Pakistan J. Zool., vol. 41(4), pp. 277-280, 2009.

Performance of Some Advance Desi Chickpea Genotypes against Pod Borer, *Helicoverpa armigera* (Hubner) Resistance

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Abstract.-Twelve advance desi chickpea (*Cicer arietinum* L.) genotypes developed at Nuclear Institute for Agriculture and Biology, Faisalabad were evaluated along with check variety for resistance against chickpea pod borer (CPB), *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) infestation in a field trial during 2006-2007. None of the tested genotypes showed complete resistance against CPB after studying larval population, pod damage and grain yield parameters. Pod damage ranged from 10.9 to 22.8% among different genotypes. With respect to the check (CM 98) the minimum damage was −35.9% and maximum as 33.1%. Grain yield increase was recorded up to 100% over check in CH 16/02. Comparison of resistance among the genotypes against CPB showed that CM 188/01, CH 07/02, CH 20/02 and CH 84/02 possessed good resistance with increased grain yield over check. Intermediate resistance was evinced in CH 11/02, CH 15/02, CH 17/02 and CH 85/02. While genotypes CM 72/02, CM 246/02, CM 282/02 and CM 98 possessed minimum resistance against CPB. So genotype CH 16/02 showed over all better resistance against CPB, with low larval population, low pod damage and high grain yield.

Key words: *Cicer arietinum*, desi chickpea, plant resistance, *Helicoverpa armigera*.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is the most important protein rich pulse crop, which is widely consumed with cereals in Pakistan. This crop covers an area of 10.5 million hectares with average production of 8.4 million tones and average yield of 796 kg/ha. This average yield of the country is lower than that of chickpea growing countries (Anonymous, 2006). Desi type chickpea with small and brown seeds, is generally recommended for cultivation in the subcontinent and the semi arid tropics (Muehlbauer and Singh, 1987). Desi chickpea contributes 90% of the total cultivated area of crop. Major yield limiting factors include severe damage to crop due to diseases and pests. Among the insect pests, chickpea pod border (CPB), *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) is the major constraint in the production of crop worldwide (Sharma *et al.,* 2005). Crop losses could reach up to 90% if CPB population is not managed properly (Lal, 1996). CPB causes serious damage to this crop during most critical stages of fruit development. Its larvae can be seen initially on leaves, then flowers, young shoots and finally on pods. They can feed on many pods before attaining maturity. Pod borer is one of the most important pests of crop that feeds on leaves and developing seeds (Smithson *et al*., 1985). Integrated management of CPB and the use of resistant varieties of chickpea have been recommended to secure high yield. Several workers have screened chickpea varieties for CPB resistance (Whightman *et al*., 1995; Hafeez and Kotwal, 1996; Patnaik and Mohapatra, 1997) and tolerance and reported differences. More than 14000 chickpea germplasms have been screened since 1976 for CPB resistance under pesticide free conditions at International Crops Research Institute for Semi Arid Tropics (Romeis *et al*., 2004). Many chickpea genotypes with low to moderate resistance were identified (Lateef and Sachan, 1990). Ahmad and Ali (1985) determined the losses caused by *H. armigera* and *Autographa nigrisigna* (Walker) on pods as 0.26 and 6.99% in March-April 1983 and 0.26 and 4.44% during March to April 1984. Anwar and Shafique (1993) have tested eleven chickpea genotypes for their resistance against *H. armigera*. Host plant studies were conducted at National Agricultural Research Centre, Islamabad and 5000 chickpea lines were evaluated against *H. armigera* resistance under field conditions (Anonymous, 1986). The objective

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0030-9923/2009/0004-0277 $ 8.00/0

of this study was to screen advance chickpea genotypes for CPB resistance under field conditions.

