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Field screening of blackgram genotypes against spotted pod borer, *Maruca vitrata* (Geyer)

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Abstract
Fifteen blackgram genotypes were screened for their resistance against spotted pod borer, *M. vitrata* under field condition at Main Agricultural Research Station, Dharwad. Based on per cent pod damage, The five genotypes, LBG-685 (8.25%), WBU-108 (9.25%), COBG-653 (9.35%), VBN-05 (9.30%) and PU-31(10.10%) were found as tolerant and LBG-631 (32.35%), VBG10-024 (31.60%), RUG-10 (32.85%), KUG-586 (32.80%) and PUSA-9531(31.25%) genotypes showed susceptibility while DU-1(16.85%), DBGV-05 (17.30%), PU-30 (21.35%) and PU-40 (22.35%) were categorized as moderately resistant. The cultivar, COBG-761 (28.15%) exhibited moderately susceptible reaction. The highest per cent infestation of spotted pod borer was registered in the genotype VBG10-024 (69.29%). The lowest number of larval webs were recorded in genotype WBU-108 (1.51webs/Pl) while, the highest was observed in VBG10-024 (5.14 webs/Pl). The maximum pod damage was found in RUG-10 (32.85%) and significantly least pod damage was noticed in LBG-685 (8.25%).

Keywords: Blackgram genotypes, spotted pod borer, pod damage

1. Introduction

Blackgram [(*Vigna mungo* L. (Hepper)] is the third most important pulse crop of India. It is an ancient and well known leguminous crop of Asia and is commonly called as Urd bean. Popularity of this pulse crop is mainly because of its superior nutritional quality and its ability to be grown in multiple cropping systems like mixed crop and intercrop apart from sole cropping due to its short duration. It can be grown as intercrop with pigeon pea, maize, sorghum, cotton and sugarcane etc. It can also be grown as green manure and fodder crop.

Among the several reasons for low productivity of green gram in the country, the damage caused by insect pests is one of the major causes. In India, nearly 60 species of insect pest have been recorded from blackgram but only a few are known to cause economic damage. The spotted pod borer, *Maruca vitrata* is the most formidable and potential pest which causes extensive damage to blackgram under field conditions. It is known to cause economic loss of 20 - 25 per cent and yield loss of 2- 84 per cent in blackgram.

Continuous and indiscriminate use of chemical insecticides, besides creating health hazards to human and animal life, has led to the development of resistance and destruction of natural enemies as well as environmental pollution. Hence, chemical measures are often termed as a necessary evil in the present pest management scenario. It has long been recognized that host plant resistance holds a great promise and plays a crucial role in exploitation of integrated pest management programmes hence, the use of resistant varieties offer crop protection that is biologically, ecologically, economically and socially acceptable. Resistant varieties have their greatest value in crops of low values per hectare or in situations when the yield varies greatly due to uncertainties of weather or other intermittent hazard. Thus, blackgram is ideally suited for exploiting the resistance phenomenon to control spotted pod borer ideally and economically. Keeping these views, the present study was formulated to identify the resistant cultivars that are less susceptible to spotted pod borer in blackgram.

2. Materials and Methods

The present investigation was carried out to screen fifteen blackgram genotypes for their reaction to spotted pod borer incidence at Main Agricultural Research Station, Dharwad. The experiment was conducted in Randomized Block Design (RBD) with two replications. Each variety was sown in 2 rows of 4m length each at a spacing of 30cm × 10cm. All the agronomic practices except for the insecticidal applications were adopted as per the package of practices in order to raise the crop satisfactorily. The predominant blackgram genotypes *viz.*, DU-1, DBGV- 5, VBN-05, PU-31, PUSA-9531, LBG-685, WBU-108, KUG-586, COBG-653, LBG-631, PU-30, PU-40, VBG10-024, RUG-10 and COBG-761 were considered for the present investigation.

The data were recorded on incidence pattern and per cent pod damage by *M. vitrata* on various genotypes. For recording observations, five plants were randomly selected from each plot and number of larvae present on each plant were recorded. Pod damage at maturity of the crop was assessed based on number of damaged pods out of total pods from five plants selected at random in each plot. The per cent infestation and per cent pod damage were determined by subjecting the data to the following formulae.

2.1 Infestation of plants

The observations on total number of plants and the number of plants infested by *M. vitrata* in each plot were counted and the per cent infestation was worked out using the following formula.

$$\text{Per cent infestation} = \frac{\text{Number of infested plants}}{\text{Total number of plants}} \times 100$$

2.2 Pod damage

The observation on pod damage was made by counting total number of pods harvested from five plants and number of pods damaged by *M. vitrata* from each of the genotypes. Later, the per cent pod damage was worked out using the following formula.

$$\text{Per cent pod damage} = \frac{\text{Number of damaged pods}}{\text{Total number of pods}} \times 100$$

Table 1: Based on the per cent pod damage, the entries were classified as detailed below [4].

