Standard deviation of peak insect population.

Mean insect population per shoot/ three leaves	Category
Below $\bar{X} - \sigma$	highly resistant
$\bar{X} - \sigma$ to $\bar{X} + \sigma$	moderately resistant
Above $\bar{X} + \sigma$	least resistant

The free amino acids and total phenol were estimated as per procedure given by Moory and Stein (1958)^[9] and Bray and Thorpe (1954)^[2], respectively. The correlation between total phenols and free amino acids with insect population was worked out.

Results and Discussion

Eight varieties of Indian bean viz., Arka Jay, Pusa Early Prolific, Pariry, Bauni, G. Local. Diana. J. K. SPL and K. Bhusan were screened for their relative resistance against major sucking insect pests (aphid, leafhopper and whitefly). Among them none was found free from the infestation of pests. The present finding is agreement with Meena *et al.* (2009)^[8] and Kumar (2016)^[7].

Aphid, *Aphis craccivora* (Koch)

The minimum population of aphid was recorded on Arka Jay and Pusa early Prolific harbored 161.00 and 172.80 aphids/shoot. The maximum population was recorded on K. Bhusan and J.K. SPL which exhibited 215.67 and 214.07 aphids/shoot, respectively. The other varieties viz., Paury, Bauni, G. Local and Diana exhibited 183.33, 186.67, 193.00 and 193.67 aphids/shoot, respectively and were ranked in middle order with regards to aphid population (Table 1).

Based on the statistical categorization ($\bar{X} \pm \sigma$) the mean population of aphid was found to be below 66.37 per shoot on varieties Arka Jay and Pusa early Prolific were categorized as highly resistant to aphid; between 66.37- 86.11 per shoot on Pariry, Bauni, G. Local and Diana were categorized as moderately resistant and above 86.11 per shoot on J.K. SPL and K. Bhusan were categorized as least resistant. The present findings are partially agreement with Gupta *et al.* (1985)^[5], Kumar *et al.* (1987)^[6] and Dalwadi *et al.* (2007)^[3]. Meena *et al.* (2009)^[8] categorized varieties, Pusa Sem-3 and Pusa Early Prolific as less susceptible (resistant) and Pusa Sem-2, EC-27598, IC-10189 and Jobner local as moderately susceptible, whereas, entries IC-6121 and EC-18544 as highly susceptible support the present findings. Godwal (2010)^[4] categorized genotypes JDL-79-1 and VRSEM-11 as least susceptible against aphid, *A. craccivora*, Glory, IS-2 Durgapura Selection-1, TRC- Dolichos-3, Swarna Utkrisht and Pusa Early Prolific as moderately susceptible and Ankur Goldy, Flora and Local (Laxmi) as highly susceptible corroborate the present findings. Likewise, Kumar (2016)^[7] categorized Indian bean variety, VRSEM-11 as least susceptible; Arka Jay, Amogha, Paury, Pusa Early Prolific, DOLPVAR-2, DOLPVAR-4 and Swarna Utkrisht as moderately susceptible

and Laxmi and Dolichos Selection-1 as highly susceptible against aphid, *A. craccivora*.

Leafhopper, *Empoasca fabae* Harris

The leafhopper population was recorded minimum on Pusa Early Prolific and Arka Jay harbored 5.67 and 16.33 leafhoppers/ three leaves, respectively. The maximum population was recorded on K. Bhusan and J.K. SPL which exhibited 27.53, 24.80 leafhoppers/ three leaves, respectively. The other varieties viz., Paury, Bauni, G. Local and Diana exhibited 20.20, 20.67, 22.07 and 22.67 leafhoppers/ three leaves, respectively were ranked in middle order with regards to leafhopper population (Table 2).

Based on the statistical categorization ($\bar{X} \pm \sigma$) the mean population of leafhopper was found to be below 8.29 per three leaves on varieties Pusa Early Prolific and Arka Jay were categorized highly resistant to leafhopper; between 8.29 – 13.45 per three leaves on Pariry, Bauni, G. Local and Diana were categorized as moderately resistant and above 13.45 per three leaves on J.K. SPL and K. Bhusan were categorized as least resistant. Kumar (2016)^[7] categorized Indian bean variety, VRSEM-11 and Arka Jay as least susceptible; Paury, Pusa Early Prolific, DOLVAR-2, DOLPVAR-4, Amogha and Swarna Utkrisht as moderately susceptible and Laxmi and Dolichos Selection-1 as highly susceptible against leaf hopper, *E. motti* support the present findings.

Whitefly, *Bemisia tabaci* (Genn.)

