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Pod characters associated with pod damage by legume pod borer in yard-long bean

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Abstract : A field experiment with 51 yard-long bean cultivars revealed significant variation in pod damage by legume pod borer among the cultivars. There was significant negative correlation between density of non-glandular trichomes on pod wall and severity of pod damage. The correlations of pod width with pod infestation and pod damage severity were positive and significant. It is concluded that high density of non-glandular trichomes on pods and low pod width tend to reduce the attack of yard-long bean pods by legume pod borer.

Keywords: Yard-long bean, Legume pod borer, Pod damage

Introduction

Yard-long bean, *Vigna unguiculata* ssp. *sesquipedalis*(L.) Verdc., is a vegetable crop widely cultivated in India, Indonesia, Philippines and Sri Lanka (Chakraborti, 1986). Legume pod borer, *Maruca vitrata*(Fab.) (Lepidoptera: Pyralidae) is an important pest of the crop. The crop loss in yard-long bean in the event of serious infestation by the pest is tremendous since their larvae feed primarily on flowers and developing pods. Identification of characters conferring resistance to legume pod borer attack would be helpful in breeding yard-long bean varieties resistant to the pest. Morphological characters such as fruit shape, fruit wall pubescence etc., are often important in deciding the extent of fruit damage by fruit feeding insect pests. The present investigation was undertaken to study the relationship of density of non-glandular trichomes on pod wall and pod width with pod damage caused by *M. vitrata* in yard-long bean.

Materials and Methods

The materials for the present study comprised of 51 diverse cultivars of yard-long bean denoted by accession numbers, Vs 1 to Vs 51. Among these, Vs 23 is an improved variety named 'Sharika' released by the Kerala Agricultural University and others are local cultivars collected from different localities in Kerala and maintained at the Department of Plant Breeding and Genetics, College of Agriculture, Vellayani.

The experimental crop was raised in the farm of College of Agriculture, Vellayani, Thiruvananthapuram during the period from November 1997 to February 1998. This cropping season was chosen since the natural incidence of legume pod borer usually peaks during this period. One week prior to sowing of the experimental crop, a legume pod borer susceptible grain cowpea cultivar was sown around the field to serve as multiplication foci for the target pest. This was to ensure infestation of the experimental crop by the pest. The test entries were planted adopting randomized block design with two replications. Each plot consisted of 3 rows of 2.1 m length. Spacing was 1.0 m between rows and 0.3 m between plants in a row. Plants were trailed on coir ropes tied between wooden stakes erected 70 cm apart along the rows of plants.

Pod damage was assessed employing two damage measurement criteria as follows :

i) Percentage pod infestation- Twenty five pods at vegetable maturity stage were collected from each plot at peak podding phase of the crop. Each sample was examined to determine the number of pods with *M. vitrata* larval entry/exit holes. Percentages of infested pods were worked out.

ii) Pod damage severity- Pod samples used for the assessment of percentage pod infestation were examined and counts of larval entry/exit points were taken. Pod damage severity was worked out as the number of entry/exit points per pod taking into account both infested and un-infested pods.

Eight days old pods were used for collection of data on non-glandular trichome density on pods and pod width since both the characters vary with age of pods.

Table 1. Pod damage measurements, density of non-glandular trichomes on pods and pod width of 51 yard-long bean cultivars

