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EXTENT OF DAMAGE CAUSED BY MAJOR INSECT PESTS ON LONG DURATION PIGEONPEA [*CAJANUS CAJAN* (L.) MILLSP.] UNDER NATURAL CONDITIONS

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Abstract

Ten long duration pigeonpea genotypes/varieties were screened for their reaction against major insect pests infestation of pigeonpea during 2015-16 at the Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (U.P.), India. The per cent pod damage due to major insect pests varied significantly among the different cultivars. The highest grain damage by insects was seen in KA-12-2 while the lowest grain damage was observed in BAHAR. The grain yield of different genotypes/varieties also differed significantly and ranged from 658 kg/ha in the genotype KA-12-2 to 1200 kg/ha in BAHAR.

Key words : Pigeonpea, insect pests, pod damage, grain damage.

Introduction

Pulses play an important role in our daily life and once diet is incomplete without including any type of pulse. Pigeonpea is the second important crop after chickpea in India. It is a legume crop grown in the tropics and subtropics, mostly in Asia, Africa, Latin America and the Caribbean region occupying 6.5 per cent of the world's total pulse area and contributing 5.7 per cent to the total pulse production (ICRISAT, 2012). It is important in semi-arid cropping systems due to its efficient nitrogen-fixing ability, tolerance to drought and contribution to soil organic matter. Pigeonpea also contains high amount of quality dietary protein and thus is an important source of nutrition to vegetarian population. India has virtual monopoly in pigeonpea production accounting to 90 per cent of world's total production. In India, it occupies an area of 3.88 million ha with a production of 3.29 million tonnes (Anonymous, 2014).

Though, India is largest producer of pigeonpea, contributing more than 90 per cent of the world's production, the productivity has always been a cause of concern. The low productivity of pigeonpea in the country may be attributed to many reasons, among which damage by insect pests is of paramount importance. The pigeonpea is attacked by nearly 250 species of insects' worldwide belonging to 8 orders and 61 families though relatively few cause serious yield losses. Amongst many insect pests attacking pigeonpea, gram pod borer, *Helicoverpa armigera* (Hübner), tur pod bug, *Clavigralla gibbosa* (Spinola), legume pod borer, *Maruca vitrata* (Geyer) and pod fly, *Melanagromyza obtusa* (Malloch) (Diptera: Agromyzidae) causes significant reduction in the crop yield of pigeonpea (Sujithra and Chander, 2014). As per a conservative estimate, losses due to these insect pests may vary from 27 per cent to even 100 per cent in pigeonpea (Srilaxmi and Paul, 2010).

Pod borers have been estimated to cause 60 to 90 per cent loss in the grain yield of pigeonpea under favourable conditions and the damage of seeds by pod fly generally ranges between 14.3 to 46.6 per cent (Priyadarshini *et al.*, 2013). *H. armigera* and *M. obtusa* cause adequate economic damage leading to very low yield levels of 500 to 800 kg ha^{-1} as against the potential yield of 1800 to 2000 kg ha^{-1} (Durairaj and Shanower, 2003; Lal, 1996). Similarly, pigeonpea plants infested with 8 to 16 larvae of *M. vitrata* suffers huge grain yield losses ranging between 50 to 68 per cent (Sharma and Franzmann, 2000; Mohapatra and Srivastava, 2002). Next

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to pod borers, pigeonpea pod sucking bug, *Clavigralla gibbosa* Spinola (Hemiptera: Coreidae) has also become a real threat to quality grain production in pigeonpea. The damage in grain yield due to this bug generally ranges between 25 to 40 per cent (Gopali *et al*., 2013).

Studies show that host plant resistance plays a very important role in governing the pest infestation level in pigeonpea and screening is an appropriate method to identify resistant genotypes. Identification and cultivation of cultivars which are less preferred by pod borers and pod fly have number of advantages, particularly for an eco-friendly management of these insect pests on pigeonpea. Since levels of resistance to these pests in the cultivated pigeonpea cultivars are low to moderate, thus it is important to identify pigeonpea cultivars that permit slow growth or lesser population build-up of such insect pests. However, Singh and Singh (1990) reported that no definite conclusions could be drawn about the relative susceptibility of pigeonpea genotypes to pod fly damage because of staggered flowering and variation in pod fly abundance over time. Thus, keeping these views in mind, the present study was conducted to identify resistant sources so as to evolve long duration cultivars less susceptible to major insect pests in pigeonpea.

Materials and Methods

The present investigation was carried out at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during *Kharif* 2015–16. Ten pigeonpea genotypes/varieties were grown each in plots of 4m × 3.75m following row to row and plant to plant spacing of 75 cm and 30 cm respectively. The crop was grown following the normal agronomic practices in "Randomized Block Design (RBD)" with three replications. The sampling for pod and seed damage assessment due to pod borers and pod fly were done at 80% maturity stage of the crop. Five plants from the five rows in each treatments were selected randomly and all the pods from five plants were pooled together and finally 100 pods were picked up randomly for pod and grain damage assessment. The grain yield was also recorded for each plot after excluding the border rows on the two sides of the plot and then extrapolated into kg/ha.

