



REGULAR ARTICLE

ANTIXENOSIS RESISTANCE IN OKRA ACCESSIONS AGAINST SHOOT AND FRUIT BORER *EARIAS VITTELLA* (FAB.)

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ABSTRACT

The present study is to analyse the antixenosis mechanisms of resistance in ten okra accessions against Shoot and Fruit Borer *E. vittella*. With regard to the free choice feeding preference, the accessions IC140880 and Trichi local were not preferred by any larvae even up to 8 h. The fruit damage of Coimbatore local by the larvae in 8 h was recorded as lowest, in confined condition. The accession IC 282228 fruit was bored up to a length 9.1 cm by the larvae in 8 h. On studying the oviposition preference, the accessions IC140880 and Trichi local were least preferred by *E. vittella* adults. The length and breadth and number of trichomes of these accessions were recorded as maximum. It was observed that the fruit length of IC140880 were greater than other accessions whereas Trichi local recorded higher fruit width compared to other accessions. While assessing the Fruit angle to stem, Coimbatore local recorded a higher value followed by Trichi local, IC140880 and IC 218877. The incidence of shoot and fruit borer was high in IC282228. In overall observation, weight and yield of the fruit is high in IC140880 followed by Trichi local.

Keywords: Okra, *Eariasvitella*, Antixenosis, Feeding preference, Ovipositional preference.

INTRODUCTION

Abelmoschus esculentus L., also known as Okra, is an important vegetable crop cultivated throughout the world [1]. It is grown widely in India [2]. Okra is mainly consumed as a vegetable, raw, cooked or fried. The roots and stems are used for clearing cane juice in preparation of Gur. High iodine content of fruit help in controlling goitre. Okra seeds contain good quality oil and protein. It contains many nutrients and vitamins essential for human [4]. The major problem in cultivation is the pest and insect attacks. One of the important major pest incidence is the spotted bollworms [5, 6]. *Earias spp.* is a serious pest of okra which attack in all stages of growth leading to heavy yield loss [3, 7]. Controlling the pest through various techniques are in practice to reduce the infestation of pest incidence [8]. The present study was conducted with an objective considering the above facts, to study the antixenosis mechanisms of resistance in okra accessions against shoot and fruit borer *E. vittella*.

MATERIALS AND METHODS

The experiment is conducted with preliminary and confirmatory field screening of 10 okra accessions at experimental farm of Annamalai University. The experiment was carried out by randomized block design and the accession details were given in table 1.

Antixenosis mechanisms of resistance

Feeding preference of *E. vittella*

Feeding preference of *E. vittella* assay was conducted with free choice test to assess the resistant accessions. The accessions of tender fruits were kept at equal distance in circular manner, in a metal container (36x15 cm). Ten, third instar larvae were pre-starved for four hours before the experiment and released in the centre of the metal container. After 1,2,4,6 and 8 h of release, the numbers of larva settled on the respective accessions were recorded and the same was replicated five times.

Further a no-choice test was also conducted with 4 h, pre-starved third instar larvae, released in fruits of respective accessions in individual containers of separately. The length of the fruit eaten (tunnelling) by the larva was measured after 8 h. The same was replicated five times [3].

Ovipositional preference of *E. vittella*

To find out the ovipositional preference of *E. vittella*, 45 d old potted plants of all the accessions of okra were placed in an oviposition cage (175x175x175 cm) made up of net to perform free choice test. Ten pairs of newly emerged adults were released in to the cage. Once in 24 h, the plants kept in the oviposition cage were observed for eggs and recorded accurately. Number of eggs per accession is calculated and

Received 23 March 2018; Accepted 05 May 2018

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then most preferred accession for oviposition is identified and these were replicated five times [3].

Bio physical bases of resistance

Trichome density

The known area of Fruit bits was boiled in hot water for 20 min. Then the fruit bits were transferred into 20 ml of ethanol and boiled for 20 min. This process was done to remove the chlorophyll content. 20 ml of lactic acid, was added to the fruit bits and boiled for 20 min. The number of trichome hairs were counted by using a compound microscope and expressed in number cm^{-2} . The samples were collected at three different parts of fruit of the same accession and replicated ten times [3, 9].

Length and breadth of the trichome hairs

The length and breadth of the trichome hairs were measured by taking thin fruit sections of all the accession after processing the fruit bits as above mentioned method. The samples were collected at three different parts of fruits of the same accession and replicated ten times. A measurement is done by using micrometer [3].

Fruit length, fruit width and fruit angle

Randomly selected 20 fruits were harvested from each accession and fruit length and fruit width is measured by tracing with the help of a graph paper. The mean angle between the fruit and stem/branch is measured by using a protractor [3].

