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Economic Damage Threshold of the Pink Bollworm, *Pectinophora gossypiella* (Saund.) and the Spiny Bollworm, *Earias insulana* (Boisd.) In Egyptian Cotton Fields

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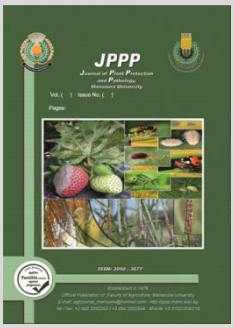

ABSTRACT

The economic damage threshold, which is the point at which a significant drop in cotton production occurs at different levels of infestation by the cotton bollworms *Pectinophora gossypiella* (Saund.) and *Earias insulana* (Boisd.) was quantitatively determined. The experiment did not include any control measures against cotton bollworms. Therefore, after planting cotton seeds for 150–170 days, mature cotton bolls were collected and investigated. Three levels of infestation were noted [infested of all shutters per boll (opened boll completely infested), infested of one-third and two-thirds of shutters per boll (opening of two-thirds and one-third per boll), and total infested bolls on cotton plant]. Based on the results, the economic damage thresholds for the three infestation levels were roughly 14.26 to 14.60, 13.90 to 15.91, and 24.05 to 25.30 percentage of infested bolls/ mature cotton bolls/plant throughout the first and second years of investigation (2021 and 2022), respectively. Effective pest control strategies require a thorough understanding of the extent to which various bollworm species reduce cotton yield. To guarantee cotton farming's long-term viability, more study in this field is required.

Keywords: *Pectinophora gossypiella; Earias insulana*; Economic damage threshold.

INTRODUCTION

The relationship between cotton yield loss and bollworms infestation has been a topic of interest for researchers over the years. Various studies have been conducted to understand the impact of bollworms infestations on cotton yield and quality. Darling (1951) highlighted the pink bollworm, *Pectinophora gossypiella*, as a significant pest of cotton in Northern Sudan. This early study shed light on the detrimental effects of bollworm infestations on cotton crops. Fry *et. al.* (1978) delved into the impact of the number of pink bollworm larvae per boll on the yield and quality of Pima and Upland cotton. In India, Srivastava *et al.* (1966) emphasized that *P. gossypiella* destroyed 25 % of the locules and 10-15 % of the produced seeds. The dynamic character of bollworm infestations has been highlighted in recent research, especially in light of the emergence of resistance to traditional control strategies, such as genetically modified Bt cotton (Tabashnik and Carrière, 2017 and Wan *et al*., 2019). Cotton bolls are directly damaged by bollworm infestations, which lower the amount and caliber of cotton fibers produced. When infestations take place during crucial growth phases and cause large output losses, the economic impact is very severe (Kranthi, 2020).

In Egypt, Gough (1922) recorded that the damage done by a single worm of *P. gossypiella* was about one tenth of the yield of the bolls in Sakellarides cotton variety, while Lukefahr and Martin (1964) recorded that an average of 60 % infested bolls had declined the cotton yield by 34 %. According to Metwally (1968), cotton bollworms, *P. gossypiella* and *E. insulana*, are to blame for losses of at least 10% to 20% every year. El-Saadany *et al.* (2009) indicated that one-unit infestation degree by the pink bollworm causes a reduction equal to 10% of the total yield weight (on an average). Whereas a unit infestation degree by the spiny bollworm causes a loss ranged from 6-9 % in cotton yield (depending on the larval content averages and infestation percentages/ 100 green bolls for each of the two involved insect-species).

Understanding the extent of yield loss caused by different bollworm species is essential for implementing effective pest control measures. Overall, the literature review on the relationship between cotton yield loss and bollworm infestation highlights the importance of pest management strategies in cotton production. Further research in this area is essential to ensure the long-term sustainability of cotton production. Thus, the present work was carried out to determine the damage caused by these two pests to the cotton yield in Egypt and estimated the economic damage threshold of these insects.