MATERIALS AND METHODS

The study was conducted at an experimental field of Nuclear Institute for Agriculture and Biology, Faisalabad during the year 2006-2007. Twelve desi chickpea advance mutants/ recombinants, here referred to as genotypes CM 72/02, CM 246/02, CM 282/02, CM 188/01, CH 7/02, CH 11/02, CH 15/02, CH 16/02, CH 17/02, CH 20/02, CH 84/02 and CH 85/02 along with the check variety CM 98 were sown in four replicates in a randomized complete block design. There were four rows per plot and each row was 5 m long. Spacing between rows and plants was maintained at 30 and 15 cm, respectively. Two border rows of linseed were also sown around each plot to differentiate the experimental plots. Agronomic practices *i.e.* hoeing, weeding, irrigation and fertilization were adopted as per standard requirement during the entire crop period. The experiment was conducted without the use of any pesticide and plant protection measures except the use of weedicide (Stomp) before sowing. Resistance of genotypes against CPB was assessed by examining larval count of CPB, pod damage and grain yield records. CPB larval count from plants was done weekly in a randomly selected 1m long section of each row of the plot. At the time of harvest of crop, pod damage was recorded from each replicate by counting the total number of pod and number of damaged pods by the pest from randomly selected five plants. Percent pod damage was measured as

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

At maturity the crop was harvested and after threshing the grain yield per plot (g) was recorded. Data on larval population, percent pod damage and grain yield was statistically analyzed following Steel *et al*. (1997) with MSTAT-C software programme and mean values compared with the help of Duncan's multiple range test (DMRT). Meteorological data was obtained from Plant Physiology section, Ayub Agricultural Research Institute, Faisalabad.

RESULTS AND DISCUSSION

Table I shows number of larvae per meter row, whereas Table II shows pod damage and the grain yield per plot as criteria for evaluation of resistance against CPB.

Larval population of CPB on per meter row length chickpea plants of different genotypes showed significant variation during March and April. CPB larvae appeared during the first week of March. This population of CPB remained below the economic injury level (1-2 larvae/meter row) in all the tested genotypes including check during the 2nd, 3rd and 4th weeks of March. The CPB larval population increased with the increase of temperature. During the first week of April the genotypes CM 72/02, CM 282/02, CH 20/02, CH 84/02 and CH 85/02 had less than 1 larvae / meter row as against 2.00 larvae/m row in check variety CM 98. During the third week of April the genotype CH 7/02 had 3 larvae/meter row, whereas, in others it varied between 4 and 5 larvae/meter row as against 6.25 larvae/meter row in check genotype CM 98. Most of the pods were matured so this increase in population did not affect the crop significantly. Here it is clear that the larval population increased with the increase of temperature and none of the test genotype was completely resistant against pod borer infestation. Some of them were, however, comparatively better than the check. Our results support the findings of Anwar and Shafique (1992) which shows that the maximum flower and pod formation stage of the crop and relatively high temperature (Minimum 17°C and maximum 27°C) were optimum for rapid population build up of CPB. Dent and Pawar (1988) stated that at low temperature (11°C) CPB population was not observed. Wakil *et al*. (2005) reported 1.2 to 5.5 larvae/plant as has been observed in the present experiment.

Table II shows the percent pod damage and the grain yield/plot after CPB attack on different genotypes of desi chickpea. The highest average pod damage (22.8 %) was recorded in CM 282/02, which was 33.1% more than by genotype CM 98.

Table I.- Weekly population (number of larvae / one meter row) of *H. armigera* larvae on different chickpea (*C. arietinum*) genotypes.