Statistical analysis

The data gathered are statistically analysed using IRRISTAT software and the critical difference values were arrived.

Results

In free choice test, the larvae were allowed to select the fruits of accessions and when observed for feeding, the accessions Trichi local and IC 140880 were not preferred by any larvae even up to 8 h compared with the other accessions. In confined condition, accession Coimbatore local is (Table. 2) recorded lowest length of fruit damage by the larvae in 8 h (1.4 cm). The accession IC 282228 fruit was bored up to a length 9.1 cm (Table. 2) by the larvae in 8 h. On studying the oviposition preference, the accessions Trichi local (12) and IC140880 is 12.4 (Table. 2) were least preferred by *E. vittella* adults when compared to other accessions. These accessions recorded maximum number (99.6), length 442 μ and breadth 24.80 μ (Table. 3) of trichomes. It was observed that the fruits length of IC140880 (14.6) were greater than other accessions whereas Trichi local (7 cm) (table 4) recorded higher fruit width than other accessions. While assessing the Fruit angle to stem, Coimbatore local (12.8°) (table 4) recorded a higher value followed by Trichi local, IC140880 and IC 218877. The shoot and fruit borer incidence was high in IC282228. In overall observation, weight and yield of the fruit is high in IC140880 followed by Trichi local (table 5).

Table 1: Pest incidence and fruit characters

S. No.	Name of the accession	Pest incidence	Fruit colour	Fruit tip	Fruit orientation
1	Trichi local	Nil	Light green	Blunt	Erect
2	Coimbatore local	Nil	Yellowish green	Pointed	Erect
3	IC218877	Nil	Pinkish green	Pointed	Erect
4	IC111532	Low	Light green	Blunt	Erect
5	IC140880	Nil	Light green	Pointed	Slightly falling
6	IC282226	Moderate	Yellowish green	Pointed	Erect
7	IC282227	Moderate	Dark green	Blunt	Erect
8	IC282228	High	Light green	Pointed	Erect
9	IC282229	Nil	Light green	Pointed	Erect
10	IC282233	Moderate	Light green	Pointed	Intermediate

Table 2: Feeding and oviposition preferences of *E. vittella* towards fruits of okra accessions

S. No.	Name of the accession	Larval feeding preference		Adult oviposition preference
		No. of the larvae preferred after 8 h (Free choice)	Tunnel length in 8h (cm) (No choice)	No. of eggs/plant
1	Trichi local	0 (0.00) ^a	3.34 (10.522) ^b	12 (13.908) ^a
2	Coimbatore local	1.6 (7.174) ^b	1.4 (6.696) ^a	14.2 (21.302) ^b
3	IC218877	1.8 (7.543) ^b	3.5 (10.761) ^b	15.2 (22.461) ^c
4	IC111532	2.6 (9.237) ^c	4 (11.509) ^{cd}	15.8 (22.786) ^{cd}
5	IC140880	0 (0.00) ^a	1.6 (7.214) ^a	12.4 (14.141) ^a
6	IC282226	3.2 (10.287) ^{cd}	4.5 (12.233) ^c	19.2 (23.733) ^c
7	IC282227	2.6 (9.237) ^c	4.42 (12.125) ^c	22.6 (25.095) ^d
8	IC282228	4.6 (12.367) ^e	9.1 (17.557) ^e	41.6 (29.448) ^d
9	IC282229	3.46 (10.752) ^d	7.2 (15.557) ^d	25 (25.252) ^e
10	IC282233	3.6 (10.912) ^d	6.4 (14.610) ^d	27.4 (26.276) ^f
	CD (p = 0.05)	1.266	1.031	0.975

Each value is a mean of five replications, values in parentheses are arc sine transformed

Table 3: Trichome density on the fruit surface of the selected okra accessions

S. No.	Name of the accession	Fruit length (cm)	Fruit width (cm)	Fruit angle (o)
1	Trichi local	13.5 (21.542) ^{ab}	7 (15.322) ^a	29.6 (32.959) ^b
2	Coimbatore local	12.8 (20.997) ^b	6.6 (14.929) ^{ab}	32.2 (34.568) ^a
3	IC218877	10.25 (18.672) ^d	3 (9.951) ^{ab}	28.8 (32.456) ^b
4	IC111532	10.05 (18.463) ^d	4.3 (12.011) ^{bc}	20.71 (27.068) ^e
5	IC140880	14.6 (22.462) ^a	6.2 (14.456) ^{bc}	28.52 (32.274) ^b
6	IC282226	14.58 (22.446) ^a	4.43 (12.147) ^{cd}	24.53 (29.688) ^c
7	IC282227	12.76 (20.923) ^b	5.43 (13.473) ^{cd}	25 (30.000) ^c
8	IC282228	12.58 (20.923) ^b	3.4 (10.605) ^{de}	22.43 (28.270) ^d
9	IC282229	11.88 (20.162) ^{bc}	3.5 (10.638) ^{de}	23.59 (29.063) ^{cd}
10	IC282233	10.75 (19.130) ^{cd}	5.3 (13.340) ^e	20.76 (27.108) ^e
	CD (p = 0.05)	1.402	1.791	1.140

