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SOIL & CROP SCIENCES | RESEARCH ARTICLE

Cataloguing, screening and assessing the effect of sowing time on the incidence of black gram pests under dryland condition

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Abstract: Cataloguing of different insect pests occurring in black gram, screening of black gram genotypes against major insect pests and their incidence on black gram at three different sowing times were investigated at Agricultural Research Station Farm, Tamil Nadu Agricultural University, Kovilpatti, Tuticorin District. Totally, 11 species of insect pests were identified in black gram ecosystem. Among the 10 black gram genotypes screened, KBG 06 016 recorded minimum population of leafhoppers during both the years and KBG 05 007 and KBG 06 021 showed minimum population of aphid during 2010–2011 and 2011–2012, respectively. The minimum damage by pod borer was noticed in KBG 04 003 and KBG 08 001 during 2010–2011 and 2011–2012, respectively. The minimum number of leafhoppers, aphids and pod borers were observed in monsoon, post-monsoon and pre-monsoon sown black gram, respectively.

Subjects: Science; Technology; Social Sciences; Pest Management; Crop Science

Keywords: cataloguing; screening; sowing time; black gram

1. Introduction

Black gram (*Vigna mungo* (L.) Hepper) is a highly nutritious short duration remunerative pulse crop cultivated worldwide in tropical and subtropical regions of the world. It contains 24% protein, 3.2% minerals and 59.6% carbohydrate (Bakr, Afzal, Hamid, Haque, & Aktar, 2004). Black gram plays a vital role in maintaining the nitrogen balance in the soil. India is the largest producer and consumer of black gram in the world. The area under black gram in India is about 3.25 m ha with production of

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PUBLIC INTEREST STATEMENT

Black gram is an important pulse crop harboured by different insect pests. This paper investigated and documented different insect pests occurring in black gram, screened various genotypes against insect pests and their incidence at different sowing periods. The findings indicated that 11 species of insects occur in black gram under dryland conditions, the genotypes viz. KBG 06 016, KBG 05 007, KBG 06 021, KBG 04 003 and KBG 08 001 were found to be resistant against different insect pests and their occurrence varied among three different sowing periods. The results will be fully exploited for identification of pests, resistant sources and exact period of sowing to evade the attack of the pest in black gram ecosystem.

1.81 m tonnes and productivity of 463 kg ha⁻¹ (Anonymous, 2012). In Tamil Nadu, black gram is cultivated in an area of 3.41 lakh ha with 1.21 lakh tonnes production and an average productivity of 354.84 kg ha⁻¹ (www.agropedia.iitk.ac.in). The crop is damaged by a number of insect pests during successive stages of the growth, right from root nodules to flowers and pods. The avoidable losses due to *Bemisia tabaci* (Gennadius) and other insect pests in black gram have been reported to range from 17.42 to 71.0% at different locations (Chhabra, 1992; Hassan, Akbar, & Latif, 1998; Saxena, 1983).

The majority of the farmers depend on insecticides for the management of black gram pests. The indiscriminate use of insecticides causes phytotoxicity and destruction of beneficial organisms, such as predators, parasitoids, micro-organisms and pollinators (Hussain, 1984; Luckman & Metcalf, 1978). Under such circumstances, it is necessary to find out certain alternative methods of insect pest management such as sowing at different times and screening of genotypes to reduce the pesticide load on the black gram. Hence, the present study was undertaken to catalogue and assess the intensity of insect pests occurring on black gram, screening of different black gram cultures against major insect pests and evaluating the effect of sowing time on the incidence of insect pests on black gram under dryland condition.

2. Materials and methods

The field experiments were conducted at Agricultural Research Station Farm, Tamil Nadu Agricultural University, Kovilpatti, Tuticorin District for three years (2010–2011, 2011–2012, and 2013–2014). The experiments were laid out in a randomized block design (RBD) and all the agronomic practices were followed as per the recommendations of Crop Production Guide (CPG, 2005).

2.1. Cataloguing the insect pests of black gram

The black gram variety (VBN 3) was raised in an area of 30 cents with three replicates of 10 cents each and the major sucking as well as borer pests were recorded in 10 randomly selected plants of each replication. The observations were recorded at weekly intervals from 15 days after sowing till harvest.

2.2. Screening of black gram cultures against major insect pests

Ten black gram cultures along with three standard checks viz. VBN 1, VBN 4 and VBN 5 were raised in a single row of 4 m length and observations were recorded on 10 plants randomly selected from each culture. The insect pests recorded include aphid, *Aphis craccivora* Koch, leafhopper, *Empoasca kerri* Pruthi, pod borer, *Helicoverpa armigera* (Hubner) and *Spodoptera litura* (Fab.). The damage caused by the pod borer was recorded on the basis of per cent damage and for aphids and leafhopper the number of insects was counted.