MATERIALS AND METHODS

The study was conducted at Sharkyia Governorate for two successive years (2021-2022) in an area of half feddan cultivated with cotton. The experimental area divided to twenty replicates (each was 50m^2). The experiment was prepared for growing cotton (*Gossypium barbadense* (L.) The cotton seeds were sown at the first half of April for both seasons. Since the beginning of the appearance of fruiting structures (in the first half of June), the cotton pest control techniques approved by the Egyptian Ministry of Agriculture were not applied in the experimental area. As for the cotton areas surrounding the experiment, the cotton pest control program was forward until the end of the cotton season.

After 150-170 days from planting date, 13 cotton plants were randomly selected from each replicate of the experiment. Mature cotton bolls were collected, counted and divided into two categories (opened mature cotton bolls

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infested and opened mature cotton bolls free of infestation). Three infestations levels were recorded as follows: infested of all shutters per boll (opened boll completely infested), infested of one-third and two-thirds of shutters per boll (opening of two-thirds and one-third of boll), and total bolls infested on cotton plant. Then, the entire cotton of each plant was weighed in grams.

The effect of the population density of pink bollworm, *P. gossypiella* and the spiny bollworm, *E. insulana* on the yield of cotton obtained through a preliminary analysis using the method termed the "C-multipliers" (Fisher, 1963). Three independent variables were considered in the regression process. Data were analyzed using Costat, 2005

Statistical Analysis

A. Preliminary analysis

For each 50 m^2 replicate (13 plants), the amount of mature bolls was counted, and the average was about 200 ripe bolls. A percentage was calculated based on the quantity of mature bolls per plant. The regression technique took into account three levels of infestation (X_I, X_2, and X_3). At the end of the crop, these levels reflected the percentages of infested of all shutters per boll per plant (X_I), infested of one-third and two-thirds of shutters per boll (X_2) and total infested bolls (X_3). The dependent variable (Y) was the average yield per a cotton plant. The regression analysis was given in Table 1.

Table 1.The average yield of a cotton plant and the corresponding population density per plant of different infested shutters at Sharkyia Governorate in 2021 and 2022 seasons

Plant	2021				2022			
No	X_1	X_2	X_3	Weight /Plant	X_1	X_2	X_3	Weight /Plant
1	4.27	6.86	11.13	25.24	7.60	13.90	21.40	16.90
2	4.62	7.06	11.68	24.67	8.70	2.80	11.50	16.00
3	8.10	7.07	15.17	23.15	12.90	7.40	20.30	15.20
4	28.47	10.09	38.56	20.18	23.60	44.50	67.30	14.20
5	14.26	7.92	22.18	20.90	14.60	10.70	25.30	14.00
6	15.95	8.10	24.05	20.44	3.80	32.20	36.00	13.80
7	19.87	8.23	28.10	20.85	14.50	38.70	46.40	13.60
8	18.20	8.15	26.35	19.67	29.60	43.70	68.80	11.60
9	20.02	9.17	29.19	19.26	19.10	31.90	58.20	10.80
10	28.22	9.24	37.46	19.84	25.00	39.20	63.70	12.10
11	28.53	10.40	38.93	18.95	26.90	39.00	63.50	13.30
12	28.74	10.85	39.59	16.52	24.10	36.60	68.60	11.80
13	31.72	11.09	42.81	17.05	25.00	43.50	68.60	13.10
14	35.21	11.55	46.76	13.46	28.90	41.80	70.70	8.90
15	35.61	11.63	47.24	18.99	34.80	38.90	73.80	11.00
16	40.34	12.84	53.18	23.86	42.10	41.80	83.90	12.70
17	43.72	13.15	56.87	14.69	34.40	43.60	78.00	11.50
18	44.72	13.25	57.97	17.62	38.50	31.40	69.90	13.60
19	46.09	15.91	62.00	17.82	48.30	32.00	80.30	11.80
20	53.38	33.31	86.69	16.41	51.40	32.80	84.20	7.90
Total	550.0	225.9	775.9	389.6	513.8	646.4	1160.4	253.8

