Pak. J. Agri. Sci., Vol. 47(2), 132-135; 2010
ISSN (Print) 0552-9034, ISSN (Online) 2076-0906
http://www.pakjas.com.pk

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

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Field studies were conducted to evaluate the comparative varietal resistance in thirteen advanced desi chickpea genotypes against chickpea pod borer (CPB), *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) during 2007-2008. Weekly observations showed that mean larval population of CPB in different genotypes ranged from 0.33 to 4.33 per meter row from 1st week of March to 3rd week of April, where the pod damage varied from 7.4 to 14.2%. The results manifest that among the tested genotypes, B 8/02, showed the maximum resistant to CPB along with B 8/03, CH 4/02 and CH 9/02 with highest resistant to CPB, less larval population per plant, minimum pod damage and highest grain yield with increase of 256.8 to 285.7% with respect to check. Therefore, conclude that these genotypes can be used in crossing/evolving new elite chickpea varieties.
Keywords: Desi chickpea, genotypes, pod borer, resistance.

INTRODUCTION

Chickpea (*Cicer arietinum* L.), an important pulse crop of Pakistan, rich in protein source with its green biomass as nutritious vegetable for the poor masses in many developing countries. Chick pea is extensively grown in Pakistan, besides India, Turkey, Ethopia USA, Mexico and Australia and account as the third most widely cultivated pulse crop in the world (Anonymous, 1994). In Pakistan, this crop was grown on an area of 1107 thousand hectares producing 475 thousand tones (Anonymous, 2008). Grain of desi chickpea is a small angular with brown seed that are generally cultivated in subcontinent and semi arid tropics (Muehlbauer and Singh, 1987). Of the total cropped area, the contribution of desi chickpea ranges to 90%.

Chickpea diseases and insect pests are considered as the main yield constrains. Amongst the pests of this crop, chickpea pod border (CPB), *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) is the major threat that causes serious damage during fruit development (Naresh and Malik, 1986; Deka *et al*. 1987). Its larvae eat leaves, growing shoots and many pods during their entire life span and hence can reduce grain yield from 30-60% (Vaishampayan and Veda, 1980; Qadeer and Singh, 1989).

Host plant resistance through varietial resistance remains as the most effective tool in integrated pest management which is compatible with other methods of control with no additional cost to growers. Many workers like Singh and Sharma (1970); Lateef *et al.* (1981); Hafeez and Kotwal (1996); Patnaik and Mohapatra (1997) and Rashid *et al*. (2003) have screened a large number of chickpea genotypes for resistance/susceptibility to CPB. More than 14000 chickpea genotypes have been screened under pesticide free conditions against *H*. *armigera* at International Crops Research Institute for Semi Arid Tropics (ICRISAT), Hyderabad since 1976 (Romeis *et al*. 2004). Chickpea genotypes possessing low to intermediate resistance against CPB have been identified (Lateef and Sachin, 1990). Anwar and Shafique, (1993) tested 11 chickpea genotypes for resistance to *H*. *armigera*. Present study was therefore, carried out to screen 13 advanced desi chickpea genotypes for their resistance against CPB under natural field conditions.

MATERIALS AND METHODS

The studies were carried out at Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad during 2007-2008 under natural field conditions to evaluate the resistance against chickpea pod borer (CPB). Thirteen advanced desi chickpea genotypes developed at NIAB including check (CM 561/03, CM 601/03, CM 628/03, CM 772/03, B 8/03, B 8/02, CH 9/02, CH 31/02, CH 32/02, CH 4/02, CH 28/02, CH 52/02 and Pb 2000) were sown in randomized complete block design with three replications. A distance of 30 and 15 cm row to row and plant to plant was maintained in each plot containing four rows of five meter each. Two border rows of linseed were sown around each plot to differentiate the genotypes. Standard agronomic practices like irrigation, hoeing, weeding and fertilization were undertaken according to the requirements of the crop. No plant protection measures except the use of weedicide (stomp) before sowing were used.

Weekly data on pod borer count were recorded per metre row per replication. Pod damage was estimated from five randomly selected plants per replicate after counting the total number of pods and number of damaged pods and percent damage computed by using simple arithmetic calculations. Temperature data during the experimental weeks was obtained from meteorological observatory of Plant Physiology section, Ayub Agricultural Research Institute (AARI), Faisalabad. After harvesting, data on grain yield per plot (g) was recorded. Larval population (meter^{-1} row length), pod damage (%) and grain yield (g) were tabulated and statistically analyzed by using MSTAC-C programme (Steel *et al*. 1997) and Duncan's multiple range test was applied to test the significance of genotypes.

