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Evaluation for Resistance in Some Local and Exotic Chickpea Genotypes Against *Helicoverpa armigera* (Hubner)

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Abstract: Eight chickpea genotypes were evaluated against the infestation of *Helicoverpa* species under the field conditions at NIA, Tandojam. *Helicoverpa* species were the most serious insect pests causing severe damage to this crop. In order to identify resistance against the infestation of this pest, seeds of the test genotypes were obtained from Plant Genetics Division of this Institute. Results depicted that all the genotypes showed varied response to the traits under observation. The data on larval population, percentage damage and yield components was highly variable, showing the percentage larval attack severity 1.00 to 50.00, pods damage 8.50 to 90.90% and 23.33 to 1920.00 gm grain yield of the sampling unit. Data revealed that genotype C-727 was relatively resistant against pod borer infestation as compared to other genotypes.

Key words: Chickpea, pod borer, *Helicoverpa armigera,* resistance

INTRODUCTION

Chickpea (*Ceicer arietinum* L.) is an important pulse crop, rich in protein and is utilized as fresh vegetable, pods as well as dry grains. The production of this crop in Pakistan is 397 (000 tones), (Anonymous, 2001) which is much lower than that of other countries. This crop is known to suffer from a number of pests, Srivastava (1964) stated that as many as 150 insect species damage to the pulse crops. Singh and Singh (1977,1978) conducted some preliminary studies on the insect pests in cowpea, green gram and black gram and made extensive studies on the succession of insect pests in early maturing varieties of red gram. Mehto and Singh (1983) listed 16 insect species appearing in succession at different stages of crop growth. Among the major pests the cutworm complex appeared during the seedling stage followed by pod borer, *Heliothis armigera* (Hubner) during the active vegetative stage and pod formation stage. In Pakistan, in addition to other insect pests, the gram pod borer during fruiting stage seriously damages to this crop and is considered to be a major limiting factor for the production of gram especially in the province of Sindh. Its larval population can be seen initially on the young leaves, under heavy infestation, young shoots are also attacked and the plants become weakened. Even the flowers may be attacked in which no fruit is formed but the pods are severally damaged. A single larva can destroy many pods before reaching to maturity, mainly feeding on seeds. It causes substantial yield losses ranging from 9.5 to 96% in different areas of Indo-Pakistan (Vaishampayan and Veda, 1980). Adults usually feed on nectar, fruit juices and similar liquid, hence they are never pests,only it is the larvae or caterpillars that damage the crop.

The informations on screening of different cultivars and varieties of gram for pod borer infestation are scanty in Pakistan. The host plant resistance was studied at National Agricultural Research Center, Islamabad (1986), where 5000 chickpea lines were tested under field conditions, the eggs, larvae and adults of pod borer were released for intensive screening. Anwar and Shafique (1993) raised 11 genotypes for screening their resistance to this insect pest. Although the control of this pest can be achieved through integrated approaches, but the use of host plant resistance is the most economical and practicable method. Therefore, the present study was designed to test 8 varieties against *Helicoverpa armigera* with the objective to identify their resistance/susceptibility.

MATERIALS AND METHODS

Seeds of eight genotypes were planted at NIA experimental farm, Tandojam during the year 2001. All genotypes were sown during the first week of November in RCB design, having plots size of 3 x 2 m, with a buffer space stripe of 1.0 m around all the treatments in three replications. Row to row and plant to plant distance was maintained at 40 cm and 10 cm space, respectively. To maintain good health of plants, recommended and standard agronomic crop husbandry practices were followed in all the replications. Experimental observations were recorded from randomly selected 1m row of plants,

Helicoverpa larval population and pods damage were counted and recorded on per plant basis from January to February. Data was recorded at weekly interval during morning time at 8:30 to 10:15 hr, before and after initial build up of larval population. All the larvae between first to final instars from the bottom to the top portion of each plant, on leaves, twigs and fruits were recorded from each replicate of a treatment. Percentage pod borer infestation was assessed by counting the healthy and damaged pods from 5 randomly selected plants in each replicate. To determine grain yield of each replicate, each chickpea plot was harvested and threshed separately. Similar observations format was followed for all the replications in all the treatments. During the study period, adults and eggs of the *Helicoverpa* were also seen from time to time, however they were not counted. At the time of appearance of insect infestation, no foliar or soil insecticidal treatment was undertaken, which was an ecologically and economically sound and feasible practice. The data obtained was subjected to statistical analysis to observe differences or otherwise of the treatments. Finally, from these observations, genotypes which showed sustained and marked resistance against the insect under study were believed to may help in effective control as a segment of integrated pest management.

