Bull. Fac. Agric., Cairo Univ., 55 (2004): 487-496.

OVIPOSITION PREFERENCES OF *Helicoverpa armigera* ON DIFFERENT VARIETIES OF COTTON IN PAKISTAN

(Received:6.1.2004)

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ABSTRACT

Oviposition preferences of *Helicoverpa armigera* on twenty-five genotypes of cotton were recorded under the field conditions. The results showed highly significant variations in the number of eggs laid among genotypes. The genotype FS-628 was the most susceptible with the highest number of eggs laid by *H. armigera* followed by FH-645 and FH-634, respectively. S-12 received the lowest number of eggs, which was statistically similar with those recorded on RH-295, FH-682 and BH-53, was found resistant. The genotypes, FH-646, FH-87, RH-386 and S-14 were categorized as moderately resistant. BH-89, FH-643, CIM-446, VH-55, MNH-147, CIM-240, SLS-1 and RH-385 were moderately susceptible, whereas BH-36, VH-137, MNH-554, MNS-329, CIM-109 and CIM-170 were intermediate based on oviposition preference.

Key words: *cotton, genotypes, Helicoverpa armigera, oviposition preferences.*

1. INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is an important cash crop of Pakistan, which substantially contributes to food, textile industry and foreign exchange earnings. Amongst the factors responsible for its low

yield, insect pests are of significant importance. Different studies have reported a loss, of 16 to 54% (Chaudhry *et al.*, 1974, Chaudhry, 1976 and Naqvi 1976) and 1.12 million bales were lost due to infestation by these insect pests in Pakistan during the financial year 1999 ,2000 (Ahmad, 2000). During the last few years, American bollworm *Helicoverpa armigera* Hübner (Lepidoptera: Noctuidae) has reached to an alarming situation on cotton in Pakistan.

Pesticides are widely used to control *H. armigera* and other pests in cotton. The continuous and indiscriminate use of pesticides has resulted in the development of resistance in *H. armigera* against various pesticides. Many scientists have documented pyrethroids resistance in field populations of *H. armigera* in Pakistan and other parts of the world (Ahmad *et al.*,. 1997, Xiwu *et al.*, 1996 and GeMei *et al.*, 1997).

Development of cotton varieties resistant to insect pests is an important strategy of integrated pest management (IPM) (Bhatti *et al.*, 1976). According to Van Den Bosch (1972), the study of the development of plant resistance is an effective approach for the formulation of a rational policy of the pest control. Scientists like Beck (1965), Van Dinther (1972), Bhatti (1973), Gallun *et al.* (1975), Naqvi (1975), Bhatti *et al.*(1976) and Maxwell *et al.* (1972) have advocated the use of resistant varieties as one of the most promising methods for reducing infestation of various insect pests of cotton. The objective of this study was to use oviposition preference of *H. armigera* on various cotton genotypes cultivated in Pakistan as a tool for determining resistance.

2. MATERIALS AND METHODS

Field studies on different cotton cultivars were conducted for comparative resistance, susceptibility and intermediate responses against *H. armigera* using oviposition preference as a tool to determine resistance. Twenty-five genotypes of cotton (Table 2) were sown on May 15, 1997 using a Randomised Complete Block Design with three replications. Plot size was 4.40 X 11.01 meters. Fertilizer and irrigation regimes were used according to common practice of the area.

Data on the number of eggs laid by *H. armigera* were collected from 10 plants taken at random from each plot. Upper 45 cm of each plant was searched to record data on oviposition using the method described by Jayaraj, (1982); Adalla, (1984); Farrar and Bradley, (1985); Singh *et al*,. (1988); Matthews, (1989); Butter and Singh, (1996) and Yang *et al*., (1999). The interval between each observation was 7 or 8 days and the data were collected between July and November. The data were analysed statistically by using M-Stat statistical package and means were further compared according to DMR test.

3. RESULTS AND DISCUSSION

The results showed highly significant variations in the number of eggs laid among the genotypes and date of observations (Table 1).