X_1= infested of all shutters per boll, X_2 = infested of one-third and two-thirds of shutters per boll, X_3= total of all bolls infestation on cotton plant

The amount of yield variability that could be explained by the three infestation factors taken together (the explained variance) was determined with the aid of the multiple regression approach. According to the findings, the infestation factors (XI, X2, and X3) collectively accounted for 49.611% of the variation (Explained variance) in the yield weights (y) in 2021. The "F" score in this instance (8.369) was highly significant (at the 1% level of probability), according to the analysis of variance, highlighting the strong impact of the components under examination. Since the infestation's responsibility for 2022 was even larger than it was in 2021 (Explained variance, 59.412%), the "F" number (7.807) was likewise more significant. Prior to applying the regression formula to the data, the simple correlation and regression values were worked out as a preliminary step. These are given along with the multiple regression and variance analysis in Table 2 and 3

Table 2 . The simple correlation, multiple regression and explained variance between infestation factors and The average yield per plant at Sharkyia Governorate in 2021 season

Infestation	Simple correlation		Regression: Multiple (Full Model)				Explained
factors	r	p.	b	S.E.	t	p.	variance %
X_1= infested of all shutters per boll	-0.697	0.0006 ***	-0.1813	-0.1812	-3.1037	.0065 **	
X_2 = infested of one-third and two-thirds of shutters per boll	-0.459	0.0418 *	0.0882	0.1448	0.6090	.5505 ns	49.611
X_3= total of all bolls infestation on cotton plant	-0.662	.0015 **	0.000	0.00	0.00	0.00	

Table 3 .The simple correlation, multiple regression and explained variance between infestation factors and The average yield per plant at Sharkyia Governorate in 2022 season

Infestation	Simple correlation		Regression: Multiple (Full Model)				Explained
factors	r	p.	b	S.E.	r	p.	variance %
X_1= infested of all shutters per boll	-0.6815	0.0009 ***	0.0793	0.1179	0.6724	.5109 ns	
X_2 = infested of one-third and two-thirds of shutters per boll	-0.5864	0.0066 **	0.1009	0.1119	0.9009	.3810 ns	59.412
X_3= total of all bolls infestation on cotton plant	-0.7559	0.0001 ***	-0.1612	0.1117	-1.4429	.1685 ns	

B. The correction procedure

The next stage in determining the damage threshold of ***P. gossypiella*** and ***E. insulana*** was to determine the precise impact of each of the three infestation parameters on cotton yield. This might be simply computed by subtracting the influence of the third component from the yield data after accounting for the effect of any two factors (as shown by their multiple regression values). In this regard, the following three equations were employed:

1. For the correction of the yield weight to X_2 and X_3 thus leaving only the effect of infested of all shutters per boll (X_1):

$$Yx_1 = Y \pm [b_2 (X_2 - \bar{X}_2) + b_3 (X_3 - \bar{X}_3)]$$

2. For the correction of the yield-weight to X_1 and X_3, thus leaving only the effect of bolls infested of one-third and two-thirds of shutters per boll (X_2):

$$Yx_2 = Y \pm [b_1(X_1 - X^-_1) + b_3 (X_3 - X^-_3)]$$

3. For the correction of the yield weight to X_1 and X_2, thus total of all bolls infestation on cotton plant (X3)

$$Yx_3 = Y \pm [b_1(X_1 - X^-_1) + b_2(X_2 - X^-_2)]$$

C. The fitting of the curve

A straightforward regression could be computed for each of the three newly corrected yield values for cotton plants, which were thought to represent the impact of a single infestation component. "Least squares" was the method used. This allowed for the gradual impact of unit infestation on yield to be calculated for each element. Determining the regression line's slope in each instance was the key concept in this regard. The position of the lines is determined by the fact that the least square line will pass through the means of x (i.e. % point).

