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SCREENING OF DIFFERENT CHICKPEA VARIETIES AGAINST GRAM POD BORER *HELICOVERPA ARMIGERA* (HUB). AND ITS LABORATORY REARING ON CHICKPEA, B.T COTTON AND CONVENTIONAL COTTON

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ABSTRACT

In Integrated Pest Management host plant resistance is very important against the insect pests. In the recent work, the different Chickpea varieties were screened out for their resistance against the Gram Pod Borer (*Helicoverpa armigera*) under the natural field conditions at the Latif Farm Sindh Agriculture University Tandojam. The pest was also reared under laboratory conditions on three different hosts i.e. chickpea, conventional cotton and B.t cotton. Results on the screening of different chickpea genotypes revealed that the genotypes NCS 0530 and NCS 0523 produced significant results in term of lower Gram pod borer infestation (*Helicoverpa armigera*). Whereas susceptible effect against Gram Pod Borer was appeared in the varieties, NCS 0605 and NCS 9917 showing significantly higher population of Gram pod borer. The rest of the varieties were intermediate in tolerance or susceptibile to the attack of gram pod borer. Studies showed that tolerant Chickpea varieties can produce good yield and can reduce the use of chemicals in Integrated Pest Management (IPM) against the Gram Pod Borer. The laboratory rearing of (*Helicoverpa armigera)* on different natural hosts e.g Chickpea, B.t Cotton and Conventional Cotton was done in laboratory conditions results revealed that chickpea was the most preferred food followed by conventional cotton (Sadori variety). However different life history parameters of *Helicoverpa armigera* were severely affected by Bt cotton (IR-FH-901) where maximum mortality of first and second larval instars and prolong life cycle of all other instars was recorded.

Key words: Chickpea, Varieties, Screening, *Helicoverpa armigera,* Bt cotton,Conventional Cotton.

INTRODUCTION

Chickpea (*Cicer arietinum*) is the most precious grain legume crop it is mostly grown in the regions of Sindh and Punjab Provinces of Pakistan. The total cultivated area under chickpea crop in 2010 was 1093.90 thousand hectares production was 668.2 thousand Tones (Anonymous 2010). Chickpea is an important pulse crop rich in proteins and utilized as vegetables pods as well as dry grains (Anonymous 2002*).* In Pakistan, yield per hectare of chickpea is lower as compared to other chickpea producing countries of the world. There are various factors responsible for this declined production like lack of utilization of modern agricultural techniques, improper use of fertilizers, competition with other crops and lot others but insect pest's infestation seems to be the main constraint (Johnson *et al.,*1994). Chickpea can be host of wide range of insect pests (Reed *et al.,* 1987: Ranga Rao and Shanover, 1999). Srivastava, (1964) stated that as many as 150 insect species damage the pulses crops in different growth stages. Among these insect pests the cut worm and *Helicoverpa armigera* are known to be the serious ones. Gram pod borer *(Helicoverpa armigera)* is very serious pest during the vegetative and pods formation stages of the crop leading to sever crop losses (Ahmed *et al.,*1989). In Sindh province, Gram pod borer is considered as major menace causing drastic reduction in chickpea yield (Metho and Singh, 1983). Female lay eggs Phenotypically spherical white creamy in colour the larva possess different colour variations from greenish to brown colour having dark brown grey lines laterally on body and also has dark and pale bunds. The larval population can be seen on young shoots which cause heavy infestation, latter larva move to the flowers and pods and feed on them. The attacked flowers bear no or low quality fruits. A single larva may destroy many pods and destroy the seeds before it reaches maturity. The yield losses may be ranged from 9.5 to 96% depending upon the severity of the infestation (Vaishampayan and Veeda, 1980*).* For the controlling of this pest large amount of toxic chemicals are being used each year which causes pest resistance, water pollution, soil degradation and environmental pollution (Naeem *et al.,* 2012). For removing such a situation it is very necessary to grow resistant Chickpea varieties. To find resistance Chickpea varieties is pre-requisite for the success of such a strategy. The researchers are going to conduct research continuously about the resistance of Chickpea varieties against to Gram Pod Borer for recommendation of resistant varieties, hence keeping in view the present studies were carried out

to check resistant varieties of Chickpea against the Gram Pod Borer on the basis of present studies the resistant varieties can be recommended for better yield.

