

# Evaluating the susceptibility of some okra genotypes to infestation with spiny bollworm *Eariasinsulana* (Boisd.)

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## Abstract

Spiny bollworm *Eariasinsulana* (Lepidoptera: Nolidae) is an economic pest affecting okra plant in Syria. This study was conducted at Agricultural Scientific Research Center of Lattakia in 2018 season to evaluate the susceptibility of 16 okra genotypes to infestation with *Eariasinsulana* (Boisd.) under natural infestation conditions. The results indicated that there were significant differences between genotypes in terms of infestation percentage with spiny bollworm. The genotype 12068 expressed

relatively high resistance with infestation rate (12.78%), while 10974, 11512, 10374 genotypes were highly susceptible. The infestation rates were (18.97, 19.52, 19.34%) respectively. The results also showed significant and negative correlation between infestation rate, fruit color & length, and pubescence density and growth shape: ( $r = -0.56$ ,  $r = -0.41$ ,  $r = -0.56$ ,  $r = -0.41$ ) respectively. Susceptible genotypes were characterized by erect growth and green fruits as well as low pubescence.

**Keywords:** *Eariasinsulana* (Boisd.), genotypes, okra, morphological characteristics, Syria.

## I. INTRODUCTION

Okra, *Abelmoschus esculentus* L. (Malvales: Malvaceae), is an important summer vegetable crop in Syria and many regions of the world [8], [14]. Spiny bollworm *Eariasinsulana* (Boisd.) is an important pest on okra plant [11], [1] causing considerable losses in production by 52.33-70.75% [3]. Several studies have indicated that there were significant differences between okra varieties to infestation with spiny bollworm *Earias* spp. [2], [9]. [4] found that there are no immune class (free from infestation) of okra

contribute to attracting insects to their hosts are color, smell, taste and Fruits on the stem [20]. Therefore, the present study is intended to determine the effect of morphological characteristics of some okra genotypes on the infestation with spiny bollworm *Eariasinsulana* (Boisd.).

varieties to infestation with *Earias* spp. [18] carried out a field evaluation of okra genotypes and their infestation with *Earias* spp. Three genotypes were identified as highly resistant; one genotype as resistant and 6 genotypes as moderately resistant to the pest. Previous studies also indicate that the damage caused by insect pests depends on their population density and the plant ability to sustain the damage as a result of its ability to grow and compensate. The population density is usually affected by plant's morphological characteristics that affect the behavior and feeding of the insect [6]. The most important qualities that

## II. MATERIALS AND METHODS

### A. Evaluating the susceptibility of some okra genotypes to *Eariasinsulana*:

The seeds of 14 genotypes were obtained from GCSAR's Department of Genetic Resources in addition to seeds of two commercial varieties. (Table, 1)

**Table 1. Tested okra genotypes**

No.	1	2	3	4	5	6	7	8
Genotype	10374	10498	10521	10526	10637	10974	11274	11353
No.	9	10	11	12	13	14	15	16
Genotype	11512	11942	11996	12068	12188	12212	Dutch	French

Okra seeds were sown in the first half of April during season 2018 at the Scientific Agricultural Research Center in Lattakia, 80 m above sea level. Sowing was done on rows 60 cm apart at plant spacing of 45 cm. All agronomic practices were carried out in accordance with the recommendations of the Ministry of Agriculture and Agrarian Reform in Syria. Each genotype replicated four times. Ten plants were selected from each replicate. The fruits were harvested every three days at tender stage from the first to the last harvest (early June to end-September). The samples were taken to the entomological laboratory, where the fruits were examined and the number of the infested fruits was recorded. The infestation rate per genotype was worked out at the end of the fruit season as follows:

Infestation rate (%) = Number of infested fruits / total No. of fruits X 100

Susceptibility of the tested genotypes was estimated based on the average total infestation ( $\bar{x}$ ) and standard deviation (S) according to the following scale:

**B. The effect of some morphological characteristics of okra genotypes on insect infestation rate:**

Some of morphological characteristics of okra genotypes were studied (height, growth shape, color of leaves & fruits, length & diameter of fruits, and