The whitefly population was also recorded minimum on Pusa Early Prolific and Arka Jay, harbored 22.07 and 22.87 whiteflies/ three leaves, respectively. The maximum population was recorded on K. Bhusan and J.K. SPL which exhibited 33.73 and 31.67 whiteflies/ three leaves, respectively. The other varieties viz., Paury, Bauni, G. Local and Diana exhibited 25.26, 26.27, 28.00 and 28.13 whiteflies/ three leaves, respectively were ranked in middle order with regards to whitefly population (Table 3).

Based on the statistical categorization ($\bar{X} \pm \sigma$) the mean population of whitefly was found to be below 9.32 per three leaves on varieties Pusa Early Prolific and Arka Jay were categorized highly resistant to whitefly; between 9.32- 15.34 per three leaves on Pariry, Bauni, G. Local and Diana were categorized as moderately resistant and above 15.34 per three leaves on J.K. SPL and K. Bhusan were categorized as least resistant. The present findings are also agreement with Kumar (2016)^[7].

Biochemical characters

The total phenols had significant negative effect on the population of sucking insect pests in Indian bean viz., aphid ($r = -0.938$), leaf hopper ($r = -0.942$) and whitefly ($r = -0.951$) populations while, the free amino acid had significant positive effect on the population of sucking insect pests in Indian viz., aphid ($r = 0.915$), leaf hopper ($r = 0.916$) and whitefly ($r = 0.921$). The results are conformity with Kumar (2016)^[7] reported that total phenols had significant negative and free amino acid had significant positive effect on sucking pest population (Table 4).

Table 1: Mean population of aphid, *Aphis craccivora* Koch on different varieties of Indian bean, *Lablab purpureus* var *typicus* (L.) Sweet

S. No.	Varieties	Mean aphid population/ shoot											Mean
		20.08.19	27.08.19	03.09.19	10.09.19	17.09.19	24.09.19	01.10.19	08.10.19*	15.10.19	22.10.19	29.10.19	
1.	Arka Jay	1.00 (1.50)	1.47 (1.71)	8.93 (3.49)	24.27 (5.43)	26.20 (5.62)	80.20 (9.46)	141.52 (12.40)	161.00 (13.19)	124.20 (11.64)	75.20 (9.17)	36.27 (6.52)	61.84 (8.36)
2.	Pusa Early Prolific	2.13 (1.96)	2.00 (1.91)	10.60 (3.76)	27.20 (5.72)	31.07 (6.07)	82.53 (9.58)	142.47 (12.44)	172.80 (13.65)	131.87 (11.98)	78.13 (9.34)	38.53 (6.71)	65.39 (8.59)
3.	Paury	2.33 (2.03)	2.40 (2.05)	13.67 (4.20)	30.40 (6.01)	40.00 (6.82)	87.20 (9.84)	152.00 (12.83)	183.33 (14.04)	143.00 (12.46)	88.87 (9.93)	42.87 (7.05)	71.46 (8.95)
4.	Bauni	2.27 (2.01)	3.60 (2.40)	12.47 (4.03)	32.20 (6.17)	47.80 (7.41)	98.20 (10.41)	160.00 (13.15)	186.67 (14.16)	149.40 (12.72)	93.87 (10.19)	43.33 (7.08)	75.44 (9.19)
5.	G. Local	1.13 (1.56)	3.73 (2.43)	12.67 (4.06)	34.13 (6.34)	52.13 (7.72)	101.07 (10.55)	162.53 (13.25)	193.00 (14.39)	153.53 (12.89)	94.87 (10.24)	46.53 (7.32)	77.76 (9.32)
6.	Diana	3.47 (2.36)	4.67 (2.66)	15.40 (4.42)	37.13 (6.59)	58.67 (8.16)	103.40 (10.67)	169.33 (13.51)	193.67 (14.42)	157.33 (13.04)	95.27 (10.26)	48.73 (7.48)	80.64 (9.48)
7.	J.K-SPL	3.80 (2.45)	7.47 (3.23)	17.53 (4.69)	39.67 (6.80)	64.40 (8.52)	111.73 (11.07)	178.53 (13.86)	214.07 (15.13)	168.73 (13.49)	105.13 (10.75)	53.80 (7.83)	87.77 (9.87)
8.	K. Bhusan	2.33 (2.03)	7.80 (3.29)	18.13 (4.76)	41.67 (6.96)	69.33 (8.83)	114.00 (11.18)	182.67 (14.02)	215.67 (15.19)	171.40 (13.59)	107.73 (10.88)	55.80 (7.97)	89.63 (9.97)
	S Em. _±	0.04	0.05	0.09	0.13	0.16	0.18	0.23	0.25	0.22	0.19	0.15	0.19
	CD at 5%	0.12	0.16	0.26	0.38	0.46	0.53	0.68	0.74	0.65	0.56	0.44	0.54
	S.D.												9.87