MATERIALS AND METHODS

Screening of Chickpea varieties under field conditions: Field trial on screening of different Chickpea (*Cicer arietinum*) varieties against Gram Pod Borer was carried out at the Latif Farm Sindh Agriculture University Tandojam during the year 2014-15. The experimental location is situated at Tandojam that is a town and Union Council of Hyderabad District in the Sindh province of Pakistan. It is located at 25°25'60N 68°31'60E and lies about 20 km away from Hyderabad city Pakistan, along Hyderabad and Mirpurkhas Road.

The chickpea genotypes selected for experiment included NCS 9917, CMC211S, NCS 0506, NCS 0605, NCS 0601, NCS 0530, NCS 0530, and NCS-0523. Pure non-contaminated seed of all these varities were grown in well prepared soil under natural field conditions. Each variety was direct seeded into four rows plot consisted of 6 meters row length having 30cm row to row distance with 1meter bed buffer zone between the plots. The plots were arranged in randomized complete block design with 4 replications. All the agronomic practices were accomplished according to the recommendations of Department of Agriculture. The experimental field was kept open for the infestation of pest, no control measures were carried during the experiment. Nitrogen and phosphorus fertilizers were applied at recommendded doses basally. The data collection on population of *H.armigera* was initiated from the second week of January when the appearance of the pest seen and continued till the invasion ended. The varietal resistance and susceptibility of chickpea in the test varieties were determined by detecting *Helicoverpa armigera* population at weekly interval by randomly selecting one-meter row length of each replicate and particular attention was given to terminal growing tips of the plants, at the time of morning when sun arose and larva come on tips of the shoots.

Rearing of *Helicoverpa armigera* under laboratory conditions: For rearing of *H. armigera*, larvae were collected from different host plants Chickpea, B.t cotton and Conventional cotton from the Latif Agricultural Farm and brought to the Postgraduate Insect Systematic laboratory Sindh Agriculture University Tandojam. The larvae were kept in growth chambers along with their natural host (chickpea leaves, conventional cotton leaves and Bt cotton leaves) which was changed daily with fresh food. The laboratory temperature was maintained (25 ± 1^0C and 70% R.H). The adults, on emergence, were paired and transferred to glass chimneys covered with muslin cloth for mating and egg laying. First instars larvae were taken from this population i.e. 20 larvae were transferred individually to Petri dishes each for chickpea, conventional and Bt cotton. The natural hosts, chickpea, B.T cotton and conventional cotton leaves were picked from the experimental farm of Latif Agricultural Farm Sindh Agriculture University Tandojam on daily basis and placed in Petri dishes having first instar larva. The foods were regularly changed.

Data analysis: The data were recorded on larval survival, mortality, larval period, pupal period, pupal recovery, adult emergence, adult longevity, sex ratio, fecundity and hatching. Computer software STATISTIX. 8.1 was used to analyze the data and the means were compared using LSD test at 5% level of significance.

RESULTS AND DISCUSSION

Screening of Chickpea varieties against larval population of Gram Pod Borer under field conditions: The results on relative abundance of *H. armigera* on different chickpea genotypes are presented in Figure1. Statistical analysis of the data revealed that the tendency of all the tested varities was varied in holding *H.armigera* population. The gram pod borer infestation appeared in the 2nd week of January and increased gradually with the growth of plant. All the resistant and susceptible plants were easily classified because they harbored and responded to larval infestation by varying degrees. At natural conditions regarding the infestation of *H. armigera* the data confirmed that the varieties NCS 0530 and NCS 0608 were the most efficient for holding minimum number of larva mean value 1.33, 1.8 per one meter row plot reduced pest infestation whereas the varieties NCS 0605 and NCS 9917 proved to be the most susceptible showing higher pest incidence NCS 0605 showed the most susceptible response mean value 2.80 larva per one meter row plot while NCS 9917 showed mean value 2.66 larva per one meter plot. The rest of the genotypes were intermediate in tolerance or susceptibility to the attack of gram pod borer. A number of researcher have conducted experiment on the screening of Chickpea verities against Gram Pod Borer and has documented results. Anwar and Shafique (1993) reported that the population of gram pod borer started to build up from fourth week of January and exceed economic injury level during second week of February, while reached to peak during second week of March. At lower temp-

erature during January the population was negligible, however rising in temperature favored flowering and pod formation which also caused rapid population growth of *H. armigera*. The host selection process in Gram Pod Borer influence by large number of factors as plant variety. plant height and plant Physiological response (Jallow & Zalucki, 1996). Similarly, some findings by Vaishampayan and Veeda (1980) revealed that high relative humidity did not favor the larval development in the gram field. Dent and Powar (1988) stated that at low temperature 11C *H. armigera* was not observed. With the availability of this information on host plant resistance and understanding on pest damage, new resistant chickpea verities can produce strong protection strategies with the co-operation of Biotechnology and plant breeding tools can provide new material for good plant management. If these management tools applied on crops they can reduce this use of toxic chemicals and can reduce the environmental pollution.

