



Journal of
Entomology

ISSN 1812-5670



Academic
Journals Inc.

www.academicjournals.com

**Relationships Between the Numbers of
Adult Male Pink Bollworm (*Pectinophora gossypiella* Saund.)
Catches on Pheromone Traps and Infestation Ratio of Cotton Bolls**

¹Levent Unlu and ²Irfan Ozturk

¹Department of Plant Protection,

²Department of Biometry and Genetics,

Faculty of Agricultural, Harran University, Sanliurfa, Turkey

Abstract: The relationships between infestation ratio and population development of Pink Bollworm adults was investigated in the periods from July to October in 2003-2004. The collection of bolls and the counting adults in the traps from three localities (Kulunce, Cavdarli and Huzurlu) in Harran Plain (Turkey) were conducted weekly. Population development of Pink Bollworm in three localities was parallel with their peak during August and September. In Huzurlu, both infestation level and adults number in trap were the highest (205 adults/per trap and 62% infestation ratio of bolls). During the 2003-2004 years, there was a significant positive linear correlation between infestation ratio of bolls and adult population of Pink Bollworm. R-value was very high such as 0.87, 0.88 and 0.88 in Kulunce, Cavdarli and Huzurlu, respectively. Similarly, R²-values in all localities were determined as 0.757, 0.781 and 0.782, respectively.

Key words: Pink Bollworm, correlation, pheromone, infestation ratio, cotton

INTRODUCTION

Pink Bollworm (*Pectinophora gossypiella* Saund.) (PBW) is an important cotton pest throughout the world. PBW was described from larvae recovered from infested cotton bolls in India in 1843 (Noble, 1969). The first reported cotton infestation in North America occurred in 1911 in Mexico, presumably from Egyptian cotton seed shipments (Glick, 1967). In the United States, pink bollworm was detected first in Robertson Country, Texas in 1917 (Noble, 1969). A number of malveaceous plants including cultivated and wild cotton, *Abelmoschus esculentus*, *Hibiscus cannabinus*, *A. sabadariffa* and *Corchorus alitorius* have been reported as hosts for pink bollworm (Noble, 1969). The damage was caused by PBW in USA, in Egypt and in Pakistan (Wilson *et al.*, 1979; Abul Nasr *et al.*, 1983; Attique *et al.*, 2001).

Cotton (*Gossypium barbadense* L.) in Egypt is attacked by various pests during the different stages of its development and one of these pests is *P. gossypiella* (Salama, 1983). In Egypt, cotton field represents about 1/6th of the total cultivated area, heavy losses are yearly recorded due to the attack of *P. gossypiella* (Monsarrat *et al.*, 1995).

Kyriakidou and Recca (1991) reported that, *P. gossypiella* constitutes the main pest for cotton in many region of Greece, causing significant quantitative and qualitative damages, but also very often large quantities of insecticides with untimely and purposeless sprays on behalf of the producers. In Turkey, PBW is also one of the most important pests for cotton and causes on the cotton yield losses in many region of the country (Karman, 1960; Mart *et al.*, 2002; Unlu and Bilgic, 2004).

Pheromone-baited traps are an important sampling tool in monitoring and establishment of the economic injury level of an insect pest by developing a correlation between moth catches in trap and larval infestation. Gossyplure [1:1 mixture of Z, Z)- and (Z, E)-7, 11-hexadecadienyl acetate], a powerful sex attractant of the *P. gossypiella* (Hummel *et al.*, 1973), has been widely used as a bait in traps (Qureshi *et al.*, 1993).

This study was conducted to determine the relationships between adult population in pheromone traps and infestation ratio by larvae in cotton bolls.

MATERIALS AND METHODS

This study was conducted at three cotton field's located Harran Plain in 2003-2004. Three delta pheromone traps (one trap for each field) were placed for determination of adult population development and traps were re-baited every three weeks. The counting of adults in traps was conducted weekly. In addition, 100 bolls of cotton were picked randomly from 100 cotton plants weekly. The collected bolls were split in the laboratory and examined whether they were infected with PBW.

The relation between variables was modeled with analyze of regression as referred by Draper and Smith (1998) using SPSS statistical software (SPSS, 1999). In addition, R² for goodness of fit was counted as:

$$R^2 = \frac{\left[\sum x.y - \frac{\sum x. \sum y}{n} \right]^2}{\sum x^2 - \frac{(\sum x)^2}{n} \cdot \left[\sum y^2 - \frac{(\sum y)^2}{n} \right]} \quad (1)$$

Correlation co-efficient (r) for variables was obtained by Pearson correlation coefficient as:

$$R = \frac{\sum x.y - \frac{\sum x. \sum y}{n}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{n} \right) \cdot \left(\sum y^2 - \frac{(\sum y)^2}{n} \right)}} \quad (2)$$

RESULTS

Relationships between adult number and boll infestation were observed simultaneously. That is, when the adult number was increased, boll infestations were also increased. Pearson correlation co-efficient between adult number catches in trap and boll infestation to determine simultaneous variation was observed.