Sl. No.	Pod damage (%)	Category
1	1-12	Resistant
2	13-24	Moderately Resistant
3	25-30	Moderately Susceptible
4	>30	Susceptible

Morphological characters for all the 15 entries were recorded in order to correlate plant characters with resistance or susceptibility to *M. vitrata*. Each of the plant character listed below were suitably divided into classes to accommodate all entries under each character. These plant characters were arbitrarily quantified for the purpose of statistical analysis and details are as follows.

Table 2: Morphological character with quantified value [4].

Sl. No.	Plant character	Classes under each character with quantified value
1	Hairiness of pod	Absent (1), Present (2)
2	Pod color	Brown (2), Black (3)
3	Pod position	Within (1), Intermediate (2)
4	Growth habit	Spreading (3), Semi erect (5), Erect (7)
5	Days to 50% flowering	<40 days (3), 40-50 Days (5), >50 days (7)
6	Days to maturity	<70 days (3), 70-80 Days (5), >90 days (7)

3. Results and Discussion

The results indicated that all the varieties were infested by pod borer at bud formation, flowering and pod formation stage. However, towards the crop maturity the population was declined which could be attributed to hard seed coat.

3.1 Infestation by *Maruca vitrata*

The data from Table 1 revealed that maximum infestation of *M. vitrata* was recorded on VBG10-024 genotype (69.29%), which was on par with RUG-10 (68.21%), LBG-631 (63.21%), KUG-586 (63.07%) and PUSA-9531(61.79%). However, the lowest infestation was noticed in COBG 653 (17.14%) which was on par with PU-31 (20.00%), LBG-685 (20.00%), WBU-108 (22.50%) and VBN-05 (22.86%). Similar variation of pest infestation on different black gam genotypes has been reported by [9] and [5].

3.2 Number of webs

Webs formed by *M. vitrata* were relatively more on susceptible genotypes *viz.*, VBG10-024 (5.14 webs/Pl) which was on par with PUSA-9531 (4.98), RUG-10 (4.97) and LBG 631 (4.64). However, the genotypes like WBU-108 (1.51), VBN-05 (1.55), PU-31(1.61), LBG 685 (1.93) and COBG-653 (1.96) recorded a significantly lower number of webs (Table 1). These results are in accordance with the findings of [7] who revealed that the web density of *M. vitrata* varied significantly in different genotypes of pigeon pea.

3.3 Per cent pod damage

The pod damage due to *M. vitrata* was significantly higher in RUG-10 (32.85%) followed by KUG-586 (32.81%), LBG-631 (32.35%) and VBG10-024 (31.60%). However, significantly lower pod damage was observed in LBG 685, WBU-108, VBN-05, COBG-653 and PU-31 which recorded <10 per cent pod damage (Table 1). The findings of earlier workers could not be related to the present studies due to lack of similarities within the genotypes. However, [4] reported that five genotypes of blackgram *viz.*, LBG 762, LBG 726, LBG 747, LBG 744 and LBG 745 showed minimum pod damage.

Based on per cent pod damage, out of fifteen genotypes screened five genotypes namely, VBN-05, PU-31, COBG-653, LBG-685 and WBU-108 were considered to be resistant whereas, DU-1, DBGV-05, PU-30 and PU-40 were categorized as moderately resistant. The cultivar, COBG-761 exhibited moderately susceptible reaction while, PUSA-9531, VBG10-024, LBG-631, KUG-586 and RUG-10 could be grouped under susceptible category (Table 2). Similar categorization of genotypes of different pulse crops have be reported by earlier workers [3, 6, 8, 10].

3.4 Morphological characters in relation to susceptibility or resistance

The morphological characters like pod hairiness, growth habit, days to flowering and days to maturity exhibited positive and non-significant correlation with the per cent infestation, number of webs and pod damage except for the correlation between growth habit and pod damage which showed negative and nonsignificant correlation (Table 3). Whereas, other morphological characters *viz.*, pod colour and pod position showed negative and non-significant correlation with pest infestation, number of webs and pod damage. The results of the study indicated that none of the plant characters significantly influenced the per cent infested plants, number of webs and per cent pod damage either singly or collectively. These results are in conformity with the findings of [1] who reported that the resistance or susceptibility of blackgram genotypes is not influenced by pod colour, pod hairiness and fragrance. Similarly, [2] also opined that no correlation exists between morphological characters and the pod borer resistance in case of cowpea.