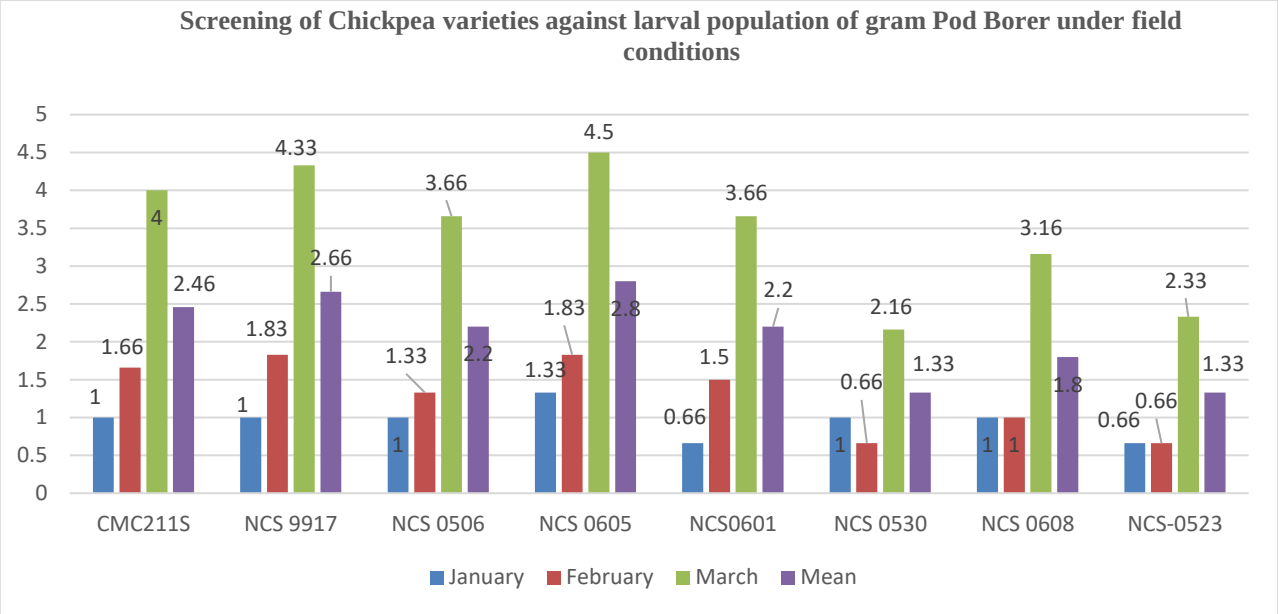

Figure 1: Screening of Chickpea varieties against larval population of gram Pod Borer under field conditions

The effect of different hosts on the biology of *Helicoverpa armegera* under laboratory conditions: The results on the rearing of *H. armigera* on different hosts under laboratory conditions are presented in Figre-2. It is obvious from the results that chickpea was the most effective diet and had a positive effect on the biological parameters of the gram pod borer. The most important physical fitness indicator of any insect population dynamics is depended on its body weight (*Liu et al*. 2004). The weight of *Helicoverpa armigera* larva is highest on Chickpea as compared to tomato *Naseri et al*. (2010). In the present studies, it was confirmed that Chickpea is the favorable host of Gram Pod Borer it has positive effect on the biology of the Gram Pod Borer. In Figure 2: Biological parameters of the pest were recorded on Chickpea. Larval survival was 18 days, larval survival 90%, larval period 13 days, Pupal period 12 days, Pupal recovery 90%, adult emergence 83%, number of eggs laid by female 150, egg hatching 93% and longevity 5-7 days were recorded. It was followed by conventional cotton where most of the parameters were found non-significantly different with the chickpea. However, Bt cotton severely affect the different life history parameters of *H. armigera* resulting in maximum larval mortality, prolonged larval period and minimum pupal recovery and adult emergence. As compared to Chickpea host B.t cotton has insignificant effects on the biological parameters of Gram Pod Borer on B.t cotton larval survival was 50%, larval period 26 days, Pupal period 18 days, Pupal recovery 50%, adult emergence 70%, number eggs laid by one female 20, number of hatched eggs 15 and longevity 2-3 days was recorded. Despite the economic importance of *H. armigera*, little published information exists on the nutritional indices of this pest on different host plants; however, some related studies have been done on the influence of host plants on *H. armigera* by different researchers and varieties of results have been documented. The significant differences in the ability of insect larvae to utilize different host plants efficiently suggest some intrinsic variations among the plant species. The difference in survival and development of *H. armigera* on different host plants, especially chickpea and non Bt cotton, might have been caused by some secondary plant

