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FIELD SCREENING OF DESI AND KABULI GRAM GENOTYPES AGAINST *Aphis craccivora* AND *Helicoverpa armigera*

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Chick peas (*Cicer arietinum* L.) are one of the oldest pulses known and cultivated from ancient times both in Asia and in Europe. It is assumed that gram is originated either from Himalayas or Mediterranean region. It is a good source of carbohydrates and protein, and protein quality is considered to be better than other pulses. Chickpea has significant amounts of all the essential amino acids except sulphur-containing amino acids. It is not only an important source of feed, but also adds nitrogen to soil which increases soil richness. The use of chickpea in the feed is growing at a much larger pace day by day. The pod borer, *Helicoverpa armigera* and gram aphid, *Aphis craccivora* are the major pests of gram. The use of crop varieties resistant or tolerant to insect pests stress is an imperative approach in non-chemical crop protection. In the presented study, six Desi chickpea genotypes *i.e*., D-12011, D-10039, D09027, D-097-10, D-11030, D-10008 and six Kabuli chickpea genotypes *i.e.*, Noor-91, Noor-09, K-70005, K-70008, K-101015, K-01014 were screened out against insects during 2015- 2016. Results revealed that, in case of Desi chickpea the minimum pod borer infestation (6.33 %) was recorded on D-10008 and maximum pod borer infestation (11.33%) was observed on D-097-10 whereas minimum aphid population (1.60/twig) was recorded on D-10039 and maximum aphid population (2.8/ twig) was observed on D-12011. In case of Kabuli chickpea genotype minimum pod borer infestation (6.00 %) was recorded on Noor-09 and maximum pod borer infestation (10.33 %) was observed on K-01014 whereas minimum aphid population (2.13/ twig) was recorded on K-70005 and maximum population (4.27/ twig) was observed on Noor-09.

Keywords: Gram, Genotypes, Screening, *Helicoverpa armigera, Aphis caraccivora***.**

INTRODUCTION

Among the grain legumes, chickpea (*Cicer arietinum* L.) is the premier pulse crop and has occupied a prominent position. It is primarily consumed as green grain, dry whole seed, decorticated split cotyledons and flour (Sarwar, 2013). Chickpea seed is recognized as a valuable source of dietary proteins (18 to 22%), carbohydrate (52 to 70%), fat (4 to 10%), minerals (Calcium, Phosphorus, Iron) and vitamins. Its straw has also good forage value (Shrestha *et al*., 2011). It is used for both human as well as for animal nutrition purposes. It is the main source of protein for vegetarian people (Kafilzadeh and Maleki, 2011). Around the world, it is mostly cultivated in 35 tropical and subtropical countries. Burma, Ethiopia, Iran, Pakistan, United States of America, Australia, Canada, India, Mexico and Turkey are the top ten chickpea producing countries (FAO, 2014). In Pakistan, it is mainly grown in irrigated and rainfed areas of the Punjab (Sha *et al.*, 2011). There are two main types of chickpea. The Kabuli type chickpea genotypes have large seeds with creamy color and are generally suitable for cultivation in well irrigated areas. Desi type chickpea with brown and small seeds are generally recommended for cultivation in the semiarid and the tropics (Muehlbauer and Singh, 1987).

Desi chickpea contributes 90% of the total cultivated area of the crop (Sha *et al.*, 2009). In Pakistan, this crop was producing 359 thousand tones and grown on an area of 931 thousand hectares and accounting 76 percent of total production of pulses in the country (GoP, 2017). Latent yield of chickpea is low in Pakistan mostly due to lack of improved varieties appropriate for cultivation (Naveed *et al.*, 2012), lack of utilization of modern agricultural techniques, improper use of fertilizers and lot others but insect pest's infestation seems to be the main constraint (Mangi *et al.*, 2017). Approximately 60 insect species are known to feed on chickpea (Reed *et al*., 1987). The important insects damaging chickpea in different regions are gram aphid (*Aphis cracivora*) and gram pod borer (*Helicoverpa armigera*). *Helicoverpa armigera* (Hubner) (Lepidoptera: *Noctuidae*) is the major constraint in the production of crop worldwide. The pest feeds voraciously and causes about 50 to 60 per cent damage to the chickpea pods, appearing throughout the year on different crops (Anusha *et al*., 2017).