RESULTS AND DISCUSSION

The results on resistance in chickpea genotypes against chickpea pod borer (CPB) are presented on the basis of counts of larvae (meter^{-1} row length), pod damage (%) and grain yield plot^{-1} (g) in table 1 and 2.

Larval population

Larval population (m^{-1} row length) of CPB on test genotypes during different weeks of March and April varied in comparison to check (Table 1). The CPB larvae appeared and remained under economic injury level during the month of March. However with the increase in temperature from low to high in March with average maximum temperature 29.5, 31.4, 32.6, and 33.3°C while the minimum 14.6, 14.4, 15.5 and 17.4 caused the increase of CPB larvae (Table 1). Pest population started increasing steadily during 1st to 3rd week of April when the average maximum temperature recorded during these weeks was 27.4, 33.0 and 34.0°C with minimum of 16.3, 20.4 and 18.0°C. Mean larval populations during first week of April were high in check Pb 2000 (2.75 larvae m^{-1} row) followed by values in their upper limits in genotypes CM 561/03 (1.33), CM 601/03 (1.00), B 8/03 (1.00), CH 31/02 (1.33), CH 32/02 (1.00), CH 4/02 (1.00) and CH 52/02 (2.00). During 2nd week of April, maximum mean larval population (2.33) was observed in Pb 2000 with population on advanced desi genotypes slightly more as compared to the first week due to increase in temperature. Increase in temperature during the third week of April also increased the larval population to 4.33 on Pb 2000. During this week, larval population count was above the economic injury level on all the genotypes while lower larval population were observed on B 8/03 (2.00), B 8/02 (2.00), CH 9/02 (2.33) and CH 4/02 (2.33). During this time when pod maturity was on its way, the increased larval population did not affect the yield significantly. None of the test genotype showed complete resistance against pod borer, but some showed comparatively better resistance in comparison to check. The findings of Anwar and Shafique, (1992) support our studies who reported that, maximum flower and pod formation time followed by optimum temperature 17 to 27°C are conducive for rapid population build up of CPB. While

Table 1. Mean weekly larval population (number m^{-1} row) of CPB on different genotypes

Genotypes	March 2008				April 2008		
	Week $_1$	Week $_2$	Week $_3$	Week $_4$	Week $_1$	Week $_2$	Week $_3$
CM 561/03	0.33 ± 0.33	0.33 ± 0.33	0.66 ± 0.33	1.00 ± 0.00	1.33 ± 0.33	1.66 ± 0.33	2.00 ± 0.00
CM 601/03	0.00	0.00	0.33 ± 0.33	0.33 ± 0.33	1.00 ± 0.00	1.33 ± 0.33	2.00 ± 0.57
CM 628/03	0.33 ± 0.33	0.33 ± 0.33	1.00 ± 0.00	1.00 ± 0.00	0.66 ± 0.66	1.66 ± 0.33	2.66 ± 0.33
CM 772/03	1.00 ± 0.00	0.33 ± 0.33	0.33 ± 0.33	0.66 ± 0.33	0.66 ± 0.33	0.66 ± 0.66	3.66 ± 0.33
B 8/03	0.00	0.33 ± 0.33	0.00	0.66 ± 0.33	1.00 ± 0.57	1.33 ± 0.33	2.00 ± 0.33
B 8/02	0.00	0.33 ± 0.33	0.66 ± 0.33	0.66 ± 0.33	0.33 ± 0.33	1.33 ± 0.33	2.00 ± 0.57
CH 9/02	0.33 ± 0.33	0.00	0.33 ± 0.33	0.66 ± 0.33	1.00 ± 0.57	2.00 ± 0.00	2.33 ± 0.33
CH 31/02	0.00	0.33 ± 0.33	0.00	0.33 ± 0.33	1.33 ± 0.33	1.00 ± 0. 57	2.66 ± 0.33
CH 32/02	0.00	0.33 ± 0.33	0.66 ± 0.33	1.00 ± 0.00	1.00 ± 0.57	1.33 ± 0.33	2.66 ± 0.33
CH 4/02	0.00	0.00	0.33 ± 0.0.3	0.33 ± 0.33	1.00 ± 0.57	1.66 ± 0.33	3.33 ± 0.33
CH 28/02	0.00	0.66 ± 0.33	0.00	0.66 ± 0.33	0.66 ± 0.33	1.00 ± 0.57	2.33 ± 0.88
CH 52/02	0.66 ± 0.33	1.00 ± 0.00	0.00	1.00 ± 0.00	2.00 ± 0.00	1.66 ± 0.33	3.33 ± 0.33
Pb 2000 (Check)	0.66 ± 0.33	1.33 ± 0.33	1.33 ± 0.33	1.33 ± 0.33	2.75 ± 0.85	2.33 ± 0.33	4.33 ± 0.57
Temperature (°C)							
Maximum	29.5	31.4	32.6	33.3	27.4	33.0	34.0
Minimum	14.6	14.4	15.5	17.4	16.3	20.4	18.0