Correlation co-efficients in all three localities were very important in the level of p<0.01. R-values for three locations (Kulunce, Cavdarli and Huzurlu) were determined as 0.87, 0.88 and 0.88, respectively. A significant positive increase between adult number catches in traps and boll infestation was found.

Adult number catches in trap (x) is independent variable and boll infestation (y) is dependent variable. To model relation between these two variables, scattered diagram was applied. In order to determine the relationship between variables linear regression model (y = a+bx) was fitted. R²-values for locations (Kulunce, Cavdarli and Huzurlu) were obtained as 0.75, 0.78 and 0.78, respectively. The significance levels concerning regression variance analyzes were found to be very important for three localities (p<0.01).

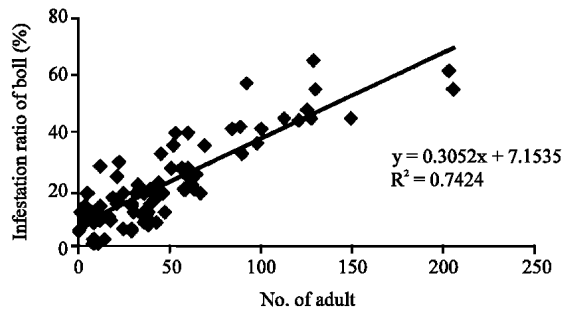


Fig. 1: The graphic of combined regression of all years and localities

The relationships adult number catches in trap and boll infestation were linear in all localities. So, the relation between variables to put forward with only one model, the data obtain from all localities were combined and regression graphic was given in below (Fig. 1).

As seen in the Fig. 1, linear relationship among variables exists. R^2 in combined data was 0.742 and the result was significant ($p < 0.01$). The correlation co-efficient (r) among variables was 0.86 and very significant positive relation was revealed in the level of $p < 0.01$.

DISCUSSION

PBW has been caused harmful on cotton in Harran Plain since 1997 (Ozpinar *et al.*, 1998). It has still continued damage and importance in Harran Plain (Unlu *et al.*, 2006; Unlu, 2006, 2007). The growers in the Plain do not apply insecticide for Pink Bollworm. In addition, they are not aware of the cultural practices such as using delinte seed and destruction of plant remains.

This study was conducted to determine the relationships adult number catches in trap and boll infestation of Pink Bollworm. In the study, significant correlation among variables was found. In all years and localities, both one by one and combined R^2 were also very significant. In Greece, there was a significant positive linear correlation between the number of *P. gossypiella* moth catches and infestation percentage from first and second stage larvae of PBW and the former was lower than the latter and were $R = 0.694$ and $R = 0.739$, respectively (Buchelos *et al.*, 1999). Henneberry and Clayton (1982) also reported similar results between catches and larvae per boll ($R = 0.82$) and the percentage of boll infestation with larvae per boll ($R = 0.91$). Campion (1994) showed that, there was a positive correlation between the numbers of male adults caught within 3-4 days prior to the first cotton flower bud invasion by PBW and the numbers of larvae in bolls. A study was conducted in Amik Plain (Turkey) in 1996-1999, the damage level in 1997 was significantly related to the number of adults trapped ($R = 0.799$) (Mart *et al.*, 2002).

Attique *et al.* (2001) reported that, chemical control of this pest is difficult, so emphasis is made on timely and effective cultural practices to reduce the over-wintering population. Unlu and Bilgic (2004) reported that, a 1% increase in infestation would reduce almost 2.5-6% of cotton yields. We recommend that, cotton growers must apply cultural practices and biotechnical control as to control of Pink Bollworm, such as mating disruption and pheromone traps. In this way, they apply efficiently and economic methods to control of the pest.

REFERENCES

- Abul-Nasr, S.E., E.D. Ammar and A.I. Merdan, 1983. Field application of two strains of *Bacillus thuringiensis* for the control of the cotton bollworms *Pectinophora gossypiella* (Saund.) and *Earias insulana* (Boisd.). Bull. Entomol. Soc. Egypt, 11: 35-39.