compounds, poor nutritional quality of the food, pericarp thickness, and absence of primary nutrients necessary for growth and development. B.t cotton expresses an insecticidal protein derived from *Bacillus thuringiensis* Berliner (Bt) which are known to have a very specific mode of action against target lepidopteron pests and that is why it had a very devastating effect on the biology of the borer (Head *et al.*, 2005). *Helicoverpa armigera* larval development may be influenced by different nutritive values of the host plant thus affecting the population dynamics of the pest. (Ruan and Wu 2001). However, for more authentic results it is very important to study the life cycle parameters of the pest under field and Laboratory as well as should check the nutritive influence of different host plants on pest.

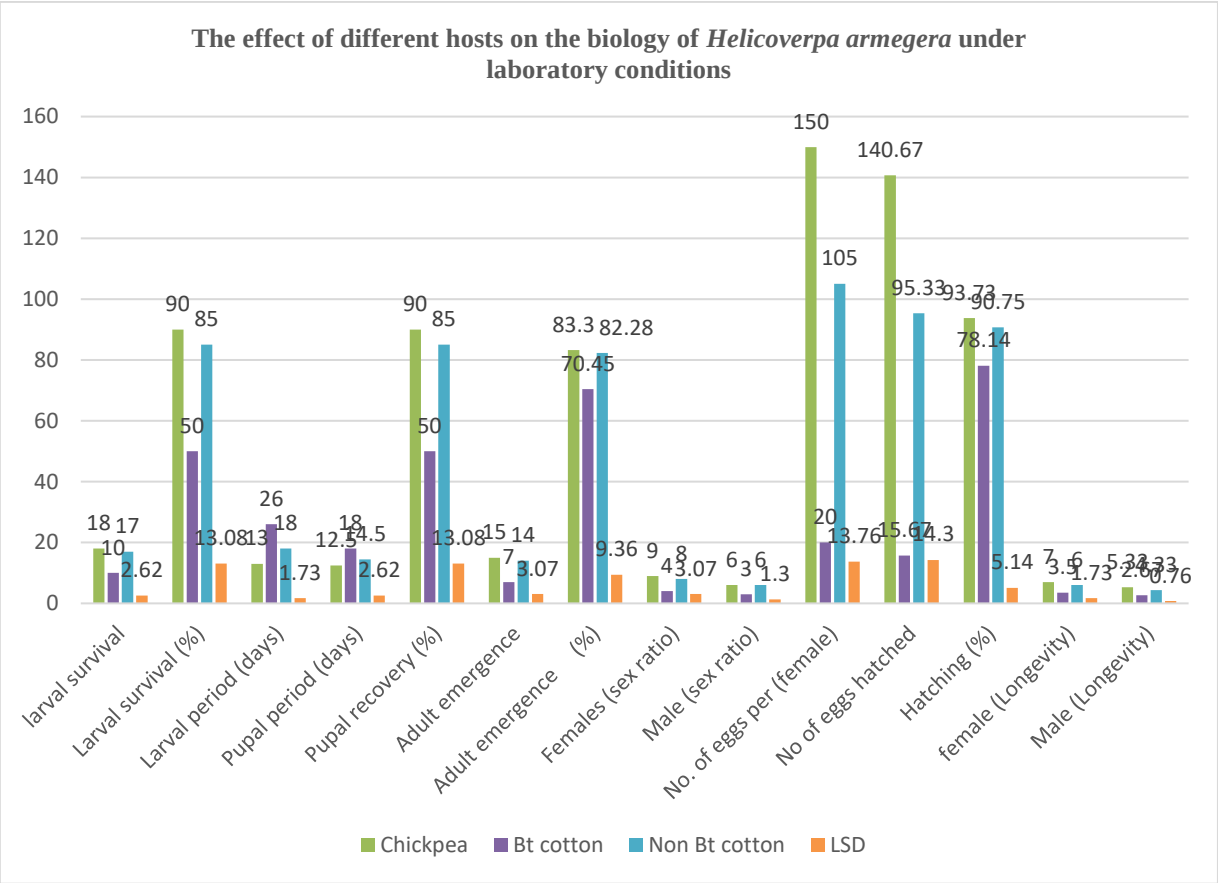

Figure 2: Effect of different host plants on Biology of *Helicoverpaarmegera* under laboratory conditions
Means followed by different letters are not significantly different at 5% level of significant.

Conclusion

On the basis of present studies, it is suggested that Chickpea varieties NCS 0530 and NCS 0523 are highly tolerant to Gram Pod Borer, they should be grown on large scale they may be result good production. On the other hand, B.t cotton (IR-HF 901) is highly effective to *Helicoverpa armigera* it also should be grown on large scale it may be reduce pest infestation in IPM management and good yield can be obtained.

REFRENCES

Anonymous. Agriculture statistics of Pakistan, Government of Pakistan. (2010).

Anonymous. Economic survey, Govt: of Pakistan. Economic advisers wing finance divisions, Islamabad, Pakistan pp 160 (2002).

Anwar and Shafique, Gram pod borer in Sindh. Proc. Pak. Conger. Zool. **13**: 215-222 (1993).

Dent, D.R. and C.S. Power. The influence of moon light and weather on catches of Helicoverpa armigera in light and pheromone traps Bull Entomol. Res., **78**: 375-378 (1988).