Cultivar	Percentage pod infestation	Pod damage severity	Non-glandular trichome density	Pod width (mm)
Vs 1	65.08 (53.76)	1.10	3.0	6.58
Vs 2	24.83 (29.88)	0.35	5.0	7.58
Vs 3	70.00 (56.77)	1.85	6.0	7.67
Vs 4	70.00 (56.77)	2.05	4.0	7.83
Vs 5	70.50 (57.08)	1.60	5.0	7.42
Vs 6	60.00 (50.75)	1.40	3.5	8.33
Vs 7	65.08 (53.76)	1.65	4.5	9.08
Vs 8	50.00 (44.98)	1.10	3.5	8.75
VS 9	81.03 (64.15)	1.30	6.0	8.50
Vs 10	55.03 (47.87)	0.75	7.0	8.08
Vs 11	70.00 (56,77)	2.35	4.5	6.58
Vs 12	75.17 (60.09)	2.15	3.5	8.58
Vs 13	75.17 (60.09)	1.55	6.5	8.00
Vs 14	80.00 (69.36)	1.70	5.0	7.75
Vs 15	75.17 (60.09)	0.95	3.0	8.00
Vs 16	75.17 (60.09)	1.30	3.5	7.75
Vs 17	87.61 (69.36)	2.20	2.5	8.00
Vs 18	75.17 (60.09)	3.05	2.5	9.67
Vs 19	29.50 (32.89)	0.70	4.5	7.17
Vs 20	60.00 (50.75)	1.20	2.5	8.83
Vs 21	39.78 (39.09)	0.90	6.5	6.58
Vs 22	94.74 (76.70)	1.80	5.5	7.83
Vs 23	60.22 (50.87)	1.30	2.5	8.23
Vs 24	39.78 (39.09)	1.10	4.5	6.00
Vs 25	75.17 (60.09)	1.40	5.5	6.42
Vs 26	85.36 (67.47)	2.35	2.5	5.42
Vs 27	55.03 (47.86)	0.95	2.0	4.42
Vs 28	24.83 (29.88)	0.35	3.5	5.33
Vs 29	50.00 (44.98)	0.75	2.0	5.33
Vs 30	44.97 (42.10)	0.55	3.0	5.67
Vs 31	34.92 (36.21)	0.75	2.0	6.17
Vs 32	50.00 (44.98)	0.80	3.5	6.17
Vs 33	50.00 (44.98)	0.75	3.5	5.83
Vs 34	80.00 (63.41)	2.15	3.5	7.00
Vs 35	44.97 (42.10)	0.95	2.5	6.83
Vs 36	75.17 (60.09)	1.75	3.0	5.75
Vs 37	65.08 (53.76)	1.40	3.0	7.17
Vs 38	75.17 (60.09)	1.75	2.0	7.25
Vs 39	80.00 (63.41)	1.40	2.5	6.25
Vs 40	55.03 (47.87)	0.80	2.5	5.25
Vs 41	94.74 (76.70)	2.55	2.0	7.83

Table 1. (Contd.

Vs 42	94.74 (76.70)	1.95	3.0	8.17
Vs 43	75.17 (60.09)	2.00	4.0	11.00
Vs 44	80.00 (63.41)	2.30	1.5	7.75
Vs 45	94.74 (76.70)	1.90	2.5	6.58
Vs 46	90.00 (71.54)	3.05	1.5	7.83
Vs 47	94.74 (76.70)	2.15	2.0	7.83
Vs 48	97.44 (80.77)	1.90	2.0	8.17
Vs 49	75.17 (60.09)	1.60	2.5	7.58
Vs 50	55.03 (47.87)	1.010	4.0	8.00
Vs 51	99.99 (90.00)	2.45	2.0	7.25
F50,50	6.14**	25.30**	2.60**	28.24**
CD (P=0.05)	15.385	0.373	2.487	0.667
CV (%)	13.53	12.30	35.46	4.54

* Significant at 1% level. Figures in parentheses are transformed values.

Table 2. Correlation between pod damage parameters and pod characters

Pod characters	Pod damage parameters	
	Percentage pod infestation	Pod damage severity
Non-glandular trichome density	-0.1451	-0.2474*
Pod width	0.3290**	0.4067**

* Significant at 5% level, ** Significant at 1% level.

Non-glandular trichome density on pods: Five pods were collected at random from each plot. A thin layer of pod wall from the middle portion of each pod was carefully removed using a sharp knife and observed under a compound microscope with a magnification of 100x. The number of non-glandular trichomes observed in a microscopic field was counted. Non-glandular trichomes are unicellular outgrowths with enlarged base and tapering tip. The area of microscopic field was calculated using ocular micrometer. Mean value of non-glandular trichome counts per mm^2 area of pod wall surface was calculated and expressed as non-glandular trichome density on pods.

Pod width: Five pods were collected at random from each plot. Each pod was cut across through a developing seed. The distance between pod wall sutures in the cross section was measured for each pod. The mean value of the measurements of the five pods was worked out to represent pod width.

Data on pod damage measurements and the above mentioned pod characters were subjected to analysis of variance (ANOVA). Data on percentage pod infestation were subjected to angular transformation before analysis. A correlation analysis was done to assess the degree of association between pod damage and the pod characters considered.

Results and Discussion

The results of the present study indicated that there was significant difference among yard-long bean cultivars in pod damage by legume pod borer, irrespective of whether the damage was assessed as percentage pod infestation or pod damage severity (Table 1). Percentage pod infestation ranged from 25 (Vs 2 and Vs 28) to 100 (Vs 51). Similarly, pod damage severity

showed substantial variation with values ranging from 0.35 (Vs 2 and Vs 28) to 3.05 (Vs 18 and Vs 46). Vs 2 and Vs 28 were identified as the cultivars suffering least pod damage when either of the pod damage criterion was employed.

