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RESEARCH ARTICLE

EVALUATION OF ADVANCED CHICKPEA GENOTYPES FOR RESISTANCE TO POD BORER, *HELICOVERPA ARMIGERA* (HÜBNER)

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ABSTRACT

Ten improved chickpea genotypes were evaluated in field condition against gram pod borer, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) during 2008-2009 and 2009-2010. Weekly observations showed that mean larval population of the insect in different genotypes ranged from 5.19 to 9.44 meter row^{-1} from 2nd week of January to end of February, whereas, the pod damage varied from 9.32 to 30.35%. The results revealed that among the tested genotypes, BG-256 showed the maximum resistance to the noctuid insect followed by KPG-59 with less larval population plant^{-1}, minimum pod damage and highest grain yield. From the experimental findings, it was concluded that the genotypes BG-256 and KPG-59 could be used in crossing/evolving new elite chickpea varieties.

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INTRODUCTION

Chickpea is extensively grown in India and is the third most widely cultivated pulse crop in the world (Anonymous, 1994). Inspite of its great adaptability, the crop suffered most from insect pests which are the major hinderence of crop production. Amongst the various insect pests, gram pod border *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) is the major yield constraint that causes serious damage to the crop during pod development (Naresh and Malik, 1986; Deka *et al*., 1987; Sharma, 2005) resulted in yield reduction by 30-60% (Vaishampayan and Veda, 1980; Qadeer and Singh, 1989; Ali and Mohamed, 2014). A single larva can damage 7-10% pods and is responsible for more than 5.4% yield loss (Chaudhury and Sharma, 1982). Since decade, breeders have been working on host plant resistance which is one of the most effective tool in sustainable management of many noxious pests. Keeping this view in mind the present experiment was conducted to identify the resistance genotypes of chickpea against *H. armigera*.

MATERIALS AND METHODS

Field trials were carried out in the university farm of Birsa Agricultural University (BAU), Ranchi, India during *rabi* seasons of 2008-09 and 2009-10. Ten promising chickpea genotypes viz BG-256, KPG-56, Phule G- 9621-12, BG- 2068, RSG-902, Phule G-5, BG-2067, KWR-108, GG-1362 and Pant G-114 were collected from the Department of Genetics and Plant Breeding, BAU. The seeds were sown in the 1st week of November in both seasons. In each plot (5 x 3.9 m^2), recommended plant spacing (30 cm x 10 cm) was maintained in randomized block design. The experiment was replicated thrice and standard agronomical practices were followed for growing the crop. Larval population of *H. armigera* and parasitoid population were recorded on per meter row length basis from three different rows in each plot by pre-determined stratified random sampling method and mean larval population meter^{-1} row length was subjected to statistical analysis after transformed to square root values. Pod damage (%) was recorded from five randomly selected plants plot^{-1} by counting total number of healthy and damaged pods and the percentage data were transformed to angular values before statistical analysis. Yield plot^{-1} in different treatments was also recorded and converted to hectare basis before subjected to analysis of variance for comparison of treatment means.

RESULTS AND DISCUSSION

Larval Population of *H. armigera*: Observations recorded indicated that, irrespective of cultivars, there was a gradual increase in larval population up to middle of February which

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Table 1. Larval population of *H. armigera*, per cent pod damage and yield in different genotypes of chickpea during 2008-09

Treatments	Larval population m^{-1} row length in different dates of observation*								Mean larval population m^{-1} row length*	Pod damage** (%)	Grain yield (q ha^{-1})
	January				February						
	10	17	24	31	7	14	21	28			
T_1. (BG256)	2.66 (1.77)	3.33 (1.95)	3.66 (2.03)	5.33 (2.41)	6.66 (2.67)	8.00 (2.91)	5.33 (2.41)	4.66 (2.27)	4.95 (2.33)	8.35 (16.74)	11.85
T_2. (KPG-59)	3.00 (1.87)	3.66 (2.03)	4.33 (2.19)	6.00 (2.54)	8.00 (2.91)	9.33 (3.13)	6.66 (2.67)	5.66 (2.48)	5.83 (2.51)	12.07 (20.36)	11.11
T_3.(Phule G 9621-12)	5.00 (2.34)	6.66 (2.67)	7.33 (2.79)	8.66 (3.02)	12.66 (3.62)	17.00 (4.18)	9.00 (3.08)	8.33 (2.97)	9.33 (3.13)	27.91 (31.88)	6.24
T_4.(BG 2068)	4.33 (2.18)	5.00 (2.34)	5.66 (2.48)	7.66 (2.85)	10.00 (3.26)	12.66 (3.62)	8.33 (2.97)	7.66 (2.85)	7.66 (2.85)	23.81 (29.20)	8.10
T_5.(RSG 902)	4.66 (2.27)	6.00 (2.54)	5.66 (2.48)	8.33 (2.97)	12.66 (3.62)	16.00 (4.06)	8.33 (2.99)	9.33 (3.13)	8.87 (3.06)	24.58 (29.73)	7.00
T_6.(Phule G -5)	4.00 (2.11)	5.00 (2.34)	5.33 (2.41)	7.66 (2.85)	10.33 (3.29)	11.33 (3.43)	7.33 (2.79)	7.00 (2.73)	7.24 (2.78)	21.28 (27.49)	8.85
T_7. (BG2067)	4.00 (2.11)	4.66 (2.27)	5.66 (2.47)	7.33 (2.79)	9.66 (3.18)	10.33 (3.29)	7.33 (2.79)	7.00 (2.73)	7.00 (2.73)	20.00 (26.56)	9.00
T_8.(KWR-108)	3.66 (2.03)	6.33 (2.61)	4.66 (2.27)	7.00 (2.73)	9.00 (3.08)	9.66 (3.18)	6.33 (2.61)	6.00 (2.54)	6.58 (2.66)	17.31 (24.58)	10.22
T_9.(GG-1362)	4.66 (2.27)	5.33 (2.41)	5.66 (2.48)	8.00 (2.91)	11.66 (3.48)	13.66 (3.76)	8.33 (2.97)	8.00 (2.91)	6.91 (2.72)	19.15 (25.92)	9.72
T_{10}.(Pant G-114) (Check)	4.66 (2.27)	5.66 (2.48)	6.00 (2.54)	8.33 (2.97)	12.00 (3.53)	14.66 (3.89)	7.66 (2.85)	7.33 (2.79)	8.28 (2.96)	24.00 (29.33)	7.86
SEm(±)	0.074	0.075	0.111	0.096	0.112	0.119	0.109	0.107	0.084	0.863	0.451
C.D (p=0.05)	0.223	0.226	0.332	0.288	0.336	0.356	0.327	0.320	0.250	2.585	1.351
CV	6.076	5.524	7.952	5.949	5.952	5.810	6.730	6.768	5.223	5.712	8.689