Each value is a mean of ten replications

Table 4: Biophysical bases of resistance in okra accession

S. No.	Name of the accession	Trichome density No. cm ⁻²	Trichome length (μ)	Trichome breath (μ)
1	Trichi local	99.6 (86.931) ^a	442 (21.20) ^a	24.80 (29.868) ^a
2	Coimbatore local	96.6 (79.374) ^b	367.167 (19.161) ^c	14.90 (26.730) ^b
3	IC218877	92.2 (73.782) ^c	345.500 (18.588) ^d	11.90 (18.013) ^h
4	IC111532	90.5 (72.048) ^c	221.767 (14.892) ^c	12.90 (23.682) ^e
5	IC140880	99.5 (86.628) ^a	392.833 (19.820) ^b	14.60 (25.682) ^{cd}
6	IC282226	88.2 (69.909) ^d	296.400 (17.216) ^g	18.60 (25.549) ^c
7	IC282227	82.4 (67.195) ^e	311.200 (17.641) ^f	12.20 (20.444) ^g
8	IC282228	74.2 (44.312) ^h	234.600 (15.317) ^h	11.20 (19.881) ^g
9	IC282229	70.6 (57.165) ^g	312.400 (17.675) ^f	13.50 (21.557) ^f
10	IC282233	48.8 (59.473) ^f	323.833 (17.995) ^e	13.10 (24.426) ^{de}
	CD (p = 0.05)	1.747	0.281	1.044

Each value is a mean of twenty replications.

Table 5: Biophysical bases of resistance in okra accession

S. No.	Name of the accession	Fruit weight per plant	Fruit yield per plant
1	Trichi local	20.36 (26.827) ^a	324.33 (17.972) ^a
2	Coimbatore local	18.16 (25.228) ^{ab}	293.33 (17.126) ^a
3	IC218877	8.43 (16.879) ^b	200.00 (14.139) ^{ab}
4	IC111532	8.03 (16.413) ^c	266.66 (16.247) ^{ab}
5	IC140880	19.03 (26.084) ^c	320.00 (17.883) ^{ab}
6	IC282226	14.26 (22.190) ^d	246.66 (15.705) ^{bc}
7	IC282227	11.23 (19.669) ^d	273.33 (16.532) ^{cd}
8	IC282228	10.56 (18.966) ^e	140.00 (11.725) ^d
9	IC282229	9.30 (17.751) ^{ef}	190.00 (13.781) ^d
10	IC282233	13.33 (21.415) ^f	183.33 (13.525) ^e
	CD (p = 0.05)	1.156	1.751