The pest status of these species has increased steadily over last 50 years due to agro-ecosystem diversification by the introduction of winter host crops (Menghwar *et al*., 2015). Leaves and shoots are deformed in severe attack of pod borer and the plants become stunted. It may require chemical sprays

(Loss *et al.*, 1998). As a result of heavy use of chemicals, they have developed resistance to some of the insecticides (Armes *et al*., 1996; Kranthi *et al*., 2002). The problem can be stunned by developing high yielding genotypes to improve the living style of chickpea growing farmers (Naveed *et al.*, 2012). Therefore integrated management of CPB and the use of resistant varieties of chickpea have been recommended to secure high yield (Whightman *et al*., 1995). Host plant resistance (HPR) as one of the important component of integrated pest management, can play major role in management of *H. armigera* and *A. craccivora*. It is economically viable, ecologically safe and compatible with other IPM strategies. Considering the above factors, the present study was conducted to determine resistance/susceptibility of chickpea varieties against *Helicoverpa armigera* and *Aphis craccivora* under field conditions.

MATERIALS AND METHODS

Experiment was conducted at the field area of Entomological Research Institute, Faisalabad, Pakistan. Six Kabuli chickpea genotypes viz; Noor-91, Noor-09, K-70005, K-70008, K-101015, K-01014 and six Desi chickpea genotypes viz; D-12011, D-10039, D09027, D-097-10, D-11030, D-10008 were sown in October to screen for resistance against *H. armigera* and *Aphis craccivora*. The experiment was laid out in a randomized complete block design (RCBD) with three replications. A distance of 30 and 15 cm between rows and plants was maintained, respectively. 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 before sowing were used. Weekly data on pod borer and aphid were recorded per meter row per replication. Aphid population was recorded from 15 twigs of 15 plants selected at random per plot. Pod damage was estimated from five randomly selected plants per replicate after counting the total number of pods and number of infested pods and percent infestation computed by using simple arithmetic calculations.
Percent infestation was measured as,

$$\text{Infestation (\%)} = \frac{\text{No. of infested bolls}}{\text{No. of total bolls of five plants}} \times 100$$

***Morphological Plant Characters*:** The morphological plant characters *i.e.* hair density and pod wall thickness were recorded from 10 randomly selected plants per treatment. Leaf and twig trichomes density were counted under a binocular microscope from an area of 1cm^2 at five different points of a leaf and twig selected randomly. Pod wall thickness was determined by ten pods from randomly selected 10 plants and estimated by Micrometer.
***Statistical Analysis*:** Data were subjected to statistical analysis according to standard procedures methods described by Gomez and Gomez (1984). Randomized complete block design (RCBD) was employed for analysis of variance (ANOVA) and correlation between morphological characters and insect pest was calculated by using SPSS statistics 20.

RESULTS AND DISCUSSION

The resistance/susceptibility of six Kabuli chickpea genotypes viz; Noor-91, Noor-09, K-70005, K-70008, K-101015, K-01014 and six Desi chickpea genotypes viz; D-12011, D-10039, D09027, D-097-10, D-11030, D-10008 against gram pod borer and aphid was carried out under natural field conditions. Performance of chickpea genotypes against the pod borer, *H. armigera* was estimated on the basis of mean percent of pod damage. Data indicates that, in case Desi chickpea minimum (6.33 %) pod borer percentage infestation was recorded on D-10008 that is followed by D-11030 with infestation of (6.66%) and the maximum (11.33%) percentage infestation was recorded on D-097-10 whereas, minimum aphid population (1.60/ twig) was observed on D-10039 followed by D-10008 with population (2.4/ twig) and maximum aphid population (2.80/ twig) was recorded on genotype D-12011(Fig. 1).