2.3. Effect of sowing time on the pest complex of black gram

The sowing of black gram variety (VBN 3) was taken at three different sowing times viz. Pre-monsoon, Monsoon and Post-monsoon and assessed for the incidence of major pests of black gram.

The sucking pests viz. aphids and leafhoppers were observed on three leaves (top, middle and bottom) from 10 randomly selected plants. For leaf-eating caterpillars, the number of larvae was counted on 10 randomly selected plants, whereas in case of pod borers, the pods were counted from 10 randomly selected plants and the per cent pod damage was determined using the following formula.

$$\text{Pod damage (\%)} = \frac{\text{No. of damaged pods}}{\text{Total no. of pods}} \times 100$$

The data thus obtained were transformed into square root or arcsine values as per the standard requisites (Gomez & Gomez, 1984) and the mean values of treatments were then separated by least significant difference (LSD).

3. Results and discussion

A total of 11 species of insect pests were found feeding on black gram crop during the experimental period and majority of them were sucking pests followed by borers and defoliators (Table 1). Reddy (2009) stated that among the pests affecting pulse crops, nearly 12 insect species cause considerable yield loss in black gram.

The sucking pest, aphids, *A. craccivora* attacked the crop in medium numbers throughout the study period. Similarly, the status of leafhopper, *E. kerri* was also medium. The infestation of whitefly, *B. tabaci* and green bug, *Nezara viridula* (L.) was very low and ash weevil, *Myllocerus undecimpustulatus* (Faust) and thrips, *Thrips tabaci* Lind were found to be medium during 2010–2011 and 2011–2012 whereas, in 2013–2014 the population was found to be low. The tobacco caterpillar, *S. litura* was found to be almost high throughout the years and which was followed by gram pod borer, *H. armigera*. The occurrence of other insect pests viz. sphingid caterpillar, blue butterfly and blister beetle was low or nil for the three years.

Among the 10 genotypes, KBG 06 016 recorded minimum leafhoppers which was on par with the standard checks VBN 5 and VBN 4, while maximum was observed in KBG 04 003 (Table 2) during 2010–2011 whereas, in 2011–2012 KBG 06 016 showed minimum population of leafhoppers and maximum was observed in KBG 04 003. During 2010–2011, the minimum population of aphid was in KBG 05 007 and it was on par with standard check, VBN 4 and maximum population was observed in KBG 06 021. In the second year (2011–2012), the mean population of aphid was found to be minimum in KBG 06 021 followed by KBG 06 015 and maximum was obtained in LBG 757. The standard check, VBN 5 recorded maximum number of aphids (30.4/plant). With regard to pod borer, minimum damage was recorded in KBG 04 003 followed by KBG 08 001 during 2010–2011; and KBG 08 001 followed by KBG 06 015 during 2011–2012; and maximum in KBG 05 007 and KBG 06 021 during 2010–2011 and 2011–2012, respectively. Kumar and Singh (2014) screened 25 different genotypes and RUG-44 had maximum number of leafhoppers, while minimum was observed in TU-631 and TU-631 showed maximum pod borer damage when compared to KUG-503, which recorded minimum damage of pod borers. Dawoodi, Parsana, Jethva, and Virani (2010) reported that among 10 varieties screened for resistance to pink pod borer, SKNU-03-03 was found least susceptible as it recorded minimum larval population (0.42 larva/ plant) and minimum damage to pods (1.98%) and

Table 1. Cataloguing the incidence of insect pests in black gram

S. No.	Common name	Scientific name	Family	Damaging part	Status of pest		
					2010–2011	2011–2012	2013–2014
1	Aphids	<i>Aphis craccivora</i>	Aphididae	Leaves, stem, floral parts	Medium	Medium	Medium
2	Whitefly	<i>Bemisia tabaci</i>	Aleyrodidae	Leaves	Low	Low	Low
3	Green bug	<i>Nezara viridula</i>	Pentatomidae	Pods	Low	Low	Nil
4	Leafhopper	<i>Empoasca kerri</i>	Cicadellidae	Leaves	Medium	Medium	Medium
5	Ash weevil	<i>Myllocerus undecimpustulatus</i>	Curculionidae	Leaves	Medium	Medium	Low
6	Thrips	<i>Thrips tabaci</i>	Thripidae	Leaves	Medium	Medium	Low
7	Tobacco cutworm	<i>Spodoptera litura</i>	Noctuidae	Leaves	High	Medium to high	High
8	Sphingid caterpillar	<i>Herse convolvuli</i>	Sphingidae	Leaves	Low	Low	Nil
		<i>Acherontia styx</i>					
9	Gram pod borer	<i>Helicoverpa armigera</i>	Noctuidae	Leaves, pods	Medium	Low	High
10	Blue butterfly	<i>Euchrysops cnejus</i>	Lycaenidae	Flowers, pods	Trace	Nil	Nil
11	Blister beetle	<i>Mylabris pustulata</i>	Meloidae	Buds and Flowers	Trace	Low	Low