* Peak population of aphid

Figures in the parentheses are $\sqrt{X+0.5}$ values**Table 2:** Mean population of leafhopper, *Empoasca fabae* Pruthi on different varieties of Indian bean, *Lablab purpureus* var *typicus* (L.) Sweet

S. No.	Varieties	Mean leafhopper population/ three leaves*											Mean
		13.08.19	20.08.19	27.08.19	03.09.2019	10.09.19	17.09.19	24.09.19	01.10.19	08.10.19*	15.10.19	22.10.19	
1.	Arka Jay	0.27 (1.02)	1.07 (1.53)	4.80 (2.69)	12.20 (3.99)	15.60 (4.45)	14.67 (4.33)	16.33 (4.54)	12.27 (4.00)	6.07 (2.96)	3.47 (2.36)	0.20 (0.95)	7.90 (3.31)
2.	Pusa Early Prolific	0.20 (0.95)	1.13 (1.56)	4.00 (2.50)	11.07 (3.83)	13.53 (4.18)	14.47 (4.30)	15.67 (4.46)	11.00 (3.82)	5.33 (2.81)	3.13 (2.27)	0.00 (0.50)	7.23 (3.19)
3.	Paury	0.33 (1.07)	1.53 (1.74)	7.00 (3.15)	14.20 (4.27)	17.67 (4.70)	16.33 (4.54)	20.20 (4.99)	13.87 (4.22)	9.33 (3.55)	4.27 (2.57)	1.13 (1.56)	9.62 (3.60)
4.	Bauni	0.33 (1.07)	1.60 (1.76)	8.20 (3.36)	15.13 (4.39)	18.73 (4.83)	18.67 (4.82)	20.67 (5.05)	15.13 (4.39)	10.33 (3.71)	5.00 (2.74)	1.93 (1.89)	10.52 (3.74)
5.	G. Local	0.47 (1.19)	1.73 (1.82)	8.67 (3.44)	16.40 (4.55)	19.73 (4.94)	20.00 (4.97)	22.07 (5.20)	16.07 (4.51)	11.53 (3.90)	5.53 (2.85)	2.33 (2.03)	11.32 (3.86)
6.	Diana	0.60 (1.27)	2.07 (1.94)	9.27 (3.54)	17.40 (4.67)	20.67 (5.05)	21.13 (5.10)	22.67 (5.26)	17.67 (4.70)	11.86 (3.94)	6.67 (3.08)	2.80 (2.17)	12.07 (3.97)
7.	J. K-SPL	0.87 (1.43)	2.40 (2.05)	10.67 (3.77)	18.87 (4.84)	22.93 (5.29)	22.73 (5.27)	24.80 (5.48)	20.67 (5.05)	14.80 (4.35)	8.07 (3.34)	4.00 (2.50)	13.71 (4.20)
8.	K. Bhusan	1.20 (1.60)	3.00 (2.23)	12.07 (3.97)	19.80 (4.95)	23.53 (5.35)	23.27 (5.32)	27.53 (5.75)	21.33 (5.12)	15.00 (4.37)	8.80 (3.47)	4.20 (2.55)	14.52 (4.31)
	S Em. _±	0.03	0.04	0.07	0.09	0.10	0.10	0.11	0.09	0.07	0.05	0.04	0.08
	CD at 5%	0.07	0.11	0.21	0.27	0.29	0.30	0.31	0.26	0.21	0.15	0.12	0.23
	SD												2.58

* Peak population of aphid

Figures in the parentheses are $\sqrt{X+0.5}$ values**Table 3:** Mean population of whitefly, *Bemisia tabaci* (Genn.) on different varieties of Indian bean, *Lablab purpureus* var *typicus* (L.) Sweet