However, a curved regression line needs to be fitted because the yield-infestation relationship is more or less curved than linear. The following equation, $y = e^{-(a+bx)}$, could be used to convert the "y" values (dependent variables) in the standard regression equation (y = a + bx) into their logarithms (i.e. Log. y = a + bx).

When converted back to ordinary numbers (antilog), the computed values of (y) theoretically form a curve. The tabular and graphical representations of the computed data are provided in Tables 4 and 5 and Figures A, B, C, D, E, and F, (Figure 1). A closer look reveals that the three infestations (X1, X2, and X3) have a tendency to consistently have a significant yield-lowering effect, despite the graphs showing that the rate of loss in the expected yield changes from one infestation level to another in the two years (2021 and 2022). The three infection levels clearly demonstrated this homogeneity.

Table 4. Gradual decrease in the corrected values of the cotton yield caused by the increase in the infestation rate of cotton bollworms of different infested shutters at Sharkyia Governorate in 2021

Plant	Yx_1			Yx_2			Yx_3		
No	X_1	Corrected	Calculated	X_2	Corrected	Calculated	X_3	Corrected	Calculated
1	4.27	43.37	48.40	6.86	24.75	20.49	12.81	41.01	59.23
2	4.62	34.38	47.62	7.06	22.80	20.45	16.17	40.67	49.43
3	8.10	33.79	40.50	7.07	21.72	20.45	16.19	37.63	49.38
4	14.26	32.64	30.40	7.92	21.69	20.31	22.45	32.08	35.26
5	15.95	30.25	28.10	8.10	20.54	20.29	23.03	30.56	34.17
6	18.20	25.76	25.31	8.15	19.75	20.28	25.47	28.59	29.97
7	19.87	24.71	23.42	8.23	19.66	20.26	27.27	27.11	27.20
8	20.02	22.89	23.25	9.17	19.52	20.11	28.77	26.80	25.09
9	28.22	20.82	15.88	9.24	19.45	20.10	37.38	19.45	15.79
10	28.47	20.22	15.69	10.09	19.20	19.97	38.96	19.35	14.50
11	28.53	19.23	15.65	10.40	19.13	19.92	39.51	19.17	14.08
12	28.74	16.34	15.50	10.85	19.12	19.85	40.00	16.24	13.71
13	31.72	13.64	13.49	11.09	19.12	19.81	43.07	14.36	11.62
14	35.21	12.82	11.47	11.55	19.00	19.74	45.99	13.06	9.93
15	35.61	11.63	11.25	11.63	18.87	19.72	47.58	12.69	9.12
16	40.34	10.00	9.03	12.84	18.78	19.53	54.12	8.67	6.41
17	43.72	9.65	7.7200	13.15	18.74	19.49	58.2	5.37	5.15
18	44.72	5.62	7.3600	13.25	18.54	19.47	60.02	4.43	4.67
19	46.09	5.61	6.9100	15.91	18.36	19.06	60.92	3.21	4.45
20	53.38	3.40	4.9200	33.31	18.03	16.60	75.12	1.00	2.07
Total	550.04	396.77	401.87	225.87	396.77	395.90	773.03	401.45	421.23
Mean	27.50	19.84	20.09	11.29	19.84	19.80	38.65	20.07	21.06
	a	1.77129		a	1.33520		a	2.071894	
	b	-0.0202		b	-0.0034		b	-0.02336	

X_1= infested of all shutters per boll, X_2 = infested of one-third and two-thirds of shutters per boll, X_3= total of all bolls infestation on cotton plant

Table 5 .Gradual decrease in the corrected values of the cotton yield caused by the increase in the infestation rate of cotton bollworms of different infested shutters at Sharkyia Governorate in 2022