Pod characters studied were non-glandular trichome density on pod wall surface and pod width. Non-glandular trichomes are epidermal outgrowths with enlarged base and tapering tip. Their number on a pod is determined in the early stage of pod development. But there will be progressive increase in the spacing between individual trichomes during fruit enlargement. Similarly pod width is also an age dependent factor. So observations on both these characters were made on eight-day old pods to avoid ambiguity in the interpretation of results.

The present study revealed significant difference among cultivars in both of the above mentioned pod morphological characters (Table 1). Non-glandular trichome density ranged from 1.5 (Vs 44 and Vs 46) to 7.0 (Vs 10). Wide range pod width was also evident with values ranging from 4.42 mm for Vs 27 to 11.00 mm for Vs 43.

The correlation coefficients relating to the pod morphological characters *viz.* non-glandular trichome density and pod width to the pod damage measurements are presented in Table 2. The correlation between non-glandular trichome density and percentage pod infestation was not significant. Nevertheless, non-glandular trichome density showed significant correlation with pod damage severity. This suggested that greater the number of non-glandular trichomes per unit area of pod wall surface the lesser the pod damage severity. Hence high density of non-glandular trichomes can be considered as a pod character that contributes to reduction in *M. vitrata* damage to yard-long bean. The hindrance to larval movement and feeding offered by non-glandular trichomes may be the reason for low pod damage in cultivars with high non-glandular trichome density on pods. Trichomes collectively form pubescence on pods. Pod wall pubescence was implicated in legume pod borer resistance of wild cowpea, *Vigna vexillata* (Chiang and Singh, 1988; Jackai and Oghiakhe, 1989). Considering both glandular and non-glandular trichomes together, Oghiakhe *et al.* (1992) studied the relationship of total trichome density on pod wall to pod damage by legume pod borer in cowpea, *V. unguiculata* and reported significant negative correlation between trichome density and pod damage.

Significant positive correlation of pod width with pod infestation and pod damage severity suggested pod width as a character deciding the extent of pod damage by legume pod borer. It is inferred that cultivars with higher pod width would suffer more pod damage. Physical characters of fruit have been reported to be associated with insect attack in certain crops. Veda *et al.* (1975) reported positive correlation between pod width and infestation of pod fly in pigeonpea. Legume pod borer infestation of pigeonpea pods was reported to escalate with increase in width and length of pods (Nawale and Jadhav, 1989).

Results of the present investigation suggested high density of non-glandular trichome density on pod wall and low pod width as two pod characters that offer resistance to pod infestation by legume pod borer in yard-long bean.

References

Chakraborti, A.K. (1986). Cowpea. In: Vegetable Crops (Bose, T.K., Som, M.G. and Kabir, J.Eds.) Calcutta: Naya Prokash. pp. 603-611.

Chiang, H.S. and Singh, S.R. (1988). Pod hairs as a factor in *Vigna vexillata* resistance to pod sucking bug, *Clavigralla tomentosicollis*. *Entomologia Experimentalis et Applicata*, 47:195-199.

Jackai, L.E.N. and Oghiakhe, S. (1989). Pod wall trichomes and their role in the resistance of two wild cowpea, *Vigna vexillata*, accessions to *Maruca testulalis (Geyer)* (Lepidoptera : Pyralidae) and *Clavigralla tomentosicollis* Stal (Hemiptera : Coreidae). *Bull. Ent. Res.* 79: 595-605.

Nawale, R.N. and Jadhav, L.D. (1983). Relative susceptibility of some varieties of pigeonpea to pod borers. *J. Maharashtra Agric. Univ.* 8: 94-95.

Oghiakhe, S., Jackai, L.E.N., Makanjuola,W.A. and Hodgson, C.J.(1992). Morphology, distribution and role of trichomes in cowpea *(Vigna unguiculata)* resistance to legume pod borer, *Maruca testulalis* Geyer (Lepidoptera : Pyralidae). *Bull. Ent. Res.* 82: 499-505.

Veda, O.P., Purohit, M.L. and Sood, N.K.(1975). Varietal susceptibility of arhar *(Cajanus cajan* (L.) Millsp.) to *Melanagromyza obtusa* Mall., *Exellastis atmosa* W. and *Heliothis armigera* Hb. *JNKVV Res. J.* 9: 7-9.

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