

## RELATIVE SUSCEPTIBILITY OF SIX COTTON VARIETIES TO INFESTATION BY THE SPINY AND THE AMERICAN BOLLWORMS

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### ABSTRACT

The present investigation aimed to determine the susceptibility of six Egyptian cotton varieties (Giza 45, Giza 70, Giza 85, Giza 86, Giza 88 and Giza 89) to infestation by the spiny bollworm, *Earias insulana* (Boisd.) and the American bollworm, *Heliothis armigra* (Hbn.). Also, the effect of mean temperature, relative humidity and wind speed on occurrence and seasonal abundance of the two cotton bollworms during 2002 and 2003 growing seasons was studied.

Results revealed that cotton (Giza 88) was the most tolerant variety to infestation by both bollworm species during the two seasons of study. Giza 89 was the most susceptible variety to infestation by the spiny bollworm, whereas Giza 85, Giza 86 and Giza 89 were the most susceptible varieties to infestation by the American bollworm. The prevailing weather factors had slight effect on the population of spiny and American bollworms.

### INTRODUCTION

In the Arab Republic of Egypt, cotton is considered as a major economic crop for its important role in the national income. Cotton is the main host plant of bollworms. Recently, extensive research evaluated the possibility of producing less susceptible varieties of cotton to solve the problem of bollworms control. The susceptibility of cotton varieties to infestation by bollworms was studied by Abul-Nasr (1960), Metwally (1961), Hassanein and Metwally (1961), Hassanein *et al.* (1969), Nasr and Azab (1969), Badawy (1974), Abd El-Rahim *et al.* (1979), Abdel-Bary *et al.* (1980), El-Refai and Emam (1994), Abo-Sholoa *et al.* (1995); Li *et al.* (1996) and Tang and Wang (1996)

For the last few years, a regular increase in the infestation by the spiny and American bollworms was pronounced on cotton fields at the Nile Delta region. The present work aimed to study

the susceptibility of certain cotton varieties to infestation by spiny and American bollworms. Also, the response of the two bollworms to the changes of the prevailing weather factors on six cotton varieties was studied.

### MATERIALS AND METHODS

Field experiments were conducted at the farm of the Horticulture Services Unit, Sakha, Kafr El-Sheikh governorate, during two cotton growing seasons, 2002 and 2003, to evaluate the relative susceptibility of six cotton varieties (Giza 45, Giza 70, Giza 85, Giza 86, Giza 88 and Giza 89) to infestation by the spiny bollworm (SBW), *Earias insulana* (Boisd. and the American bollworm (ABW), *Heliothis armigra* (Hbn).

Cotton varieties were sown on the last week of March in both years and an area of one feddan for every variety was divided into 4 plots (1/4 feddan each) in a complete randomized block design with 4 replicates for each variety. The normal agricultural practices were followed and no insecticides were applied during the experimental period.

For assessing the infestation by spiny and American bollworms, Delta sticky traps baited with one sex pheromone capsule for the SBW [(E,E)-10,12-hexadecadienal] and another one for the ABW [(Z)-11-hexadecanal] were used. The sticky traps and pheromone capsules were supplied by Ministry of Agriculture, Egypt. One trap was positioned in each plot from the second week of May up to the end of September, of both seasons. Capsules were replaced by new ones every two weeks. The sticky plates were replaced by new ones every three days and the captured male moths were counted on the 7<sup>th</sup> day.

The effect of prevailing temperature, relative humidity and wind speed on the numbers of trapped male moths was studied. The records of the three weather factors were obtained from the Agro-meteorological Station at Sakha, Kafr El-Sheikh. The simple correlation coefficients (r) values between the weather factors and the populations of male moths were estimated. Also, the analysis of variance was used to determine significant differences among the tested varieties.