Means±SE

Table 2. Average pod damage, grain yield and their percent difference over check in chickpea genotypes

Genotypes	Pod damage (%)	Pod damage decrease over check (%)	Grain yield per plot (g)	Yield difference over check (%)
CM 561/03	12.7 ± 0.40 ab	−10.5	559 ± 60.8 f	+47.3
CM 601/03	10.7 ± 1.27 bcd	−24.6	819 ± 102.0 cd	+114.9
CM 628/03	12.5 ± 0.37 ab	−11.9	768 ± 70.7 cde	+101.6
CM 772/03	10.3 ± 1.09 bcd	−27.4	824 ± 22.3 cd	+116.2
B 8/03	7.8 ± 0.28 de	−45.0	1428 ± 103.7 a	+273.2
B 8/02	7.4 ± 0.37 e	−47.8	1476 ± 56.6 a	+285.7
CH 9/02	8.9 ± 0.98 cde	−37.3	1456 ± 34.9 a	+280.5
CH 31/02	9.4 ± 0.65 cde	−33.7	1139 ± 51.3 b	+198.1
CH 32/02	10.7 ± 1.56 bcd	−24.6	909 ± 63.3 c	+138.3
CH 4/02	7.9 ± 0.95 de	−44.3	1365 ± 47.8 a	+256.8
CH 28/02	11.4 ± 0.95 abc	−19.7	605 ± 53.5 ef	+59.2
CH 52/02	12.4 ± 0.96 ab	−12.6	707 ± 54.0 def	+85.8
Pb 2000 (Check)	14.2 ± 0.30 a		377 ± 26.9 g	

Means ±SE, sharing same letters are statistically similar ($P < 0.05$).

at 11°C (Dent and Pawar 1988) CPB population are not observed.

Pod damage

Pod damage (%) by CPB was significantly different among the test genotypes (Table 2). Maximum pods damage (14.2) was observed in Pb 2000 (check), while minimum pod damage (7.4) was observed in B 8/02 resulting in 47.8% decrease over the check. Increasing trend of pod damage from 7.8 (B 8/03) to 12.7% (CM 561/03) was observed in different genotypes. Results obtained by Qadeer and Singh, (1989) are in the line to our studies who reported 10-30% pod damage. Our findings are agreed to the results reported by Srivastava and Srivastava, (1989) who have reported 3.5 to 21.6% CPB damage. However, Anwar and Shafique, (1993) and Parkash *et al*. (2007) reported 60.1- 94 and 70-95% pod damage by CPB respectively. This too much variation in pod damage may be due to difference in regional climatic conditions and the tested genotypes.

Grains yield

High grain yield plot^{-1} (1476 g) genotype B 8/02 with an increase of 285.7% grain yield over check performed the maximum resistant against CPB and showed a genetic potential of improved yield over check (Table 2). Similarly CH 9/02, B 8/03 and CH 4/02 performed significantly better than the other genotypes including the check. Remaining genotypes as CM 561/03, CM 601/03, CM 628/03, CM 772/03, CH 31/02, CH 32/02, and CH 28/02 also produced increased grain yield over check. Our results are in close conformity to that of Shafique *et al.* (2009) who reported 827g grain yield per plot from highly resistant line among the tested chickpea strains.

CONCLUSION

High to moderate resistance against CPB was observed in CH 09/02, B 8/03, B 8/02, CH 4/02, CH 31/02, CH 32/02 and CM 772/03; while CM 628/03, CH 52/02, CH 28/02 and CM 561/03 possessed minimum resistance. The genotype B 8/02 possessed the maximum comparative resistance with low larval population, less pod damage and high grain yield over check. Therefore, genotypes showing comparatively more resistance against CPB and high grain yield over check may be used for release of varieties or to impart resistance against pod borer in cross breeding programmes.

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