- Attique, M.R., M.M. Ahmad, Z. Ahmad and M. Rafiq, 2001. Sources of carry-over and possibilities of cultural control of *Pectinophora gossypiella* (Saunders) in the Punjab, Pakistan. *Crop Prot.*, 20: 421-426.
- Buchelos, C.Th., C.G. Athanassiou, C.Ch. Papapostolou and A. Georgiou, 1999. Correlation between the number of adult male *Pectinophora gossypiella* (Saund.) (Lep., Gelechiidae) catches on pheromone traps and the rate of infestation in fruiting bodies of cotton plants by young larvae in three regions of central Greece. *J. Applied Ent.*, 123: 433-436.
- Campion, D.G., 1994. Pheromones for the Control of Cotton Pests. In: *Insect Pest of Cotton*. Matthews, G.A. and J.P. Tunstall (Eds.), CAB International, pp: 505-534.
- Draper, N.R. and H. Smith, 1998. *Applied Regression Analysis*. 3rd Edn., New York: Wiley.
- Glick, P.A., 1967. Aerial dispersal of the pink bollworm in the United States and Mexico. US. Department Agric. Prod. Res. Rep., pp: 96.
- Henneberry, T.J. and T.E. Clayton, 1982. Pink Bollworm of cotton [*Pectinophora gossypiella* (Saund.)]: Male moth catches in gossypure baited traps and relationships to oviposition, boll infestation and moth emergence. *Crop Prot.*, 1: 497-504.
- Hummel, H.E., L.K. Gaston, H.H. Shorey, R.S. Kaae, K.J. Bryne and R.M. Silverstein, 1973. Clarification of chemical status of the pink bollworm sex pheromone. *Science*, 181: 873-875.
- Karman, M.Ş., 1960. Investigations on damage, distribution and control of Pink Bollworm on Cotton in Aegean Region (Turkey) Publications of Institute of Plant Protection in Bornova. Technical Bulletin: 1, Gutenberg Press, İzmir, 1960, (In Turkish), pp: 39.
- Kyriakidou, I. and E. Recca, 1991. Biological control of pink bollworm on cotton using spraying pheromone. *Hellenic Cotton Board, Res. Cotton*, 2: 89-97.
- Mart, C., O. Doganlar and S. Tarla, 2002. The possibilities of using pheromone traps and total thermal summation in estimating adult emergence of *Pectinophora gossypiella* (Saund.), a pest of cotton growing areas in Amik Plain. *Turk. J. Agric. For.*, 26: 331-336.
- Monsarrat, A., S. Abol-Ela, I. Abdel-Hamid, G. Fediere, G. Kuhl, M. El Hussein and J. Giannotti, 1995. A new RNA Picorna-Like Virus in The Cotton Pink Bollworm *Pectinophora gossypiella* (Lep.:Gelechiidae) in Egypt. *Entomophaga*, 40: 47-54.
- Noble, L.W., 1969. Fifty years of research on the pink bollworm in the United States. *USDA Agric. Handb.*, 357: 62.
- Ozpinar, A., L. Unlu and S. Yildiz, 1998. Determination of the infestation rate and population development of spiny bollworm (*Earias insulana* Boisd.) on cotton in Sanliurfa province. *Harran University. J. Faculty Agric.*, 2: 1-10.
- Qureshi, Z.A., N. Ahmad and T. Hussain, 1993. Pheromone trap catches as a means of predicting damage by pink bollworm larvae in cotton. *Crop Prot.*, 12: 597-600.
- Salama, H.S., 1983. Cotton-pest management in Egypt. *Crop Prot.*, 2: 183-191.
- SPSS Inc., 1999. *SPSS Professional Statistics*, 8.0, SPSS Inc., Chicago.
- Unlu, L. and A. Bilgic, 2004. The Effects of the Infestation Ratio of Spiny Bollworm (*Earias insulana* Boisd.) and Pink Bollworm (*Pectinophora gossypiella* (Saund.) on Cotton Yield Grown in Semi-Arid Region of Turkey. *J. Applied Entomol.*, 128: 652-657.
- Unlu, L., 2006. Infestation mapping of Pink Bollworm and Spiny Bollworm on cotton in the western part of Harran Plain. *J. Ent. Res. Soc.*, 8: 7-13.
- Unlu, L., E. Yanik and I. Ozturk, 2006. The effect of Cotton Gins Factories on Infestation Ratio of Pink Bollworm, *Pectinophora gossypiella* Saund. (Lepidoptera: Gelechiidae). VIIIth European Congress of Entomology. September 17-22, 2006, Izmir, Turkey (Abstract).
- Unlu, L., 2007. The Estimation of Field Infestation Ratio by Using Infestation Ratio of Blind Bolls of Pink Bollworm, *Pectinophora gossypiella* Saund. (Lepidoptera: Gelechiidae) and Spiny Bollworm, *Earias insulana* Boisd. (Lepidoptera: Noctuidae). *J. Entomol.*, 4: 33-39.
- Wilson, F.D., R.L. Wilson and B.W. George, 1979. Pink Bollworm: Reduced growth and survival of larvae placed on bolls of cotton race stocks. *J. Econ. Entomol.*, 72: 860-864.