*Figures in parentheses are square root transformed values. **Figures in parentheses are angular transformed values.

Table 2. Larval population of *H. armigera*, per cent pod damage and yield in different genotypes of chickpea 2009-10

Treatments	Larval population m^{-1} row length in different dates of observation*								Mean larval population m^{-1} row length*	Pod damage** (%)	Grain yield (q ha^{-1})
	January				February						
	10	17	24	31	7	14	21	28			
T_1. (BG256)	3.00 (1.87)	3.88 (2.09)	4.11 (2.14)	5.66 (2.48)	7.22 (2.77)	9.00 (3.08)	5.66 (2.48)	4.88 (2.31)	5.42 (2.43)	10.3 (18.72)	11.00
T_2. (KPG-59)	3.55 (2.01)	4.33 (2.19)	4.88 (2.31)	6.33 (2.61)	8.33 (2.97)	9.77 (3.20)	7.00 (2.73)	6.33 (2.61)	6.31 (2.60)	11.0 (19.37)	10.85
T_3.(Phule G 9621-12)	5.44 (2.43)	6.88 (2.70)	7.88 (2.89)	9.00 (3.08)	12.88 (3.65)	16.33 (4.10)	9.33 (3.13)	8.66 (3.02)	9.55 (3.17)	32.8 (34.94)	5.55
T_4.(BG 2068)	4.66 (2.27)	5.66 (2.48)	5.88 (2.52)	7.77 (2.87)	10.22 (3.27)	14.00 (3.80)	8.55 (3.00)	8.00 (2.91)	8.09 (2.93)	24.26 (29.53)	7.97
T_5.(RSG 902)	5.11 (2.36)	6.33 (2.61)	6.22 (2.59)	8.55 (3.00)	13.11 (3.68)	14.11 (3.82)	8.66 (3.02)	8.00 (2.91)	8.76 (3.04)	29.10 (32.65)	5.96
T_6.(Phule G -5)	4.77 (2.29)	5.33 (2.41)	5.88 (2.52)	7.88 (2.89)	10.77 (3.35)	11.66 (3.48)	8.00 (2.97)	7.11 (2.75)	7.67 (2.85)	25.50 (30.33)	6.78
T_7. (BG2067)	4.44 (2.22)	4.66 (2.27)	6.00 (2.54)	7.66 (2.85)	10.00 (3.24)	10.88 (3.37)	7.77 (2.87)	7.22 (2.77)	7.32 (2.79)	19.00 (25.84)	9.18
T_8.(KWR-108)	3.88 (2.09)	5.00 (2.34)	4.88 (2.31)	7.33 (2.79)	9.22 (3.11)	10.11 (3.25)	7.00 (2.73)	6.11 (2.57)	6.69 (2.68)	21.10 (27.35)	8.86
T_9.(GG-1362)	5.11 (2.36)	5.44 (2.43)	6.00 (2.54)	8.33 (2.97)	12.11 (3.55)	12.00 (3.53)	8.77 (3.04)	8.00 (2.91)	8.22 (2.95)	25.7 (30.46)	8.29
T_{10}.(Pant G-114) (Check)	5.22 (2.39)	6.00 (2.54)	7.66 (2.85)	8.88 (3.06)	13.00 (3.67)	15.11 (3.95)	8.00 (2.91)	7.22 (2.74)	8.88 (3.06)	29.30 (32.77)	6.87
SEm(±)	0.109	0.116	0.133	0.120	0.098	0.103	0.121	0.099	0.116	1.205	0.441
C.D (p= 0.05)	0.325	0.349	0.399	0.360	0.292	0.308	0.363	0.296	0.348	3.609	1.319
CV	8.442	8.380	9.147	7.276	5.086	5.012	7.263	6.217	7.061	7.403	9.384

*Figures in parentheses are square root transformed values. **Figures in parentheses are angular transformed values.