Plant	Yx1			Yx2			Yx3		
No	X1	Corrected	Calculated	X2	Corrected	Calculated	X3	Corrected	Calculated
1	3.80	21.27	21.37	2.80	22.90	23.39	11.50	19.01	20.34
2	7.60	20.80	20.44	7.40	21.82	22.16	20.30	18.84	19.58
3	8.70	20.32	20.18	10.70	21.22	21.32	21.40	18.58	19.49
4	12.90	20.29	19.22	13.90	21.15	20.54	25.30	18.51	19.16
5	14.50	19.84	18.86	31.40	18.56	16.73	36.00	18.21	18.29
6	14.60	19.27	18.84	31.90	17.74	16.63	46.40	18.13	17.48
7	19.10	16.68	17.87	32.00	16.20	16.61	58.20	17.96	16.60
8	23.60	16.54	16.96	32.20	15.96	16.57	63.50	17.82	16.23
9	24.10	16.53	16.86	32.80	15.85	16.45	63.70	17.81	16.21
10	25.00	16.48	16.68	36.60	15.78	15.74	67.30	17.67	15.96
11	25.00	16.17	16.68	38.70	15.32	15.35	68.60	17.52	15.87
12	26.90	16.16	16.32	38.90	15.09	15.32	68.60	17.39	15.87
13	28.90	15.66	15.94	39.00	14.99	15.30	68.80	17.05	15.86
14	29.60	15.47	15.81	39.20	14.96	15.26	69.90	16.50	15.78
15	34.40	14.87	14.95	41.80	14.95	14.81	70.70	16.18	15.73
16	34.80	14.74	14.88	41.80	14.93	14.81	73.80	15.00	15.51
17	38.50	14.66	14.25	43.50	14.92	14.51	78.00	13.69	15.23
18	42.10	13.53	13.67	43.60	14.56	14.50	80.30	13.46	15.08
19	48.30	13.12	12.71	43.70	14.22	14.48	83.90	13.22	14.85
20	51.40	12.57	12.26	44.50	13.88	14.34	84.20	12.42	14.83
Total	513.80	334.97	334.77	646.40	335.00	334.82	1160.40	334.97	333.95
Mean	25.69	16.75	16.74	32.32	16.75	16.74	58.02	16.75	16.70
	a	1.349073		a	1.383356		a	1.330182	
	b	-0.00507		b	-0.00509		b	-0.00189	

X_1= infested of all shutters per boll, X_2 = infested of one-third and two-thirds of shutters per boll, X_3= total of all bolls infestation on cotton plant