1. Highly resistant: genotype with percent fruit damage less than  $\bar{x}-2S$
2. Resistant: genotype with percent damage between  $\bar{x}-2S$  and  $\bar{x}-S$ .
3. Moderately resistant: genotype with percent damage between  $\bar{x}-S$  and  $\bar{x}$ .
4. Susceptible: genotype with percent damage between  $\bar{x}$  and  $\bar{x}+S$ .
5. Highly susceptible: genotype with percent damage between  $\bar{x}+S$  and  $\bar{x}+2S$  and above. [5]

The climatic data of the study area for the 2018 season was obtained from Bouka Meteorological Station. (Table, 2).

**Table 2. Mean monthly temperature and humidity for the 2018 season at Scientific Agricultural Research Center of Lattakia (Bouka)**

Month	Mean temperature (c°)	Mean humidity (%)
June	26	56
July	27	58
August	28	57
September	26	73

pubescence density [17]. Data was taken on 3-day post-fruit setting (tender stage). (Table, 3)

Correlation coefficient between morphological characteristics and infestation rate was also calculated.

**Table 3. Evaluation of morphological characteristics of okra**

Plant characteristic	Classes under each characteristic with quantified values in parenthesis
Plant height	40-60(1), 60-80(2) and >80 cm(3)
Growth shape	Erect(1), spreading(2), semi-spreading(3)
Leaf color	Green(1), Red(2) and Red green(3)
Fruit color	Green(1), Red(2) and Red green(3)
Fruit length	< 5(1), 5-7(2) and > 7 cm(3)

<b>Fruit diameter</b>	< 1 (1), 1-2 (2) and > 2cm(3)
<b>Position of fruits on the main stem</b>	Erect(1), Oblique(2), Horizontal(3).
<b>Fruit pubescence</b>	Low(1), Medium(2) and High(3)

### III. RESULTS AND DISCUSSION

The results showed that none of the tested genotypes was free from infestation with spiny bollworm. The infestation rate during growing season varied from 12.78% (12188) to 19.52% (10974) with significant differences between genotypes. This result is in accordance with that obtained by [13] for assessing the susceptibility of eight varieties of okra in the Indian region of Kuncan. They stated that all okra varieties were susceptible to spiny bollworm *Earias vittella* (Fab.), and the incidence of fruit damage ranged from 21.29 to 36.38%. [4] found that the incidence of *Earias* spp. on the fruits and shoots of different varieties of okra ranged from 13.1% on Arka Anamikauto 27.7% on Prabhani Kranti. The results also revealed that the morphological characteristics affect the infestation rate of fruits. The genotype 12068 expressed relatively high resistance with an infestation rate of (12.78%), while the genotypes 10974, 11512 and 10374 were relatively high susceptible with infestation rate of 18.97, 19.52, 19.34%, respectively (Table, 4). [9] found, during their evaluation the susceptibility of 25 genotypes of okra to *Earias* spp., that the genotypes (Sabz pari, Green wonder and Super star) were resistant, while the genotypes (Lakshmi-24, Cok-1418 and Ikraanamika) were moderately resistant, and genotypes (Pusasawani, Ikra-2 and Okra-3) were susceptible. The results also revealed that the average length of the plants ranged from 79.5 cm (10374) to 163.75 cm (French). Most genotypes were characterized by semi-spreading growth. The leaves were either green or reddish. Most okra fruits were green, a few were reddish green and one genotype (12068) was red. The average length of the fruit ranged from 5.33 to 9.58 cm, and the diameter 1.21 - 2.77 cm. The fruit was placed on the stem in an erect or oblique form. The fruits of genotypes 11996 and 12068 were characterized by the presence of pubescence while others had low-pubescence (smooth). In a previous study, [15] found that the length of okra plants ranged between (33.9-51.6 cm), while the length of the 3-day post-fruit setting between (5.47-8.62 cm), and diameter (0.67- 0.80 cm). The plant growth shape is spreading and semi-spreading. This difference may be due to variation in the genotypes studied. The results showed a significant and negative correlation between density of fruit pubescence ( $r = -0.65$ ) and infestation rate. The infestation rate of smooth fruits was  $(17.39 \pm$