Table 3. Pooled values of larval population of *H. armigera* and yield in different cultivars of chickpea during 2008-09 & 2009-10

Treatments	Mean larval population m^{-1} row length*	Pod damage (%) **	Grain yield (q ha^{-1})
T_1. (BG256)	5.19 (2.38)	9.32 (17.76)	11.42
T_2. (KPG-59)	5.48 (2.44)	11.53 (19.82)	10.98
T_3.(Phule G 9621-12)	9.44 (3.15)	30.35 (33.46)	5.89
T_4.(BG 2068)	7.87 (2.89)	24.03 (29.33)	8.03
T_5.(RSG 902)	8.81 (3.05)	26.84 (31.18)	6.48
T_6.(Phule G -5)	7.46 (2.82)	23.39 (28.93)	7.81
T_7. (BG2067)	7.16 (2.76)	19.50 (26.21)	9.09
T_8.(KWR-108)	6.63 (2.67)	19.20 (25.99)	9.54
T_9.(GG-1362)	7.56 (2.83)	22.42 (28.25)	9.00
T_{10}.(Pant G-114) (Check)	8.58 (3.01)	26.65 (30.98)	7.37
SEm(±)	0.255	0.957	0.479
C.D (p=0.05)	0.763	2.866	1.434
CV	5.952	6.098	9.688

*Figures in parentheses are square root transformed values. **Figures in parentheses are angular transformed values.

started declining thereafter in both the years. The incidence of *H. armigera* on all the genotypes differed significantly. The results on mean incidence revealed that the genotype, BG-256 had significantly lower (4.95 and 5.42 larvae m^{-1} row length) larval population in 2008-09 and 2009-10, respectively, as compared to other genotypes. KGP-59 genotype was also proved better (5.83 and 6.31 larvae m^{-1} row length) than all other genotypes except BG-256 in both the seasons. Whereas, the highest incidence of insect population (9.33 and 9.55 larvae m^{-1} row length) in 2008-09 and 2009-10, respectively, was recorded on Phule G 9621-12. However, pod borer population in rest of the chickpea genotypes was *at par* to each other (Table 1 and 2). The above findings indicated the superiority of BG 256 and KPG 59 over other genotypes due to their higher level of tolerance to *H. armigera*. Similarly, results of pooled mean of two years also revealed the similar trend i.e. BG- 256 showed the lowest (5.19 larvae m^{-1} row length) incidence of the insect followed by the KPG- 59 (5.48 larvae m^{-1} row length) while the rest of the genotypes remained *at par* with each other except Phule G- 9621-12 which supported the highest population of 9.44 larvae m^{-1} row length (Table 3). Earlier, several lines of chickpea were evaluated by several workers for larval population along with ovipositional preference of the insect. The experimental results in most of the cases revealed a significant variation in larval population associated with different genotypes (Chandrakar *et al.*, 2006; Devesh *et al.*, 2006; Kooner and Cheema, 2008).

Pod infestation: Table 1 and 2 revealed that the genotype BG 256 had the least (8.35% and 10.3%) pod infestation followed by the genotype KPG 59 (12.07% and 11.00%) in 2008-09 and 2009-10, respectively, which was significantly better than the rest of the genotypes. Highest (27.91% and 32.8%) pod damage was recorded in Phule G 9621-12. Out of the nine genotypes of chickpea tested, six genotypes viz BG-256, KPG-59, Phule G-5, BG-2067, KWR-108 and GG-1362 showed significantly superior performance over the check (Pant G 114). Two years of pooled data of pod infestation also showed similar trend of performance of genotypic lines of the crop (Table 3). The results indicated that all the varieties showed differential reaction with respect to pod damage. These findings were corroborated with that of reported by Borikar *et al.* (1982).

Grain Yield: The highest grain yield was recorded on BG- 256 (11.85 and 11.00 q ha^{-1}) followed by KPG-59 (11.11 and 10.85 q ha^{-1}) in 2008-09 and 2009-10, respectively. The genotype Phule G 9621-12 was the poorest performer (6.24 and 5.55 q ha^{-1}) than others in both the years (Table 1 and 2). Across the years BG-256 (11.42 q ha^{-1}) was the best performer and was significantly superior to check, Pant G -114 (7.37 q ha^{-1}) (Table 3). The results revealed that different genotypes showed the varied yield potential and resistance to *H. armigera*. This was an agreement with Pandey *et al.* (2005).

Conclusion

From the present experiment it can be concluded that among the tested genotypes, BG-256 showed the maximum resistance to pod borer followed by KPG-59 with less larval population per plant, minimum pod damage and highest grain yield.

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