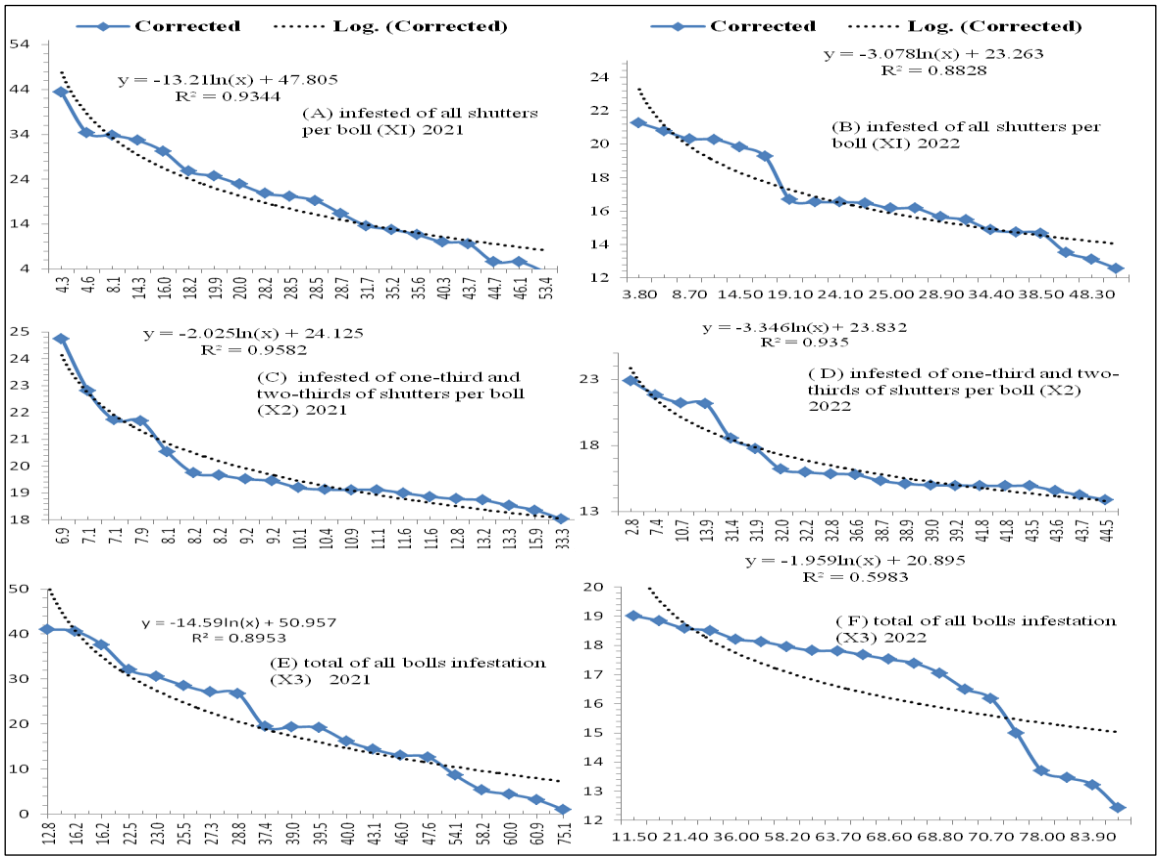

Figure 1. The corrected average decline in the cotton yield per plant (Y) per unit increase in bollworms infestation (X) for three different counts

D. The economic damage-threshold

The point at which the yield-weights at the upper portion of the curved regression slope begin to exhibit a noticeable twist is simply known as the economic damage-level. All weight figures are presumed to be statistically identical above this threshold. It is fair to consider "the economic damage threshold" to be the infection level that corresponds to that specific point (either in the tables or the graphs). Practically speaking, as soon as the infestation reaches that stage, quick chemical control measures are required to prevent the negligible yield drop from becoming substantial.

Applying the chi-squared analysis method known as rx2 contingency tables with no expectation (Baily 1959) to the y data allowed for the precise location of that point on the smoothed curve. The specifics of this process (as used to determine the damage-threshold for the infestation, Table 6) are illustrated in the following example. The criteria for the X_2 and X_3 infestation levels were calculated similarly.

.Table 6. The change in the cotton yield with the increase in the population density of infested bolls X1 (2021)

Plant	Yx1				
No	Infested all carpels X_1	Corrected	Log Corrected	Equation $Y= e^{-(a+bx)}$	Calculated
1	4.27	43.37	1.6372	1.6849	48.40
2	4.62	34.38	1.5363	1.6778	47.62
3	8.10	33.79	1.5288	1.6075	40.50
4	14.26	32.64	1.5138	1.4829	30.40
5	15.95	30.25	1.4807	1.4488	28.10
6	18.20	25.76	1.4109	1.4033	25.31
7	19.87	24.71	1.3929	1.3695	23.42
8	20.02	22.89	1.3596	1.3665	23.25
9	28.22	20.82	1.3185	1.2007	15.88
10	28.47	20.22	1.3058	1.1957	15.69
11	28.53	19.23	1.2840	1.1945	15.65
12	28.74	16.34	1.2133	1.1902	15.50
13	31.72	13.64	1.1348	1.1300	13.49
14	35.21	12.82	1.1079	1.0594	11.47
15	35.61	11.63	1.0656	1.0513	11.25
16	40.34	10.00	1.0000	0.9557	9.03
17	43.72	9.65	0.9845	0.8874	7.72
18	44.72	5.62	0.7497	0.8672	7.36
19	46.09	5.61	0.7490	0.8395	6.91
20	53.38	3.40	0.5315	0.6921	4.92
Total	550.04	396.75	24.30	24.30	401.87
Mean	27.50	19.84	1.22	1.22	20.09
	a	1.77119344			
	b	-0.0202152			