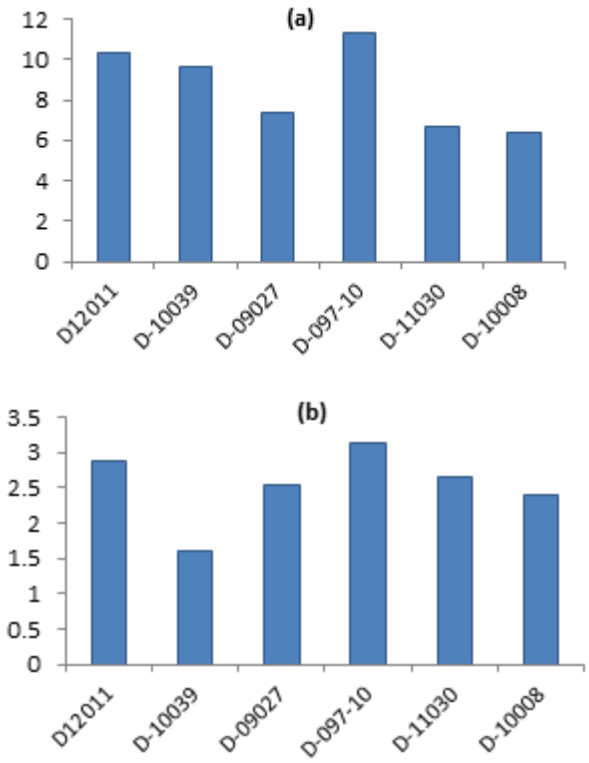

Figure 1: Performance of Desi chickpea genotypes against Pod Borer infestation % and aphid population. (a), Pod borer percentage infestation (b), Aphid population

In case of Kabuli chickpea genotype minimum (6.00 %) pod borer percentage infestation was recorded on Noor-09 followed by K-70005 with infestation (6.33%) and maximum (10.33 %) percentage infestation was observed on K-01014 whereas, minimum (2.13/ twig) aphid population was recorded on K-70005 followed by K-101015 with population (2.57/ twig) and maximum population (4.27/ twig) was observed on Noor-09 (Fig. 2).

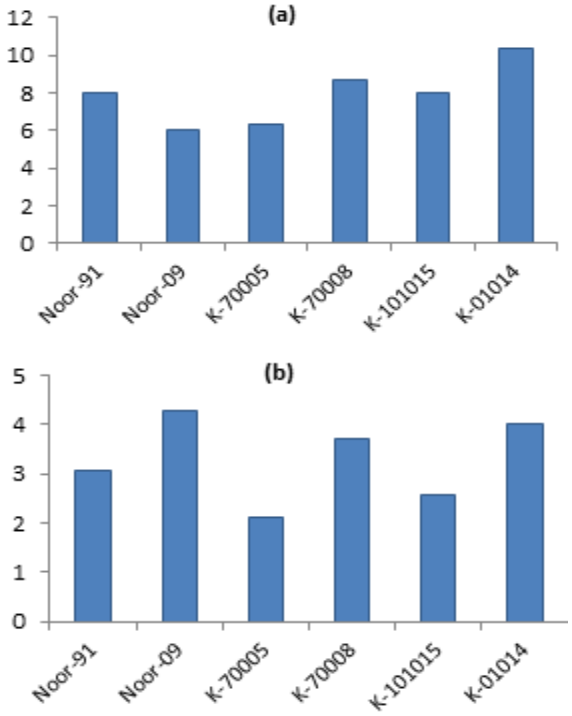

Figure 2. Performance of Kabuli chickpea genotypes against Pod Borer infestation % and aphid population. (a), Pod borer percentage infestation (b), Aphid population