Table (1). Analysis of variance of the data on eggs laid by *H. armigera* as a function of cotton genotypes in 1997.

SOV	DF	MS	F.RATIO
Replication	2	64.549	7.26 * *
Dates	9	9606.975	1080.56 * *
Genotypes	24	466.311	52.45 * *
Dates + Genotypes	216	57.693	6.49 * *
Error	498	8.891	

* = Significant at $P < 0.01$

3.1.Varietal Differences

Comparison of the mean number of eggs laid by *H. armigera* per 10 plants on various genotypes of cotton is given in Table (2). These data indicate that FS-628 was the most susceptible genotype showing the maximum number of eggs (21.43/10 plants). The genotypes FH-645 and FH-634 had means (19.77 and 19.57 eggs/10 plants, respectively) and ranked next in a descending order from FS-628. The minimum oviposition (6.80 eggs/10 plants) was found on S-12, which was not different from RH-295, FH-682 and BH-53 with 7.10, 7.37 and 7.83 eggs / 10 plants, respectively.

The genotype FH-646 with a mean number of 9.30 eggs/10 plants was at par with BH-53, FH-87, and RH-386 having 7.83, 10.60 and 10.57 number of eggs laid per 10 plants, respectively. The numbers of eggs laid on BH-36, BH- 137, MNH-554, MNS-329 and

CIM-109 were 12.97, 12.03, 11.93, 11.63, and 11.60 per 10 plants, respectively. There were not statistical differences among these genotypes. The response was also similar among FH-87 (10.60 eggs/10 plants), RH-386 (10.57), S-14 (10.97), CIM-70 (11.03), CIM-109 (11.60), MNS-329 (11.63), MNH-554 (11.93) and VH-137 (12.03 eggs/10 plants). The mean number of eggs laid by *H. armigera per* 10 plants on CIM-446, VH-55, MNH-147, CIM-240, SLS-1 and RH-385 also did not differ significantly from one another.

The genotype FS-628 was the most susceptible, where it received the highest number of eggs laid by *H. armigera* followed by FH-645 and FH-634, respectively. None of the genotypes showed immunity for oviposition. However, S-12 had the lowest number of eggs, which was statistically similar with those recorded on RH-295, FH-682 and BH-53, was found the most resistant. The genotypes, CIM-170, FH-646, FH-87, RH-386 and S-14 were categorized as moderately resistant. BH-89, FH-643, CIM-446, VH-55, MNH-147, CIM-240, SLS-1 and RH-385 were moderately susceptible, whereas BH-36, VH-137, MNH-554, MNS-329 and CIM-109 were intermediate based on oviposition preference.

Hassan *et al.*(1990) compared oviposition of *H. armigera* (Hübner) and *H. punctigera* (Wallengren) on four cotton cultivars. They concluded that Deltapine smooth leaf had the fewer eggs than Coker 201 okra leaf, both in green house and in the field. The present studies were focused on oviposition preference of *H. armigera* on various cotton genotypes cultivated in Pakistan as a tool for determining resistance. The research work conducted by Hassan *et al.*, (1990) is in line with the present studies but cannot be compared, as they found that out of four strains of Deltapine smooth leaf had few eggs and Coker 201 okra leaf had more eggs in the green house and in the field. Moreover, there were differences in the materials and the set of environmental conditions. Similarly, the current studies are not in accordance with those of JuYing *et al.*, (1996), ShuangLin *et al.*, (1996). Murthy *et al.*, (1998) conducted some studies and screened out strains of cotton using larval infestation and plant tolerance as screening criteria under different set of conditions, instead of oviposition preferences. The present findings cannot be compared with those of Hayas (1991) who correlated egg laying with adults' population.

3.2. Period of Maximum Oviposition

The comparisons of means of the data on fluctuation in the number of eggs laid by *H. armigera* per 10 plants on cotton at different dates of observations are presented in Table(3). The results differed significantly among dates of observations. The egg laying started in the first week of September (mean temperature 30.96°C). An increasing trend was observed continuously up to the first week of October when the number reached its maximum (36.49eggs/10 plants) with a mean temperature 24.61°C.