RESULTS AND DISCUSSION

A. infested of all shutters per boll (X_1) at 2021

For each plant, the chi-square value (8.578) was not significant for infested of all shutters per boll (X1) at 2021, infestation-level that ranged from 4.27 to 14.26 (X_1). Accordingly, the equivalent drop in yield from 48.40 to 30.40 gm. per a cotton plant may have been the result of chance. The chi-square value (8.578) shows a substantial drop above 14.26 for infested of all shutters per boll on cotton plant, indicating that there is a considerable fall in yield weight beginning at that level of infestation. The economic damage threshold for bollworms per cotton plant could be defined as 14.26 for infested of all shutters per boll on cotton plant(X_1).

B. Infested of all shutters per boll (X_1) at 2022

With an infestation level from 3.8 to 14.60 for all shutters per boll (X_1), the chi-square value (9.677) was likewise not significant. This suggests that the yield drop from 21.37 to 18.84 gm. per plant that year might have been the result of chance. The chi-square value (14.697) became significant above 14.60 for infested of all shutters per boll, suggesting that the yield-weight loss at that infection level is mathematically significant enough to call for the prompt implementation of control measures. The earlier result from the 2021 analysis is supported by this one. Accordingly, it seems that the average number of infested of all shutters per boll on cotton plant (X_1) by cotton bollworms ranged between 14.26 and 14.60, which represent the economic damage threshold

C. Infested of one-third and two-thirds of shutters per boll(X_2) at both years

According to the minor chi-square value for infested of one-third and two-thirds of shutters per boll, the yield loss from 20.49 to 19.06 gm. per plant (induced by a range of 6.86 - 15.91 for infested of one-third and two-thirds of shutters per boll on cotton plant (X_2) may have been the result of chance. The output dropped significantly as the number of infested of one-third and two-thirds of shutters per boll /plant (X_2) increased to 15.91. The economic damage threshold for cotton bollworms in 2021 may therefore have been the average of 15.91 affected bolls per plant.

According to the minor chi-square value for infested of one-third and two-thirds of shutters per boll on cotton plant (X_2) at 2022, the yield loss from 23.39 to 20.54 gm per plant (induced by a range of 2.80 - 13.90 for infested of one-third and two-thirds of shutters per boll on cotton plant) may have been the result of chance. The output dropped significantly as the number of infested of one-third and two-thirds of shutters per boll on cotton plant(X_2) increased to 13.90. The economic damage threshold for cotton bollworms in 2022 may therefore have been the average of 13.90 affected bolls per plant. This result validates the 2021 analysis's earlier finding. The average number of infested of one-third and two-thirds of shutters per boll on cotton plant ranges from 13.90 to 15.91(X_2), which appears to be the threshold for economic damage.

D. Total of all bolls infestation on cotton plant (X_3) at both years

The production decrease from 59.23 to 25.09 gm. per plant (caused by a range of 12.81-28.77 for Total of all bolls infestation on cotton plant (X_3) at 2021 may have been due to chance, based on the modest chi-square value. From 25.30 to 28.77, the yield dramatically decreased as the quantity of infested bolls/plant X_3 rose. As a result, the average number of total of all bolls infestation on cotton plant by cotton bollworms (28.77) per plant may have been the threshold for economic injury in 2021. As for at 2022, the production loss from 20.34 to 19.16 gm. per plant (caused by a range of 11.5 - 25.30 for total of all bolls infestation on cotton plant) may have been the result of chance, according to the inconsequential chi-square value. Therefore, in 2022, the economic damage threshold for cotton bollworms may have been the 25.30 for Total of all bolls infestation on cotton plant (X_3). This result validates the 2021 analysis's earlier finding. For every plant X_3 of cotton bollworms, the average number of total of all bolls infestation on cotton plant on cotton plant (X_3) by cotton bollworms is 25.30 to 28.77, which seems to be the threshold for economic damage.