***Gram Pod Wall Thickness and Hair Density*:** Pod wall thickness and hair density is considered a mechanism of defense in plants to prevent damage by insects [10]. The observed genotypes revealed result in relation to maximum pod wall thickness with minimum infestation of pod borer and maximum density of hair with lowest aphid population. In case of Desi chickpea, pod wall thickness was negatively correlated (r = -0.902) and significant (p =0.014) with pod borer percentage infestation while hair density and aphid population had negative correlation (r = -0.778) but showed non-significant (P=0.068) results (Table 1)

In case of Kabuli chickpea, borer infestation had negative (r = -0.926) and highly significant (P =0.008) correlation with pod wall thickness whereas hair density was negatively correlated (r =-0.995) with aphid population and showed significant results (P=0.000) (Table:2).

DISCUSSION

Desi and kabuli chickpea genotypes were evaluated during cropping season 2015-16 and all the genotypes performed differently against pod borer and aphid infestations. In the present study average seasonal pod borer infestation ranged from 6.33 to 11.33% and 6.00 to 10.33% on Desi and Kabuli chickpea genotypes, respectively. In case of aphids, population ranged from 1.60 to 2.80 per twig and 2.13 to 4.27 per twig on Desi and Kabuli chickpea genotypes, respectively. These results are in line with those of Devi, *et al*. (2017). In their study pod borer percentage infestation ranged from 8.17 to 12.45 during 2014-15 and 4.49 to 11.55 during 2015-16. In the experiments of Rashid *et al.* (2003), Wakil *et al.* (2005) and Girjia *et al*. (2008) pod borer infestation ranged from 9.38 to 21.49, 12.71 to 38.83 and 6.65 to 37.59, respectively. Present study results indicate that Desi chickpea genotypes D-10008 and D-10039 performed well against pod borer (6.33%) and aphid population (1.60/twig),

Table 1. Correlation between insect pest and morphological characters of Desi chickpea genotypes

	Aphid pop	Hair density	Borer infestation	Pod wall thickness
Aphid pop	1.000			
Hair density	-0.778	1.000		
Borer infestation	0.230	-0.754	1.000	
Pod wall thickness	-0.368	0.698	-0.902*	1.000

*. Correlation is significant at the 0.05 level (2-tailed).

Table 2. Correlation between insect pest and morphological characters of Kabuli chickpea genotypes .

	Aphid pop	Hair density	Borer infestation	Pod wall thickness
Aphid pop	1.000			
Hair density	-0.995**	1.000		
Borer infestation	0.288	-0.361	1.000	
Pod wall thickness	-0.212	0.280	-0.926**	1.000

*. Correlation is significant at the 0.05 level (2-tailed).

respectively. While in case of Kabuli chickpea genotypes Noor-09 was found to be comparatively tolerant against pod borer with infestation (6.00 %) and K-70005 against aphid population (2.13/twig). Afzal et al (2001), Rashid *et al*. (2003), Manda (2003) and Chandraker *et al.* (2006) also screened 8, 11, 18 and 14 advance chickpea genotypes, respectively. Their results can't be compared with the present study findings as different genotypes were tested.

In the present study morphological characters i.e. pod hair density and pod wall thickness were observed and correlated with pest infestations. Pod hair density was found to be significantly and negatively correlated with pod borer percentage infestation. Present study results are in accordance with those of Shahzad *et al.* (2005) but contradict with those of Brar and Singh (2017). They concluded that trichome density on pods had significant and positive correlation with pod damage. Pod wall thickness was found to be significantly and negatively correlated with pod borer percentage infestation. These results are similar with those of Hossain *et al.* (2008) and Girjia *et al.* (2008). Hossain *et al*. (2008) observed negative and non-significant correlation between pod wall thickness negatively and pod borer infestation percentage whereas Girjia *et al.* (2008) observed highly significant correlation.