**RESULTS AND DISCUSSION**

**1. The relative susceptibility of six cotton varieties to infestation by spiny and American bollworms:**

Data presented in Table (1) revealed that in 2002 cotton season the highest mean numbers of *E. insulana* (18.6 and 17.32 male moths/trap/7days) were recorded on Giza 86 and Giza 89 cotton fields. respectively. Meanwhile, the infestation by *E. insulana* recorded lower levels on the other cotton varieties (11.99, 13.53, 12.97 and 11.81 male moths/trap/7days) on Giza 45, Giza 70, Giza 85 and Giza 88, respectively. In 2003, data indicated that the highest infestation by SBW (20.09 male moths/trap/7days) was recorded on Giza 89, while the other tested cotton varieties were less susceptible to infestation, Giza 45 (13.01), Giza 70 (11.28), Giza 85 (9.51), Giza 86 (10.96) and Giza 88 (12.15 male moths/trap/7days).

**Table (1):**The mean catch of *E. insulana* male moths during 2002 and 2003 cotton growing seasons using pheromone baited sticky traps on certain cotton varieties.

Date of inspection	Mean number of male moths/trap/7 days												
	2002 season						2003 season						
	G. 45	G. 70	G. 85	G. 86	G. 88	G. 89	G. 45	G. 70	G. 85	G. 86	G. 88	G. 89	
June	7	12.00	2.50	11.00	9.25	4.25	7.00	20.25	8.50	3.50	11.00	7.25	5.75
	14	11.25	4.00	11.00	15.50	6.50	8.25	12.25	6.75	5.00	8.25	6.75	12.75
	21	9.75	5.25	6.00	22.25	10.00	9.50	6.25	3.75	8.00	4.25	3.75	14.00
July	28	5.25	8.25	8.25	17.25	13.75	14.50	2.25	4.00	3.25	3.50	3.75	6.25
	5	11.50	8.75	16.75	20.50	8.50	10.25	8.25	5.00	7.50	7.50	5.75	11.25
	12	18.00	12.25	13.75	22.00	5.25	10.75	15.25	7.25	9.50	13.00	7.75	8.25
	19	15.75	16.50	10.75	23.75	4.50	16.00	18.75	15.25	24.50	25.25	15.75	22.00
Aug.	26	12.75	23.00	6.00	29.25	11.50	21.75	21.75	14.25	13.50	15.75	11.75	21.50
	2	10.25	18.75	7.00	21.00	15.50	18.75	8.00	13.75	4.00	7.00	7.00	21.25
	9	9.25	19.00	15.50	14.25	12.50	15.75	5.25	8.25	5.50	7.75	9.00	13.75
	16	13.00	12.50	17.75	17.50	9.25	17.25	15.75	14.50	11.25	13.75	14.25	23.75
	23	16.25	17.50	20.00	20.00	15.00	22.75	26.25	14.50	17.50	17.0	28.25	55.25
Sept.	30	18.00	21.50	15.75	23.50	21.25	31.00	18.25	9.25	13.25	14.00	23.75	37.25
	6	19.50	15.75	14.00	18.25	16.00	23.50	15.25	19.50	11.75	16.50	20.75	26.00
	13	13.00	14.25	17.75	18.50	16.00	21.00	12.25	22.50	11.00	11.75	19.75	31.50
	20	6.50	18.50	18.50	13.50	18.25	29.00	9.50	15.50	8.00	6.50	13.50	19.50
Mean	27	1.75	11.75	10.75	11.00	12.75	17.50	6.75	9.25	4.75	3.50	7.75	11.50
		11.99a	13.53a	12.97a	18.66b	11.81a	17.32b	13.01a	11.28a	9.51a	10.96a	12.15a	20.09b

G. = Giza

By Duncan's multiple range test, means followed by the same letter are not significantly different at 5% level.

Data in Table (2) indicated that the highest (ABW) infestation in 2002 season (17.16 male moths/trap/7days) was recorded on cotton (Giza 86), whereas, the lowest rates of infestation