RESULTS AND DISCUSSION

The results achieved revealed that chickpea genotypes were differing in their degree of resistance from highly resistant to highly susceptible, due to the much genetic variability occurring in them. All resistant and susceptible plants were easily classified because they harbored and respond to larval population, infestation and yield by varying degrees. The results revealed that none of tested genotypes were completely resistant to pod borer infestation. Larval population on eight chickpea genotypes exceeded from second week of January and peaked upto last week of February, consequently, heavy damage was recorded during this period. But genotypes C-727 and CM-1918 received lower larval population than the rest of genotypes; while genotype Flip 84-15C was the most susceptible one. More or less similar population fluctuation results were obtained by Anwar and Shafique (1993) they found that population of this pest on gram started building up generally from 4th week of January and exceeded economic injury level during 2nd week of February, while peaked during 2nd week of March. At lower temperature during January the population was negligible, however the further rising in the temperature favored flowering and pod formation which also caused rapid population growth of *Helicoverpa*. These above mentioned workers (1992) reported that incidence of larval infestation on chickpea plants started during mid December when crop was 4 weeks of age. The larval infestation remained low during the next 5 weeks, till rise in temperature and inception of fruiting bodies on gram plants. This lag phase in larval development may be due to environmental factors. Potter and Watson (1980) observed that temperature and photoperiod usually had been considered the key stimuli for diapause's induction in *Helicoverpa*, high temperature (25°C) reduced the diapause response at all photoperiods. Vaishampayan and Veda (1980) found that high relative humidity did not favor the larval development in gram field, however relative humidity ≥ 75% predicted the outbreak of this insect in near future. Dent and Pawar (1988) stated that at low temperature (11°C), this insect pest was not observed.

The results achieved and presented in Table 1 revealed that these chickpea genotypes also differed in their degree of percent pod infestation. Mean infestation on genotypes Flip 84-15C, Jubiha-1 and Dokri-92 was 90.70, 60.65 and 28.35%, respectively indicating their susceptible behavior; while CM-88 and CM-98 exhibited moderate infestation and CM-72, CM-1918 and C-727 showed resistance receiving 18.50, 11.30 and 8.50% infestation, respectively. The incidence of larval infestation was noted on the crop when it was about one month of age. As the plant growth progressed, the infestation increased accordingly. On the inception of flowering and pod formation initiation periods larval population development was favored, which was peaked when maximum infestable fruiting bodies were available on chickpea plants. But the mean percentage infestation was ranged from 8.5 to 90.70%. These findings are contradictory to the observations of Srivastava and Srivastava (1989) who observed 3.5 to 21.6% pod borer damage in their studies, but are in conformity to those of Anwar and Shafique (1993) who noted the pod damage from 60.1 to 94%.

When the borer damage data was correlated with yield potential of the tested genotypes, it was estimated that genotypes C-727 and CM-1918 yielded 1920.00 and 1793.00 gm per 6 square meter area, respectively contributing towards higher production as compared to genotypes Flip 84-15C and Jubiha-1 by generating 23.33 and 128.33 gm of seed, respectively showing the somewhat poor yield. Similar results were obtained by different workers and was noted that gram pod borer in normal years, caused more than 10% losses to chickpea crop and 60-80% in case of outbreaks. It caused substantial yield losses ranging from 9.5 to 96% in different area of Pakistan (Vaishampayan and Veda, 1980;

Table 1: *Helicoverpa armigera* (Hubner) larval population, % damage to pods and yield of chickpea genotypes

Chickpea genotypes	Average number of larvae/m row during 08-01-2001	22-01-2001	07-02-2001	26-02-2001	Damaged pods (%)	Grain yield/ plot ($6m^2$) (gm)
CM-72	2.33AB	2.00AB	2.75AB	2.00C	18.50E	831.66C
CM-88	2.67AB	2.67AB	2.67AB	2.67BC	23.40D	593.33E
CM-98	2.67AB	2.33AB	2.42B	2.67BC	20.50DE	776.66D
Dokri-92	3.00AB	3.00AB	2.58AB	4.33AB	28.35C	498.33F
C-727	1.00B	2.00AB	2.33B	1.67C	8.50F	1920.00A
CM-1918	1.67AB	1.67B	2.33B	1.67C	11.30F	1793.00B
Jubiha-1	3.33AB	3.33AB	3.00AB	4.00ABC	60.65B	128.33G
Flip 84-15C	3.67A	4.33A	3.67A	5.00A	90.70A	23.33H

Anonymous, 1986). According to Anwar and Shafique (1993) gram pod borer is the most destructive pest of chickpea in Pakistan, resulting in poor yield ranging from 0.034 to 0.564 kg per 4.5 square meter plot. The basis of resistance may be due to ovipositional non preference, high malic acid (Rembold and Winter, 1982; Rembold *et al*., 1990) and PH differences (Weigand and Tahhan, 1990) in chickpea plant.

Our results are similar with those of Singh and Sharma (1970), Beech and Brinsmead (1980), Chhabra and Kooner (1980), Lateef *et al.* (1981), Borikar *et al.* (1982), Dias *et al.* (1983), Tripathi and Sharma (1984), Bhalani *et al.* (1987), Lateef and Schan (1990), Kotikal and Panchabhavi (1992), Hussain and Begum (1992) and Khan and Faizullah (1999) who also obtained significant results on the screening of different chickpea genotypes against pod borer infestation.

It is evident from the data that genotype C-727 was relatively resistant and high yielding as compared to other tested genotypes, which clearly showed that this genotype, therefore, could be used as a source of resistance against the gram pod borer. This discovery of resistance can elicit much interest of scientists to focus their interest to identify germplasm that had pod borers resistance. The most successful insect breeding programmes would be those in which scientists of several disciplines work as team. The objective of team must be to develop a high yielding variety with acceptable grain quality and able to with stand certain biological and physical stresses.

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