***Conclusion*:** All the Desi and Kabuli chickpea genotypes such as D-12011, D-10039, D09027, D-097-10, D-11030, D-10008 and Noor-91, Noor-09, K-70005, K-70008, K-101015, K-01014, respectively performed differently against the attack of pod borer and aphid population in terms of pod wall thickness and hair density. All genotypes also performed well against aphid population, as the aphid population on all genotypes remains below ETL. Desi chickpea genotypes D-10008 and D-10039 comparatively found to be good against pod borer (6.33%) and aphid population (1.60/twig) respectively. While in case of Kabuli chickpea genotypes Noor-09 found good against pod borer with infestation (6.00%) and K-70005 performed well against aphid population (2.13/twig).

REFERENCES

Afzal M, H.A. Ghafoor, A. Javed, M.A. Sabri. 2001. Role of physico-morphic characters in different varieties and advanced lines of chickpea towards resistance against *Helicoverpa armigera* Hub. Pak. Entomol. 23:71-74.

Anusha, S., K. Dinesh and R.B. Singh. 2017. Varietal response of chickpea against the gram pod borer, *Helicoverpa armigera* (Hubner) under natural field conditions. J. Ento. Zool. Sci. 5: 938-942.

Armes, N.J., D.R. Jadhava and K.R. Desouza. 1996. A survey of insecticide resistance in *Helicoverpa armigera* in Indian subcontinent. Bulletin of Entomol. Res., 86:499-514.

Brar H.S. and R.Singh. 2017. Role of trichomes on leaves and pods for imparting resistance in chickpea [*Cicer arientinum* (L.)] genotypes against *Helicoverpa armigera* (Hübner). J. Appl. Nat. Sci. 9:2193-2198.

Chandraker, M.K., S.K. Shrivastava and A. Kumar. 2006. Field screening of resistant varieties of chickpea against pod borer, *Helicoverpa armigera* Hub. Environ. Ecol. 245:728-729.

Devi, N., R. Singh and S. Singh, 2017. Role of host plant resistance in interspecific chickpea genotypes against gram pod borer, *Helicoverpa armigera* (Hübner) under field conditions. J. Insect Sci. 30: 99-105.

FAO. 2014. Faostat data 2014. http://www.fao.org.

Hossain, A., A. Haque and M.Z.H. Prodhan. 2008. *Effect of pods characteristics on pod borer (Helicoverpa armigera, Hubner) infestation in chickpea.* SAARC J. Agric. 6:51-60.

Girija, P.M. Salimath, S.A. Patil, C.L.L. Gowda and H.C. Sharma. 2008. Biophysical and biochemical basis of host plant resistance to pod borer (*Helicoverpa armigera* Hübner) in chickpea (*Cicer arietinum* L.). Indian J. Gen. 68:320-23.

Gomez, K.A. and A.A. Gomez. 1984. Statistical procedures for agricultural research (2ed.). John wiley and Sons, NewYork.pp. 680.

GOP. 2017. Pakistan. Economic survey 2016-17. Economic adviser's wing, finance division, government of Pakistan, Islamabad.

Kafilzadeh, F. and E. Maleki. 2011. Chemical composition, in vitro digestibility and gas production of straws from different varieties and accessions of chickpea. J. Anim. Physiol. Anim. Nutr. 96:111-118.

Kranthi, K.R., D.R. Jadhav, S. Kranthi, R.R., Wanjari, S.S. Ali and D.A. Russel. 2002. Insecticide resistance in five major insect pests of cotton in India. Crop Prot. 21:449-460.

Loss, S., N. Brandon and K.H.M. Siddique. 1998. The chickpea book. bulletin 1326. Western Australian Department of Agriculture, Perth, Australia.

Mandal, S.M.A. 2003. Screening of some chickpea genotypes against *Helicoverpa armigera*. Environ. Ecol. 21:240-241.

Mangi, N., N.A. Abro, M.A. Abro, I. Khatri, S.N. Mazari and R. Kandhro. 2017. Screening of different chickpea varieties against gram pod borer *Helicoverpa armigera* (Hub) and its laboratory rearing on chickpea, B.t cotton and conventional cotton. Pak. J. Biotechnol. 14: 443-447.