(6.49, 6.84 and 6.75 male moths) were recorded on Giza 45, Giza 70 and Giza 88 cotton varieties, respectively. The infestation by the (ABW) on Giza 85 and Giza 89, represented a middle group, recording 11.75 and 13.51 male moths. In 2003, the highest infestation (14.54 male moths) was recorded on Giza 85, meanwhile, the lowest infestations were recorded on Giza 88 (7.84 male moths). Intermediate rates of infestation (10.57, 9.97 and 11.54 male moths/trap/7days) were recorded on Giza 45, Giza 86 and Giza 89 cotton varieties, respectively. Hassanein *et al.* (1969) and Abd El-Rahim *et al.* (1979) found that Giza 45 and Giza 70 were the most susceptible varieties to bollworm infestation. Meanwhile, Abul-Nasr (1960) reported that no significant differences were found between the rates of spiny bollworm infestation on six cotton varieties. The results of Abdel-bary *et al.* (1980), indicated that except for the hairy strain Bahtim 101, all Egyptian cultivars are highly susceptible to bollworm infestation. Also, Tang and Wang, 1996, reported that gossypol, tannin and oil gland contributed the greatest components to cotton resistance against the attack by American bollworm, with total sugar and total protein content of secondary importance.

**Table (2):** The mean catch of *H. armigra* male moths during 2002 and 2003 cotton growing seasons using pheromone baited sticky traps on certain cotton varieties.

Date of inspection	Mean number of male moths/trap/7 days												
	2002 season						2003 season						
	G. 45	G. 70	G. 85	G. 86	G. 88	G. 89	G. 45	G. 70	G. 85	G. 86	G. 88	G. 89	
June	7	4.75	5.25	6.75	8.75	8.75	9.00	16.00	11.00	16.75	15.50	14.25	17.75
	14	8.25	11.00	13.25	11.75	4.75	18.75	29.50	12.00	25.00	18.25	16.25	19.75
	21	6.50	10.75	13.25	15.00	6.25	17.00	20.00	13.50	20.25	16.75	16.25	18.75
	28	7.75	7.25	4.25	17.25	5.75	12.50	19.00	15.00	25.00	15.50	17.00	16.00
July	5	9.75	9.25	12.00	19.50	7.50	18.50	10.25	13.75	5.25	11.25	14.25	8.00
	12	8.75	12.25	15.50	25.00	9.50	23.25	12.75	13.25	24.00	14.50	9.00	18.50
	19	7.25	10.25	16.50	23.25	12.00	28.75	7.75	6.25	10.25	9.50	4.75	11.75
	26	4.50	7.25	13.50	19.50	13.00	18.00	5.00	5.50	10.50	5.50	2.75	9.75
Aug.	2	3.25	5.00	10.25	17.25	7.50	9.25	7.00	7.50	12.25	10.50	6.75	10.25
	9	1.00	2.25	8.00	23.25	6.00	6.50	10.75	6.75	15.50	13.00	6.25	13.75
	16	3.25	5.75	10.50	26.00	8.00	12.25	8.75	6.25	15.50	7.75	3.50	13.00
	23	5.50	9.50	16.50	20.25	10.50	16.50	8.00	7.75	14.00	7.75	6.75	7.00
30	11.00	6.50	20.50	15.00	6.50	19.25	6.75	9.50	9.75	5.50	7.50	7.75	
Sept.	6	10.25	3.25	15.00	13.00	3.25	10.75	6.25	6.25	10.00	8.75	4.50	13.25
	13	7.50	2.25	8.25	19.50	1.00	7.25	7.75	3.75	12.25	6.00	2.25	5.25
	20	4.25	5.25	11.25	12.75	1.00	1.25	3.25	2.00	15.50	2.50	1.00	2.75
	27	6.75	3.25	4.50	4.75	3.50	1.00	1.00	1.25	5.50	1.00	0.25	3.00
Mean	6.49 a	6.84a	11.75b	17.16c	6.75a	13.51b	10.57c	8.31ab	14.54d	9.97bc	7.84a	11.54c	

G. = Giza

By Duncan's multiple range test, means followed by the same letter are not significantly different at 5% level.

**2. Effect of the prevailing weather factors on infestation by the spiny and American bollworms:**

The correlation between the seasonal abundance of the (SBW) and the (ABW) and the prevailing weather factors (mean temperature, relative humidity and wind speed) was studied during 2002 and 2003 seasons on six cotton varieties. The results obtained are given in Tables 3 and 4.

**Table (3):** Simple correlation coefficient values between infestation by the spiny bollworm and mean temperature (Temp.), relative humidity (R.H) and wind speed (W.S).