Statistical analysis

All the data recorded were subjected to statistical analysis as per the Randomized Block Design procedure. The insect population data were transformed with square root transformation $\sqrt{x+0.5}$ method and damage assessment data were transformed by arc sin (q = sin-1x) transformation method.

Results and Discussion

Ten pigeonpea genotypes/varieties were screened under unprotected conditions for studying the damage assessment in relation to per cent pod and grain damage due to major insect pests. The results obtained from the investigation as well as relevant discussion have been summarized under the following heads:

Pod fly, *Melanagromyza obtusa* (Malloch)

The data presented in the table 1 depicted that the per cent pod and grain damage by pod fly on different cultivars varied significantly. It ranged from 34.43 per cent in variety BAHAR to 49.97 per cent in genotype KA-12-2. The maximum pod damage due to pod fly were seen in KA-12-2 (49.97) followed by KA-12-3 (48.04) and NDA-1 (44.40) and lowest pod damage was observed in BAHAR (34.42) followed by MA-3 (34.43) and MAL-13 (36.85). The per cent grain damage due to pod fly also showed differences among the genotypes/varieties. It ranged from 22.26 per cent in variety BAHAR to 34.15 per cent in genotype KA-12-2. The highest grain damage by pod fly were seen in KA-12-2 (34.15) followed by KA-12-3 (33.71), NDA-1 (30.91) and lowest grain damage was observed in BAHAR (22.26) followed by MA-3 (24.25) and MAL-13 (25.04), respectively.

Mishra *et al*. (2012) also reported that among the 50 pigeonpea germplasms, a wide range of variation of pod (18.33 to 47.00%) and seed (16.43 to 48.44%) damage by pod fly were recorded with average mean of 30.68 and 31.69%, respectively. On the basis of pooled mean, two lines *viz*., ICP 2514 (18.33%) and ICP 2454 (19.33%) revealed resistance against the pod damage caused by pod fly, respectively whereas, based on seed damage ICP 2459 (16.43%) and ICP 2155 (18.62%) were categorized as resistant. This may be due to difference in susceptibility of genotypes to pod fly. Srivastava and Mohapatra (2002) also reported that the extent of pod damage inflicted by lepidopteran pod borers and pod fly on fifteen pigeonpea genotypes varied from 1.0 to 6.3 per cent and 15.1 to 33.1 per cent, respectively. Various authors all over the country have rated the pod fly as the serious pest in northern part of India (Kumar *et al.,* 1998; Reddy *et al*., 1998; Minja *et al.,* 2000). The present finding corroborates with the findings of these authors.

Pod bug, *Clavigralla gibbosa* (Spinola)

The per cent pod damage and grain damage by pod bug on different pigeonpea genotypes/varieties also varied significantly (table 1). It ranged from 23.04 per cent in variety BAHAR to 47.27 per cent in genotype KA-12-2. The maximum pod damage due to pod fly were seen in

Table 1 : Extent of damage due to major insect pests on some long duration pigeonpea genotypes/varieties during *Kharif* 2015-16.

Genotypes	Damage (%) due to *M. vitrata**		Damage (%) due to *H. armigera**		Damage (%) due to *C. gibbosa**		Damage (%) due to *M. obtusa**		Yield (kg/ha)
	Pod	Grain	Pod	Grain	Pod	Grain	Pod	Grain	
KA-12-2	0.46(12.455)	0.43(7.030)	0.32(18.102)	0.29(9.237)	0.33(47.276)	0.64(34.447)	0.39(49.972)	0.73(34.154)	658
MA-3	0.12(5.737)	0.02(3.121)	0.52(10.491)	0.11(5.202)	0.45(23.562)	0.96(13.512)	0.66(34.431)	0.16(24.258)	1188
PUSA-9	0.61(8.741)	0.20(4.801)	0.41(13.335)	0.41(7.048)	0.37(31.933)	0.67(16.104)	0.86(37.641)	0.97(28.580)	942
MA-6	0.10(8.127)	0.67(4.415)	0.88(12.413)	0.34(6.312)	0.40(27.957)	0.24(14.609)	0.72(37.049)	1.0(26.303)	1002
KA-12-3	0.46(11.993)	0.48(6.329)	0.61(16.403)	0.29(9.158)	0.52(37.249)	0.34(26.261)	1.01(48.046)	0.56(33.716)	694
NDA-1	0.46(11.993)	0.33(6.322)	0.36(15.698)	0.29(7.441)	0.34(36.854)	0.37(24.695)	0.66(44.409)	0.51(30.916)	748
MAL-13	0.80(7.330)	0.09(4.197)	0.46(11.993)	0.27(5.782)	0.43(25.089)	0.13(13.994)	0.34(36.854)	0.07(25.049)	1052
NDA-2	0.52(11.012)	0.25(5.841)	0.41(13.754)	0.20(7.089)	0.35(35.046)	0.41(22.918)	0.33(40.959)	0.73(29.335)	934
BAHAR	0.12(5.737)	0.03(2.995)	0.61(9.356)	0.11(4.620)	0.26(23.041)	0.57(12.097)	0.71(34.429)	0.63(22.265)	1200
MAL-24	0.52(11.012)	0.17(6.308)	0.75(14.923)	0.46(7.327)	0.35(35.653)	0.97(23.767)	1.14(43.261)	0.35(30.278)	788
SE(m)±	**0.476**	**0.273**	**0.581**	**0.307**	**0.392**	**0.605**	**0.715**	**0.671**	**-**
CD at 5%	**1.425**	**.818**	**1.740**	**0.920**	**1.173**	**1.812**	**2.141**	**2.009**	**-**

*Figures in parantheses are angular transformed values.