The economic damage thresholds of pink bollworm varied with different countries, it were 5-15% infested bolls in USA and 4-10% damage bolls in Pakistan (Benedict *et al.* 1989) in India, economic threshold levels was 10% damage bolls with larvae (Surulivelu, 1999). In this study, the economic damage thresholds of pink bollworm levels were roughly 14.26 to 14.60, 13.90 to 15.91, and 24.05 to 25.30 percentage of infested bolls/ mature cotton bolls/plant throughout the first and second season of investigation (2021 and 2022), respectively. According to Lukefahr and Martin (1964), an average of 60% boll infestation had decreased cotton productivity by 34%, whereas Gough (1922) indicated that damage from a single *P. gossypiella* worm was roughly one tenth of the boll yield. According to Metwally (1968), *P. gossypiella, E. insulana,* and cotton bollworm are responsible for losses of at least 10% to 20% annually. In addition, the annual cost of the chemical insecticides required to manage them is several million pounds. The average yield weight reduction from a single unit of pink bollworm infection was 10%, per El-Saadany *et al*. (2009). For each of the two pest species involved, the average larval content and infection percentages per 100 green bolls determine how much cotton production is lost by the spiny bollworm, which ranges from 6 to 9% per unit infestation degree.

CONCLUSION

According to the results, during the two years of 2021 and 2022, the economic damage thresholds for the three infection levels were around 14.26 to 14.60, 13.90 to 15.91, and 24.05 to 25.30/percentage /plant mature cotton bolls, respectively. Understanding the extent of crop loss experienced by different bollworm species is essential for developing effective pest control measures. Overall, by looking at the relationship between bollworm infection and cotton yield loss, the literature analysis highlights the importance of pest control methods in cotton production. Further research in this area is necessary to ensure cotton cultivation's long-term sustainability.

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عتبة الضرر الاقتصادي لدودة اللوز القرنفلية، بيكتينوفورا جوسبيلا (ساوندر) ودودة اللوز الشوكية، إيرياس إنسيولانا (بويزد.) في حقول القطن المصرية

على أحمد السيد ، محمد محمد ندا و عادل السيد على عامر

معهد بحوث وقاية النباتات مركز البحوث الزراعية الدقى جيزه ، مصر

الملخص

قد حاول الباحثون تحديد عتبة الضرر الاقتصادي، وهي النقطة التي يحدث عندها انخفاض كبير في إنتاج القطن عند مستويات مختلفة من الإصابة بدودتى لوز القطن،دودة اللوز القرنفلية ، بيكتينوفورا جوسبيلا (ساوندر) ودودة اللوز الشوكية إيرياس إنسيولانا (بويزد) بشكل كمي. ولم تتضمن التجربة أي تدابير مكافحة ضد هم . وبالتالي، بعد 150-170 يومًا من زراعة بذور القطن، لوحظت ثلاثة مستويات من الإصابة، إصابة جميع المصاريع لكل لوزه (اللوزة المتفتحة مصابة بالكامل)، إصابة ثلث وثلثي المصاريع لكل لوزة (تفتيح ثلثي وثلث لكل لوزة) وإجمالي جميع إصابات اللوز في نبات القطن. وبناءً على النتائج، كانت حدود الضرر الاقتصادي لمستويات الإصابة الثلاثة تقريبًا 14.26 إلى 14.60، و13.90 إلى 15.91، و24.05 إلى 25.30/نسبة مئوية/نبات من لوز القطن الناضج على مدار العامين 2021 و2022 على التوالي. تتطلب استراتيجيات مكافحة الآفات الفعّالة فهمًا شاملاً لمدى تأثير أنواع مختلفة من ديدان لوز القطن على إنتاج القطن. ولضمان استمرارية زراعة القطن على المدى الطويل، هناك حاجة إلى مزيد من الدراسة في هذا المجال.