Table (2). Mean number of eggs laid by *H. armigera* on various cotton genotypes in 1997.

Cotton genotypes	Mean No. of eggs/ 10 plants	Comparative response
FS-628	21.43 A *	Susceptible
FH-645	19.77 B *	
FH-634	19.57 B *	
BH-89	16.83 C	Moderately Susceptible
FH-643	16.33 CD	
CIM-446	15.27 CDE	
VH-55	15.07 DE	
MNH-147	14.83 DE	
CIM-240	14.43 EF	
SLS-1	13.97 EF	
RH-385	13.67 EF	
BH-36	12.97 FG * *	Intermediate
VH-137	12.03 GH * *	
MNH-554	11.93 GH * *	
MNS-329	11.63 GH	
CIM-109	11.60 GH	
CIM-170	11.03H	Moderately Resistant
S-14	10.97H	
RH-386	10.57 HI	
FH-87	10.60 HI	
FH-646	9.30 IJ	
BH-53	7.83 JK	Resistant
FH-682	7.37 K * *	
RH-295	7.10 K * *	
S-12	6.80 K * *	

Means not followed by the same letter are significantly different
(P = 0.05; LSD)

The trend of egg laying decreased thereafter and the number reached down to 0.96egg/10 plants in the second week of November (mean temperature 20.37 0 C). Thus, the peak period was the first week of October when oviposition was the highest. The present findings are not comparable with those of Butter and Singh (1996) who reported maximum oviposition during April among the various months of crop season. This variation can be attributed to the differences in climatic and crop growing conditions.

Table (3).Mean numbers of eggs laid by *H. armigera* per 10 plants on different dates of observations in 1997.

Dates of Observations	Mean No. of Eggs / 10 Plants
07.09.1997	2.80 G
15.09.1997	7.23 F
21.09.1997	11.52 E
28.09.1997	18.92 C
05.10.1997	36.49 A
12.10.1997	23.77 B
19.10.1997	17.93 D
26.10.1997	6.39 F
04.11.1997	3.15 G
11.11.1997	0.96 H

Means not followed by the same letters are significantly different (P = 0.05 ; DMRT).

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تفضيل وضع البيض لدودة اللوز الأمريكية *Helicoverpa armigera* على أصناف مختلفة من القطن فى باكستان

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ملخـــــــص

تمت دراسة تفضيل وضع البيض لدودة اللوز الأمريكيـــة *Helicoverpa armigera* على ٢٥صنفا من طرز القطن تحت الظروف الحقلية فى باكســـتان وكانت النتائج كالتالى :-

أظهرت النتائج إختلافات معنوية واسعة من حيث عدد البيض الموضـــوع لكل صنف . فالطراز FS-628 كان الأكثر تأثرا بأكبر عدد من البيض الذى تـــم وضعه , يليه الطراز FH-634 ,FH-645على التوالى . اســـتقبل الطـــراز S-12 sdYQYQY–اقل عدد من البيض وتم تصنيفه كطـــراز مقـــاوم لـــدودة اللـــوز الأمريكية . *Helicoverpa armigera*.أما الطرز الجينيـــة S-14, RH-386, FH-78,FH-646 فقد تم تصنيفها كطرز متوسطة المقاومة . و الأصنـــاف–SLS -CIM446,,FH643,BH-89 , RH-,1,CIM-240 MNH-147,VH-55 385,كانت متوسطة الإصابة بالآفة وكذلك الطـــرز , CIM-170, CIM-109 MNS-329 ,MNH-554,VH-137BH-36 كانت متوسطةالمقاومة بناء علـــى تفضيل الأفة لعملية وضع البيض .

المجلة العلمية لكلية الزراعة – جامعة القاهرة – المجلد (٥٥) العدد الثالـــــــث (يوليه٢٠٠٤): ٤٨٧-٤٩٦.