KA-12-2 (47.27%) followed by KA-12-3 (37.24%) and NDA-1 (36.85%) and lowest pod damage was obtained in BAHAR (23.04%) followed by MA-3 (23.56%) and MAL-13 (25.08%). The per cent grain damage due to pod bug also varied significantly among the different genotypes/varieties. It ranged from 12.09 per cent in BAHAR to 34.44 per cent in KA-12-2. The highest grain damage were seen in KA-12-2 (34.44%) followed by KA-12-3 (26.26%), NDA-1 (24.69%) and lowest grain damage was observed in BAHAR (12.09%) followed by MA-3 (13.51%) and MAL-13 (13.99%), respectively. Jaisal *et al*. (2010) also studied the incidence of pod fly, pod bug and lepidopterous pod borer on long duration pigeon pea genotypes (MA-20, MAL-13, Bahar, MAL-24 and MA-3) and found that the pod damage by pod fly, pod bug and LPB was greatest on MA-20 (50.3%), MAL-24 (31.0%) and MAL-6 (14.1%), respectively.

Gram pod borer, *Helicoverpa armigera* (Hübner)

The per cent pod damage and grain damage due to gram pod borer on different pigeonpea genotypes/ varieties also showed significant differences among the genotypes/cultivars. It ranged from 9.35 per cent in variety BAHAR to 18.10 per cent in genotype KA-12-2. The maximum pod damage due to gram pod borer were seen in KA-12-2 (18.10%) followed by KA-12-3 (16.40%) and NDA-1 (15.69%) and lowest pod damage was observed in BAHAR (9.35%) followed by MA-3 (10.49%) and MAL-13 (11.99%). The per cent grain damage due to gram pod borer also showed differences among the genotypes/variety and it varied from 4.62 per cent in BAHAR to 9.23 per cent in KA-12-2. The highest grain damage were seen in KA-12-2 (9.23%) followed by KA-12-3 (9.15%), NDA-1 (7.44%) and lowest grain damage was observed in BAHAR (4.62%) followed by MA-3 (5.20%), and MAL-13 (5.78%), respectively. Srivastava and Mohapatra (2002) also reported that the extent of pod damage inflicted by lepidopteran pod borers and pod fly on fifteen pigeonpea genotypes varied from 1.0 to 6.3 per cent and 15.1 to 33.1 per cent, respectively.

Legume pod borer, *Maruca vitrata* (Geyer)

The data presented in table 1 depicted that the per cent pod damage and grain damage by legume pod borer on different pigeonpea genotypes/varieties varied significantly. It ranged from 5.73 per cent in genotype BAHAR to 12.45 per cent in genotype KA-12-2. The maximum pod damage due to legume pod borer were seen in KA-12-2 (12.45%) followed by KA-12-3 (11.99%) and NDA-1 (11.99%) and lowest pod damage was observed in BAHAR (5.73%) followed by MA-3 (5.73%) and MAL-13 (7.33). The per cent grain damage due to legume pod borer also showed differences among the genotypes/varieties. It ranged from 2.99 per cent in genotype BAHAR to 7.03 per cent in genotype KA-12-2. The highest grain damage by legume pod borer were seen in KA-12-2 (7.03%) followed by KA-12-3 (6.32%), NDA-1 (6.32%) and lowest grain damage was observed in BAHAR (2.99%) followed by MA-3 (3.12%), MAL-13 (4.19%), respectively. Randhawa and Kumar (2013) also screened fifteen genotypes of pigeonpea against *M. vitrata* and on the basis of larval polytatic, genotype AL

1743 was found most promising with mean of 14.33 larvae/ 100 flower buds as compared with 28.00 larvae on AL 1811.

Grain yield

The data on grain yield per hectare of different genotypes are given in table 1. There was significant difference in grain yield among the genotypes/varieties. The highest grain yield was recorded from BAHAR (1200 kg/ha) which was significantly different from other genotypes where as the lowest grain yield was recorded from KA-12-2 (658 kg/ha). Banu *et al.* (2007) and Borad *et al.* (1991) also reported higher yield potential in those pigeonpea genotypes which showed lesser incidence of pod borers.

On the basis of the above investigation, it may be concluded that host plant resistance plays a very important part in governing the pest infestation level in pigeonpea. Among the ten genotypes/ cultivars screened, BAHAR followed by MA-3 and MAL-13 were found to be most tolerant against pod fly, pod bug and pod borers damage and these also gave the highest yield and hence, it can be recommended as a source of resistance against pod borer complex in pigeonpea.

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