Marquis, R.J. 1992. The selective impact of herbivory. In: Plant resistance to herbivory and pathogens. Ecology, evolution and genetics (R. S. Fritz and E. L. Simms, eds). The University of Chicago Press, Chicago. Pp. 301-325.

Menghwar, V., S.S Tajwar, B. Lubna, H.A. Ghulam and A.H.S. Syed. 2015. Investigations on varietal resistance

of gram against *Helicoverpa armigera* (HB).under field conditions. Pak. J. Entomol. 30:173-178.

Muehlbauer, F.J. and K.B. Singh. 1987. Genetics of chickpea. In: M.C. Saxena and K.B. Singh (eds.). The chickpea. CAB. International, Wallingford, Oxon, OX10 8DE, UK. Pp. 99-125.

Naveed, M. T., Q. Ali, M. Ahsan and B. Hussain, 2012. Correlation and path coefficient analysis for various quantitative traits in chick pea (*Cicer arietenum* L.) Int. J. Agro. Vet. Med. Sci. 6:07-106.

Naveed, M.T., Q. Ali, U. Saeed and B. Hussain. 2012. Combining ability analysis for various quantitative traits in chick pea (*Cicer arietenum* L.). Int. J. Bio. Pharm. Allied Sci. 1:503-511.

Rashid, A., H.A. Saeed, S.Z. Siddique and M. Arshad. 2003. Performance of advance chickpea strains against gram pod borer *Helicoverpa armigera* Hubner. Asian J. Plant Sci. 2: 418-419.

Reed, W., C. Cardona, S. Sithanantham and S.S. Lateef. 1987. The chickpea insect pests and their control. In: Saxena, M.C. and Singh, K.B. (eds) The Chickpea. CAB International, Wallingford, UK. Pp. 283–318

Sarwar, M. 2013. Survey on screening resistance resources in some chickpea (*Cicer arietinum* L.) genotypes against gram pod borer *Helicoverpa armigera* (Hubner) (Lepidoptera: *Noctuidae*) pest. Int. J. Agric. Sci. 3:455-458.

Shahzad, K., A. Iqbal, S. K. Khalil and S. Khattak. 2005. Response of Different Chickpea (*Cicer aritinum*) Genotypes to the Infestation of Pod Borer (*Helicoverpa armigera*) with Relation to Trichomes. Res. J. Agric. Biol. Sci. 1:120-124.

Sha, M. T., S. Nadeem, M. Hamed, M. Shafique and B. M. Atta. 2009. Performance of some advance desi chickpea genotypes against pod borer, *Helicoverpa armigera* (Hubner) Resistance. Pak. J. Zool. 41:277-280.

Sha, M.T., S. Nadeem, M. Hamed, M. Shafique and B.M. Atta, 2011. Evaluation for resistance in Kabuli chickpea genotypes against chickpea pod borer, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) under field conditions. Songklanakarin J. Sci. Technol. 33:291-294.

Shrestha, R., R.K. Neupane and N.P. Adhikari. 2011. Status and future prospects of pulses in Nepal. Paper presented at regional workshop on pulse production held at Nepal Agricultural Research Council (NARC), Kathmandu, Nepal, pp. 24-25.

Wakil, W., M. Ashfaq, M. Hasan and A. Javed. 2005. Evaluation of different chickpea (*Cicer arietinum* L.) genotypes against *Helicoverpa armigera* (Hüb.) in Rawalpindi, Pakistan. Pak. J. Entomol. 27:37-41.

Whightman, J.A., M.M., Anders, V.R. Rao and L. Reddy. 1995. Management of *Helicoverpa armigera* (Lepidoptera: Noctuidae) on chickpea in southern India: Threshold and economics of host plant resistance and insecticide application. Crop Prot. 14:37-46.