Table 3: Incidence of spotted pod borer, *Maruca vitrata* on different blackgram genotypes

Sl. No.	Genotype	Infested plants (%)	Number of webs per plant	Pod damage (%)
1	DU-1	42.86 (40.26*)^{c}	3.13 (1.88**)^{de}	16.85 (24.22*)^{d}
2	DBGV-05	44.29 (41.00)^{c}	3.24 (1.92)^{de}	17.30 (24.55)^{d}
3	VBN-05	22.86 (22.22)^{d}	1.55 (1.50)^{e}	9.30 (17.63)^{e}
4	PU-31	20.00 (20.45)^{d}	1.61 (1.49)^{e}	10.10 (18.48)^{e}
5	PUSA-9531	61.79 (54.22)$^{a b c}$	4.98 (2.52)^{ab}	31.25 (33.97)^{ab}
6	LBG-685	20.00 (20.37)^{d}	1.93 (1.61)^{de}	8.25 (16.55)^{e}
7	WBU-108	22.50 (21.96)^{d}	1.51 (1.45)^{e}	9.25 (17.53)^{e}
8	KUG-586	63.07 (56.85)$^{a b c}$	4.37 (2.18)$^{a b c}$	32.81 (34.92)^{a}
9	COBG-653	17.14 (18.46)^{d}	1.96 (1.59)^{de}	9.35 (17.68)^{e}
10	LBG-631	63.21 (55.56)$^{a b c}$	4.68 (2.40)^{a}	32.35 (34.64)^{a}
11	PU-30	50.00 (44.31)$^{a b c}$	3.0 (1.85)$^{b-e}$	21.35 (27.51)^{cd}
12	PU-40	48.57 (42.05)$^{b c}$	3.08 (1.86)$^{b c d}$	22.35 (28.19)$^{b c d}$
13	VBG10-024	69.29 (62.33)^{a}	5.14 (2.89)^{a}	31.60 (34.19)^{ab}
14	RUG-10	68.21 (61.71)^{ab}	4.97 (2.33)^{a}	32.85 (34.94)^{a}
15	COBG-761	55.36 (47.86) $^{a b c}$	4.14 (2.01)$^{c d e}$	28.15 (32.03)$^{a b c}$
	S.EM.±	4.61	0.10	1.45
	C.D. (5%)	14.00	0.30	4.39
	C.V. %	16.74	9.21	11.74

* Figures in parentheses are arcsine transformed value. ** Figures in parentheses are $\sqrt{x + 0.5}$ transformed value

Table 4: Categorisation of blackgram genotypes against spotted pod borer, *Maruca vitrata*

Sl. No.	Genotypes	Pod damage (%)	Resistance rating
1	LBG-631	32.35	Susceptible
2	VBG10-024	31.60	Susceptible
3	RUG-10	32.85	Susceptible
4	KUG-586	32.80	Susceptible
5	PUSA-9531	31.25	Susceptible
6	COBG-761	28.15	Moderately susceptible
7	PU-30	21.35	Moderately resistant
8	PU-40	22.35	Moderately resistant
9	DU-1	16.85	Moderately resistant
10	DBGV-05	17.30	Moderately resistant
11	LBG-685	8.25	Resistant
12	WBU-108	9.25	Resistant
13	COBG-653	9.35	Resistant
14	VBN-05	9.30	Resistant
15	PU-31	10.10	Resistant

Table 5: Correlation between morphological characters of selected blackgram genotypes with pod borer incidence

Sl. No.	Genotype	Hairiness of pod	Pod color	Pod position	Growth habit	Days to 50% flowering	Days to maturity
1	DU-1	2	3	1	5	45.5	80.0
2	DBGV-05	2	3	1	5	46.5	82.0
3	VBN-05	2	3	1	5	43.5	77.5
4	PU-31	1	3	1	5	37.0	75.0
5	PUSA-9531	2	2	1	5	48.5	84.5
6	LBG-685	2	3	2	7	47.5	86.0
7	WBU-108	2	2	1	5	35.0	75.0
8	KUG-586	2	2	1	3	41.5	74.5
9	COBG-653	1	3	1	3	35.5	75.0
10	LBG-631	1	2	1	7	53.0	85.0
11	PU-30	1	3	1	7	34.5	74.0
12	PU-40	1	3	1	5	35.0	73.5
13	VBG10-024	2	3	1	5	42.0	76.0
14	RUG-10	2	2	1	5	38.0	75.0
15	COBG-761	2	3	1	5	53.0	85.0

Correlation coefficient (r)	X +	0.183	-0.422	-0.352	0.052	0.311	0.098
	Y +	0.227	-0.441	-0.277	0.025	0.413	0.226
	Z +	0.130	-0.499	-0.349	-0.013	0.330	0.114

X +: Infested plants (%), Y +: Number of webs / plant, Z +: Pod damage (%) Pod color: 2-Brown, 3-BlackPod position: 1-Within, 2-Intermediate, Hairiness of pod: 1-Absent, 2- Present Growth habit: 3-Spreading, 5-Semi erect, 7-Erect

4. Conclusion

On the basis of the above investigation it may be concluded that host plant resistance plays a very important role in managing the pest infestation level in blackgram and screening is an appropriate method to identify resistant genotypes. The incidence of spotted pod borer increases with the advancement of crop age and the actual damage to the economic produce take place after flowering of the crop. The spotted pod borer, *Maruca vitrata* is the most damaging insect in blackgram. The tolerant genotypes LBG-685 (8.25%), WBU-108 (9.25%), COBG-653 (9.35%), VBN-05 (9.30%) and PU-31(10.10%) might be utilized in resistance breeding programmes against *M. vitrata* pod damage and may be recommended for their cultivation in the endemic areas.

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