Liu Z.D., Li D.M., Gong P.Y., Wu K.J., Life table studies of the cotton bollworm, Helicoverpa armigera (Hübner) (Lepidoptera: Noctuidae), on different host plants. Environmental Entomology **33**: 1570-1576 (2004)

Naseri B., Fathipour Y., Moharramipour S., Hosseininaveh V., Nutritional indices of the cotton bollworm, Helicoverpa armigera, on 13 soybean varieties. Journal of Insect Science 10: 151 (2010).

Head, G., M. Moar, M. Eubanks, B. Freeman, J. Ruberson, A. Hagerty and S. Turnipseed, A multiyear, large-scale comparison of arthropod populations on commercially managed Bt and non-Bt cotton fields. Environ. Entomol. **34**: 1257–1266 (2005).

Jallow, M.F.A. and M.P. Zalucki, Within and between population variation in host plant preference and specificity in Australian *Helicoverpa armigera*(Hubner) (Lepidoptera: Noctuidae). Australian J. of Zoology **44**: 503-519 (1996).

Josansen, Biotic and abiotic stress constraining productivity of cool season legumes in Asia, Africa, Oceana, Proc. Int. Fd. Legum. Res. Conf. on pea, Lentil, Fababean, Chickpea and Grasspea (eds.F.J.Muelbour and M.J Kaiser) Cairo Egypt 12-26 April (1994).

Mehto, D.N. and K.M. Singh. Succetion of insect pest in chickpea. Ind. J. Entomol. **45**: 377-383(1983).

Naeem, M., A. Farid, M.H. Khan and S.K. Ali, Laboratory studies on the comparative effect of neem oil (*Azadirachta indica*) and insecticides on *Trichogramma chilonis*(Ishii). Pak. J. Entomol. Karachi, **27**(1): 33-38(2012).

Ranga Rao G.V. and Shanover T.G., Trip report by International crops research institute for the semi-arid tropic (ICRISAT) Patancheru, A.P India from 27 Feb. to 19th March (1999).

Reed, W.C., C. Sithantham and Lateef S.S., Chickpea insect pests their control. CAB International ICARDA Pp. 283-318(1987).

Ruan, Y.M., K.J. Wu, Performances of the cotton bollworm, *Helicoverpaarmigera* on different food plants. *Acta Entomologica Bohemoslovaca* 44: 205–212 (1987).

Srivastava, B.K., Pests of pulse crops. Indian J. Entomol. 83-99(1964).

Vaishampayan and O.P. Veeda, Population dynamics of gram pod borer. Ind. J. Entomol. 42: 453-459 (1980).