Weather factor	Simple correlation coefficient (r)						
	2002 season						
	G. 45	G. 70	G. 85	G. 86	G. 88	G. 89	
Temp.	0.347	0.785*	0.383	0.235	0.350	0.589*	
R.H.	-0.020	0.129	0.045	-0.081	-0.233	-0.136	
W.S.	-0.204	-0.777**	-0.468	0.118	-0.594**	-0.808**	
	2003 season						
	Temp.	-0.001	0.360	0.408	0.367	0.179	0.447
	R.H.	-0.113	-0.140	0.180	0.215	-0.100	0.159
	W.S.	-0.210	-0.171	-0.290	-0.343	-0.284	-0.310

\*\* = Significant at the 0.01 level

\* = Significant at the 0.05 level

G = Giza

Data in Table 3 revealed that the simple correlation coefficient values between the spiny bollworm male moths catch and weather factors were insignificant in all cases during the two seasons of study except that on Giza 70, Giza 88 and Giza 89 during 2002 season. On Giza 70, the simple correlation coefficients were highly significant in case of mean temperature (0.785) and wind speed (-0.777), meanwhile on Giza 88, the coefficient was highly significant in case of wind speed (-0.594). On Giza 89, the simple correlation coefficients were significant for temperature ( $r = 0.589$ ) and highly significant for wind speed ( $r = -0.808$ ). During 2002 and 2003, the correlation between the spiny bollworm catch and relative humidity was insignificant. Generally, the correlation was positive with mean temperature and negative with wind speed.

Concerning the effects of weather factors on American bollworm male moths catch, data in Table (4) revealed that the

simple correlation coefficients were insignificant in all cases except that for relative humidity during 2003 season was positive and highly significant ( $r = 0.627$ ) on Giza 45 cotton fields.

**Table (4):** Simple correlation coefficient values between infestation by the American bollworm and mean temperature (Temp), relative humidity (R.H) and wind speed (W.S).

Weather factor	Simple correlation coefficient (r)					
	2002 season					
	G. 45	G. 70	G. 85	G. 86	G. 88	G. 89
Temp.	-0.206	-0.438	0.091	0.408	0.175	-0.078
R.H.	0.195	0.436	-0.148	-0.273	0.171	-0.028
W.S.	-0.093	-0.195	-0.312	0.203	0.119	0.228
	2003 season					
Temp.	-0.459	-0.292	-0.165	-0.267	-0.488	-0.225
R.H.	0.627**	0.110	0.367	0.146	-0.003	0.168
W.S.	-0.134	0.198	0.023	0.408	0.377	0.371

\*\* = Significant at the 0.01 level

\* = Significant at the 0.05 level

G = Giza

As a general rule, the results agree with those obtained by Hafez *et al.* (1969), Hamid *et al.* (1994), Nassef (1995) and Shawer (2000).

Generally, it could be concluded that:

1. Among six Egyptian cotton varieties, Giza 89 was the most susceptible variety to infestation by spiny bollworm, meanwhile, Giza 85, Giza 86 and Giza 89 were the most susceptible varieties to infestation by American bollworm during the two seasons of study. Hassanein *et al.* (1969) discussed the ability in producing early blooms in certain cotton varieties, and therefore it could escape from the heavy attack by the bollworms at the end of the season to represent the least susceptible cotton varieties among those tested.
2. The three weather factors under investigation (mean temperature, relative humidity and wind speed) induced a slight effect on the population of spiny and American bollworms on most tested cotton varieties.