S. No.	Varieties	Mean whitefly population/ three leaves*											Mean
		13.08.19	20.08.19	27.08.19	03.09.2019	10.09.19	17.09.19	24.09.19	01.10.19	08.10.19*	15.10.19	22.10.19	
1.	Arka Jay	0.00 (0.50)	1.20 (1.60)	3.00 (2.23)	9.33 (3.55)	9.80 (3.63)	14.87 (4.36)	16.13 (4.52)	22.07 (5.20)	11.00 (3.82)	4.73 (2.67)	0.07 (0.76)	8.38 (3.40)
2.	Pusa Early Prolific	0.07 (0.76)	1.47 (1.71)	3.33 (2.32)	10.47 (3.74)	10.60 (3.76)	15.47 (4.43)	17.60 (4.70)	22.87 (5.28)	12.07 (3.97)	5.20 (2.78)	0.87 (1.43)	9.09 (3.52)
3.	Paury	0.20 (0.95)	1.87 (1.87)	5.27 (2.80)	11.80 (3.94)	12.00 (3.96)	17.20 (4.65)	19.93 (4.96)	25.26 (5.53)	14.60 (4.32)	7.00 (3.15)	1.80 (1.84)	10.63 (3.76)
4.	Bauni	0.60 (1.27)	2.40 (2.05)	5.80 (2.91)	12.80 (4.08)	14.47 (4.30)	18.00 (4.74)	20.33 (5.01)	26.27 (5.63)	15.33 (4.42)	8.60 (3.43)	3.27 (2.31)	11.62 (3.91)
5.	G. Local	0.73 (1.35)	3.20 (2.29)	7.00 (3.15)	13.27 (4.14)	15.33 (4.42)	19.73 (4.94)	21.87 (5.18)	28.00 (5.79)	16.33 (4.54)	9.40 (3.57)	4.33 (2.58)	12.65 (4.06)
6.	Diana	0.67 (1.32)	4.40 (2.60)	8.07 (3.34)	15.47 (4.43)	16.47 (4.56)	21.40 (5.13)	22.40 (5.23)	28.13 (5.80)	17.40 (4.67)	10.53 (3.74)	5.67 (2.88)	13.69 (4.20)

7.	J. K-SPL	0.93	5.33	10.07	17.07	18.33	24.33	25.53	31.67	19.80	12.07	8.07	15.75
		(1.46)	(2.81)	(3.67)	(4.63)	(4.78)	(5.43)	(5.55)	(6.13)	(4.95)	(3.97)	(3.34)	(4.47)
8.	K. Bhusan	1.13	5.87	11.30	18.27	19.73	25.33	26.87	33.73	20.80	13.60	8.73	16.85
		(1.56)	(2.92)	(3.86)	(4.77)	(4.94)	(5.53)	(5.68)	(6.31)	(5.06)	(4.19)	(3.45)	(4.60)
	S Em.+	0.03	0.06	0.07	0.09	0.09	0.10	0.11	0.11	0.09	0.07	0.05	0.08
	CD at 5%	0.08	0.17	0.21	0.26	0.27	0.30	0.31	0.32	0.28	0.22	0.16	0.25
	SD												3.01

* Peak population of aphid

Figures in the parentheses are $\sqrt{X+0.5}$ values

Table 4: Biochemical parameters of different Indian bean, *Lablab purpureus* var *typicus* (L.) Sweet varieties

S. No.	Varieties	Mean pests population			Total phenols (%)	Free amino acid (%)
		Aphids/ shoot	Leaf hoppers/ three leaves	Whiteflies/ three leaves		
1	Arka Jay,	56.96	7.23	8.38	2.65	1.56
2	Pusa Early Prolific	60.02	7.90	9.09	2.45	1.85
3	Pariy	65.71	9.62	10.63	2.42	1.93
4	Bauni	69.44	10.52	11.62	2.36	1.82
5	G. Local	71.38	11.32	12.65	2.02	1.90
6	Diana	76.16	12.07	13.69	1.62	2.14
7	J.K. SPL	80.82	13.71	15.75	1.57	2.18
8	K. Bhushan	82.50	14.52	16.85	1.55	2.30
Correlation coefficient with mean aphid population (r)					-0.938**	0.915**
Correlation coefficient with mean leaf hopper population (r)					-0.942**	0.916**
Correlation coefficient with mean whitefly population (r)					-0.951**	0.921**

* Significant at 5% level of significance

** Significant at 1% level of significance

Conclusion

Out of eight varieties of Indian bean screened for relative resistance against sucking insect pests, none was found free from the infestation of pests. The varieties Pusa Early Prolific and Arka Jay were categorized as highly resistant to leafhopper and whitefly whereas, Arka Jay and Pusa Early Prolific to aphid. The varieties Pariy, Bauni, G. Local and Diana were categorized as moderately resistant and J. K. SPL and K. Bhusan were categorized as least resistant to aphid, leafhopper and whitefly. The total phenols had significant negative and free amino acid had significant positive effect on the population of sucking insect pests on Indian bean.

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