Genotype	Date of observation (n=4)					
	05/03/07	12/03/07	19/03/07	02/04/07	09/04/07	16/04/07
CM 72/02	0.00	0.25±0.25	0.25±0.25	0.50±0.28	2.75±0.25	4.00±1.18
CM 246/02	0.00	0.00	0.75±0.47	1.00±0.57	2.50±0.64	4.75±0.62
CM 282/02	0.00	0.25±0.25	0.25±0.25	0.75±0.25	2.50±0.28	4.25±0.85
CM 188/01	0.25±0.25	0.50±0.50	0.50±0.28	1.00±0.40	2.75±0.47	5.75±0.47
CH 7/02	0.25±0.25	0.25±0.25	0.75±0.31	1.25±0.25	2.50±0.47	3.00±0.70
CH 11/02	0.00	0.00	1.00±0.40	1.00±0.40	3.00±0.40	4.75±0.62
CH 15/02	0.25±0.25	0.25±0.25	0.75±0.25	1.00±0.40	3.25±0.25	4.00±0.81
CH 16/02	0.25±0.25	0.25±0.25	0.50±0.28	1.25±0.25	2.75±0.85	4.50±0.64
CH 17/02	0.00	0.00	0.25±0.25	1.75±0.47	3.50±0.28	4.75±1.25
CH 20/02	0.25±0.25	0.50±0.28	0.75±0.47	0.50±0.28	2.25±0.25	4.25±0.47
CH 84/02	0.00	0.25±0.25	0.50±0.28	0.75±0.28	2.25±0.25	4.00±0.70
CH 85/02	0.00	0.25±0.25	0.50±0.28	0.75±0.25	3.25±0.47	5.00±0.70
CM 98 (Check)	0.50±0.25	0.75±0.47	0.75±0.25	2.00±0.25	2.75±0.85	6.25±0.75
Mean squares	0.105 ns	0.185 ns	0.224 ns	0.644 ns	1.897*	4.432 ns
Temperature (°C)						
Maximum	23.5	23.4	26.9	32.9	33.1	39.3
Minimum	9.6	9.8	13.4	16.4	16.0	17.6

*P<0.05; ns, non-significant.

Table II.- Effect of *H. armigera* larvae on mean pod damage and grain yield of twelve chickpea (*C. arietinum*) genotypes.

Genotype	Pod damage (%)	Grain yield per plot (g)
CM 72/02	18.8±0.17 b	322±17.0 d
CM 246/02	18.6±1.08 b	548± 29.9 bc
CM 282/02	22.8±0.84 a	326± 36.6 d
CM 188/01	12.9±0.38 cde	785± 17.9 a
CH 07/02	12.1± 0.60 de	748± 53.1 a
CH 11/02	14.8± 0.47 c	591± 25.4 bc
CH 15/02	14.6± 0.41 cd	581± 28.0 bc
CH 16/02	10.9±1.41 e	827± 20.3 a
CH 17/02	13.2±0.72 cde	536±48.7 c
CH 20/02	11.5±0.59 e	630± 19.3 b
CH 84/02	12.9± 0.83 cde	806± 07.6 a
CH 85/02	17.9± 0.85 b	788± 32.0 a
CM 98 (Check)	17.1± 0.87 b	408± 30.5 d

Means with similar alphabets for pod damage or grain yield are statistically similar at P= 0.05

The lowest pod damage, 10.9% and 11.5% was observed in genotype CH 16/02 and CH 20/02 which was 35.9 and 32.4%, respectively less that of check variety. Chhabra and Kooner (1980) have reported 0.5% infestation in resistant and 30-40% infestation in susceptible genotypes by using different lines. Our findings are also contradictory to those of Anwar and Shafique (1993) who reported 60.1-94% CPB damage and Prakash *et al*. (2007) who reported 70 to 95% pod damage in an experiment conducted under different environment conditions. Our findings are, however, in line with those of Srivastava and Srivastava (1989) who got 3.5 to 21.6% CPB damage.

The highest average grain yield per plot (827g) was recorded in genotype CH 16/02 with 100% increase grain yield over check and survived best against CPB. Genotypes CH 84/02 and CM 188/01 showed grain yield of 806 and 785 g per plot respectively, which is 95.5 and 90.4% increase over check, respectively. Both these genotype showed less than 25% pod damage as compared with the check. Our results agree with results reported by Rashid *et al.* (2003) with 0.333 kg per plot yield obtained from least susceptible line among the eleven tested chickpea strains.

It is concluded that the genotype, CH 16/02 in comparison with the check genotype CM 98 showed over all better resistance against CPB, with low larval population, low pod damage and high grain

yield. The genotypes CH 20/02, CH 07/02, CM 188/01 and CH 84/02 possessed good resistance against CPB with 25-30% less pod damage and 80-94% more grain yield compared with the performance of check genotype. Other tested genotypes had either moderate or very little resistance against the CPB. So the genotype CH 16/02 could be exploited for direct release as varietiy and could also be used in cross breeding programmes to impart comparative resistance against pod borer and high yield to the chickpea germplasms.

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(Received, 5 November 2008, revised 18 April 2009)