Table 2. Screening of black gram genotypes against major insect pests

S. No.	Genotypes	Leaf hopper (Number of plants)*		Aphids (Number of plants)*		Pod borer (%)*	
		2010–2011	2011–2012	2010–2011	2011–2012	2010–2011	2011–2012
1	KBG 05 007	2.3 (1.5)	2.3 (1.5)	12.0 (3.5)	20.2 (4.5)	14.2 (22.3)	11.6 (19.9)
2	KBG 04 008	2.5 (1.6)	2.5 (1.6)	12.5 (3.5)	24.6 (5.0)	12.3 (20.3)	12.3 (20.5)
3	KBG 04 010	2.0 (1.4)	2.0 (1.4)	13.0 (3.6)	21.2 (4.6)	9.8 (18.4)	9.8 (18.2)
4	KBG 06 016	1.4 (1.2)	1.3 (1.1)	13.8 (3.7)	15.9 (4.0)	11.1 (19.5)	10.2 (18.6)
5	KBG 06 015	2.3 (1.5)	2.6 (1.6)	14.2 (3.8)	15.2 (3.9)	9.4 (17.9)	9.7 (18.2)
6	LBG 757	2.2 (1.5)	2.4 (1.6)	13.7 (3.7)	29.2 (5.4)	10.2 (18.6)	10.2 (18.6)
7	KBG 04 003	3.0 (1.7)	3.0 (1.7)	13.7 (3.7)	23.1 (4.8)	9.2 (17.7)	12.1 (20.4)
8	KBG 08 001	2.5 (1.6)	2.7 (1.6)	14.3 (3.8)	16.4 (4.1)	9.7 (18.2)	9.4 (17.9)
9	KBG 06 021	2.5 (1.6)	2.3 (1.5)	15.0 (3.9)	14.5 (3.8)	12.1 (20.4)	16.0 (23.6)
10	KBG 05 001	2.5 (1.6)	2.7 (1.6)	13.3 (3.7)	20.1 (4.5)	11.6 (19.9)	11.6 (19.9)
11	VBN 1	2.5 (1.6)	2.0 (1.4)	12.0 (3.5)	28.0 (5.3)	7.8 (16.2)	7.8 (16.2)
12	VBN 4	1.2 (1.1)	1.6 (1.3)	11.7 (3.4)	17.6 (4.2)	8.8 (17.3)	8.8 (17.3)
13	VBN 5	1.1 (1.0)	1.4 (1.2)	9.7 (3.1)	30.4 (5.5)	11.6 (19.1)	14.2 (22.1)
	CD ($p=0.05$)	0.13	0.14	0.12	0.07	0.55	0.52

Notes: Figures in parantheses for Leafhopper and Aphids: Square root transformed values and pod borer: Arcsine transformed values.

*Mean of three observations.

Table 3. Effect of sowing time on the incidence of major insect pests of black gram

Time of sowing	2010–2011			2011–2012			2013–2014		
	Leafhopper (No.)	Aphid (No.)	Pod damage (%)	Leafhopper (No.)	Aphid (No.)	Pod damage (%)	Leafhopper (No.)	Aphid (No.)	Pod damage (%)
Pre-monsoon	2.9	4.0	9.3	3.2	4.4	10.06	2.5	4.8	9.50
Monsoon	1.3	4.5	8.4	2.6	4.7	11.46	3.0	6.5	15.00
Post-monsoon	2.7	2.5	8.9	2.7	3.8	15.40	6.0	2.8	17.60

grains (1.97%). Chavan et al. (2009) screened 24 entries for their resistance to pod borers, tur plume moth and pod fly and found that pod damage by the lepidopteran borers ranged from 7.35 to 28.71% with the mean pod damage of 11.72%.

The results of the incidence of major insect pests of black gram at different sowing times viz. pre-monsoon, monsoon and post-monsoon are presented in Table 3. The incidence of leafhopper was found to be less i.e. 1.3, 2.6 and 3.0 Nos./plant in the monsoon sown crop, whereas the minimum population of aphid was recorded in the post-monsoon sown crops. The post-monsoon sown crop had the highest percentage of pod borer during 2011–2012 and 2013–2014 and the pre-monsoon sown crop showed less incidence of pod borer. The present study indicated that advanced planting resulted in lower infestation of major insect pests and delayed planting showed higher infestation except for aphids. Thus, the present finding is in confirmity with that of Prodhan, Hossain, Rahman, Afroze, and Sarker (2008) who stated that early planting gave lower infestation by the insects than late planting.

4. Conclusion

The present study revealed that a few sucking pests and borers were found to occur in black gram ecosystem. Among the different genotypes screened, KBG 06 016, KBG 06 021 and KBG 08 001 were found to be promising and early sowing resulted in less incidence of insect pests.

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