$1.50)$  while it was  $(13.71 \pm 1.32)$  % for fruit pubescence. Our findings agree with [19], [10] that there is a negative correlation between the density of fruit pubescence and the resistance of okra varieties to *E. vittella*. This may be due to difficulty in laying eggs on fruit surface, inhibiting the first larval ages to move and penetrate the fruit for feeding. There was also a significant and negative correlation between fruit color and infestation rate with spiny bollworm ( $r = -0.56$ ). The infestation rate was  $17.39 \pm 1.50$  % for green fruit,  $14.65 \pm 0.00$  % for the reddish green and  $12.78 \pm 0.00$  % for the red fruits. This may be due to the high pubescence density of fruits. The results also showed a significant and negative correlation between infestation and color of leaves ( $r = -0.44$ ). The infestation rate of green-leaved genotypes was  $(17.32 \pm 1.54)$  % versus  $(15.22 \pm 2.78)$  % for the reddish green leaves. Also, there was a significant negative correlation between the rate of fruit infestation and growth shape ( $r = -0.41$ ). The infestation rate of fruits of the spreading genotypes was  $13.71 \pm 1.32$  % versus  $17.49 \pm 1.69$  % for the semi-spreading and  $17.14 \pm 1.02$  % for the erect ones. These findings agree with [12], which showed that the okra plant with low number of shoots is more susceptible to infestation with *Earias* spp. This may be due to an increase in the number of shoots and high plant density that hinder the movement of adults and the difficulty of reaching fruits to lay eggs, which reduces the pest incidence. The results also showed a significant negative correlation between the infestation rate and length & diameter of fruit ( $r = -0.41$ ). The fruit infestation rate was  $(18.97 \pm 0.00)$  % for the genotype 10374, which was 5.33 cm an average of fruit length, while the infestation rate was  $(12.78 \pm 0.00)$  % for the fruits of genotype 12188 (average length of 9.58 cm). [15] demonstrated that the correlation between the length of the fruit and the rate of infestation with *Earias vittella* was negative, and between the diameter of the fruit and the rate of infestation was positive. This may be due to that the less length fruits are relatively the most tender, therefore the most prefer for the insect feed and the highest injury. Another study showed no significant effect of the length, diameter and number of seeds, and pubescence density on infestation rate [7]. The results [16] revealed that no significant effect of length, diameter and color of okra plants on the

incidence of *Eariasspp*. However, the diameter of shoots had a significant effect on infestation rate.

**Table 4. Infestation rate of spiny bollworm on okra fruits**

No	Genotype	Infestation rate%	No	Genotype	Infestation rate%
1	10374	18.97	9	11512	19.34
2	10498	16.92	10	11942	17.25
3	10521	14.75	11	11996	18.25
4	10526	15.83	12	12068	14.65
5	10637	15.08	13	12188	12.78
6	10974	19.52	14	12212	17.37
7	11274	18.22	15	Dutch	16.21
8	11353	18.16	16	French	17.62

**Table 5. Susceptibility of okra genotypes based on total infestation rate ( $\bar{x}$ ) and standard deviation (S)**

No	Class	Fruit infestation%	Classification of genotypes
1	Highly resistant	13.11>	12188
2	Resistant	15.02-13.11	12068- 10521
3	Moderately resistant	16.93-15.02	Dutch - 10637- 10526- 10498
4	Susceptible	18.84-16.93	French -12212- 11996- 11942- 11353-11274
5	Highly susceptible	20.75-18.84	11512- 10974- 10374

**CONCLUSIONS**

this study demonstrates that all tested genotypes were susceptible to spiny bollworm, The genotypes 12188 and 12068 expressed relatively high resistance, and they were characterized by spreading growth, reddish green leaves, red and reddish green fruit and highly-dense pubescence, while genotypes 10974, 11512 and 10374 were relatively high susceptible. The infestation rate was 18.97 19.52 and 19.34%, respectively. Susceptible genotypes were characterized by erect growth and green color of fruits as well as low pubescence.

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