## REFERENCES

- Abdel-Bary, A.A.; M.A. Omar and M.M. Shahbander (1980). Evaluation of bollworm resistance in some Egyptian cotton cultivars and strains. *Alex. Jour. Agric. Res.* 28(1): 91-96.
- Abd El-Rahim, W.A.; S.M.I. Metwally and F. El-Dakroury (1979). Effect of certain physical and chemical characteristics of cotton varieties on susceptibility to infestation by pink and spiny bollworms. *Proc. 3<sup>rd</sup> Arab Pest. Conf. Tanta Univ., Egypt*, 3: 97-101.
- Abo-Sholoua, M.K.A.; M.M. Abou Kahla and A.E. El-Sorady (1995). The relationship between susceptibility of some Egyptian cotton varieties to bollworms infestation and efficiency of chemical control program in Egypt. *Egypt. J. Appl. Sci.*, 10(6): 67-77.
- Abul-Nasr, S. (1960). The susceptibility of different varieties of cotton to infestation with insect and mite pests. *Bull. Soc. ent. Egypte*, 44: 143-156.
- Badawy, A. (1974). The susceptibility of certain American upland and Sakel cotton varieties to bollworms infestation. *Bull. Soc. ent. Egypte*, 58: 261-266.
- El-Refai, S.A. and A.K. Emam (1994). Some factors affecting cotton aphids, whitefly, bollworms infestation and cotton yield. *Ann. Agric. Sci., Cairo*, 39(1): 431-439.
- Hafez, M.; M.H. Hassanein and G.A. Rizk (1969). The simultaneous effect of certain weather factors on the activity and population density of bollworms in Upper Egypt. *bull. Soc. ent. Egypte*, 53: 557-566.
- Hamid, A.M.; A.M. Al-Beltagy and M.A. El-Hamaky (1994). Influence of certain weather conditions on the bollworms at El-Mansoura district. *J. Agric. Sci. Mansoura Univ.*, 19(2): 815-821.
- Hassanein, M.H. and A.G. Metwally (1962). Susceptibility of some cotton varieties to pink bollworm infestation. *Tech. Bull. 3<sup>rd</sup> Cotton Congress (in Arabic)*.
- Hassanein, M.H.; M. Hafez and G.A. Rizk (1969). The susceptibility of certain cotton varieties to bollworms infestation. *Bull. Soc. ent. Egypte*, 53: 261-269.
- Li, Q.S.; Z.R. Gao; W.X. Wang and Z.M. Wang (1996). Resistance of the cotton variety Zhongshi 372 to cotton bollworm. *Plant Protection*, 22(5); 17-19.

- Metwally, A.G. (1961) Studies on the pink bollworm, *Pectinophora gossypiella* (Saund.). M.Sc. Thesis, Fac. of Agric., Ain Shams Univ.
- Nasr, E.A. and A.K. Azab (1969). Susceptibility of different cotton varieties to bollworms infestation. Bull. Soc. ent. Egypte, 53: 459-472.
- Nassef, M.A. (1995). Control of certain cotton pests. Ph.D. Thesis. Fac. of Agric., Zagazig Univ., 221 pp..
- Shawer, D.M.B. (2000). Ecological studies on some insect pests attacking cotton plants. M.Sc. Thesis, Fac. of Agric., Kafr El-Sheikh, Tanta Univ., 92 pp.
- Tang, D.L. and W.G. Wang (1996). Influence of contents of secondary metabolic substances in cotton varieties on the growth and development of cotton bollworm. Plant Protection, 22(4); 6-9.

### المخلص العربي

حساسية ستة اصناف من القطن المصرى للاصابة ببيدان اللوز الشوكية والامريكية

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أجري هذا البحث لتقدير حساسية ستة اصناف من القطن المصرى وهى الاصناف جيزة ٤٥ – جيزة ٧٠ – جيزة ٨٥ – جيزة ٨٦ – جيزة ٨٨ – جيزة ٨٩ للاصابة بكلا من دودة اللوز الشوكية ودودة اللوز الامريكية تحت الظروف الحقلية. وكذلك تم دراسة تأثير كلا من درجات الحرارة والرطوبة النسبية وسرعة الرياح على تلك الاصابة خلال موسمى ٢٠٠٢، ٢٠٠٣. ويمكن تلخيص النتائج المتحصل عليها فيما يلى:

- صنف القطن جيزة ٨٨ كان اكثر الاصناف تحملا للاصابة بكلا النوعين من بيدان اللوز خلال الموسمين. بينما كان الصنف جيزة ٨٩ الاكثر حساسية للاصابة بدودة اللوز الشوكية والاصناف جيزة ٨٥ وجيزة ٨٦ وجيزة ٨٩ اكثرها حساسية للاصابة بدودة اللوز الامريكية.
- لم يكن للعوامل الجوية تأثير واضح على التغيرات فى تعداد بيدان اللوز الشوكية والامريكية فى أغلب اصناف القطن تحت الدراسة.