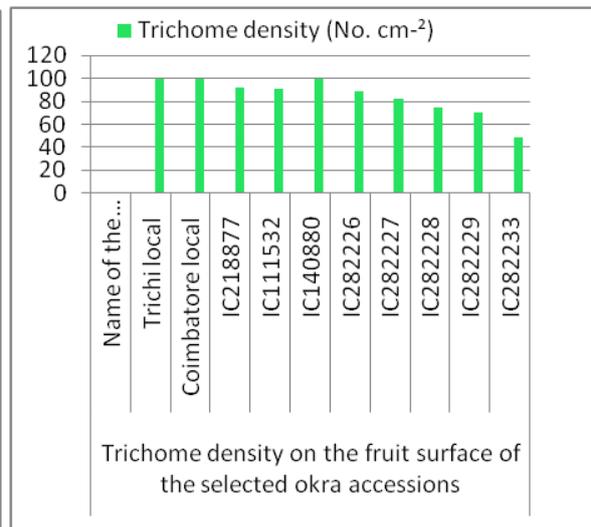
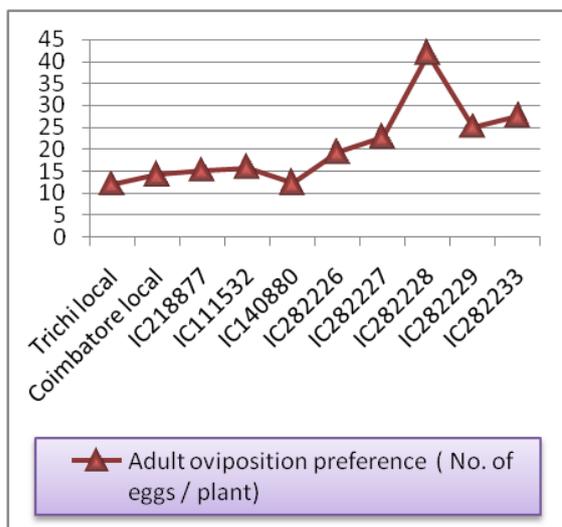
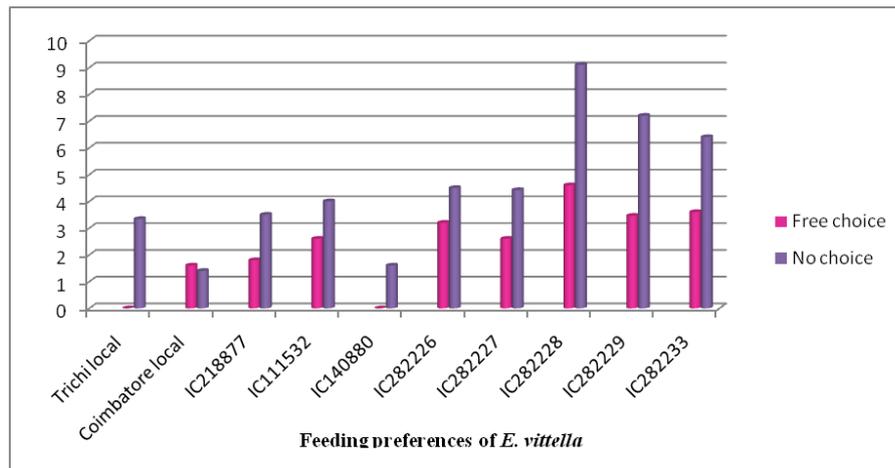
Each value is a mean of five replications

DISCUSSION

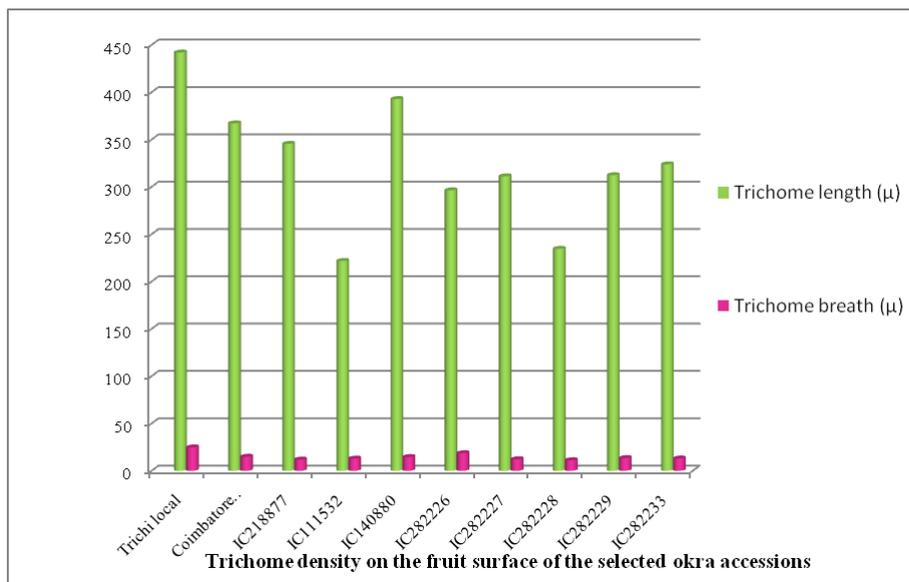
The accession Trichi local was least preferred by *E. vittella*. Parentage of this accession is IC140880 and Coimbatore Local. Wild relatives or their derivative was reported to possess resistance against fruit worm, *H. armigera* [10]. With regard to Fruit feeding preference of *E. vittella* larvae, the accession Trichi local and IC140880 was not preferred by larvae up to 8 h and the same trend is observed in no choice condition also. The oviposition preference of *E. vittella* female moths least preferred the accession IC140880 and Trichi local on which only 12 eggs were laid. These were followed by accession Coimbatore local. This

may be possibly due to the wild origin that possesses insect and disease resistance [11]. Accession IC282228 was most preferred host for oviposition. With reference to density of trichomes and their length and breadth, among the accessions, Trichi local and Coimbatore local had maximum number of trichomes and these accession were least preferred by *E. vittella* larvae in both free choice and no choice test [3, 12]. Halder *et al.* [9] also reported that a significant negative correlation was observed between trichome density and borer incidence. Further, high trichome density might be imparting the physical barrier for the borer rendering their non-preference over the low trichome genotypes.

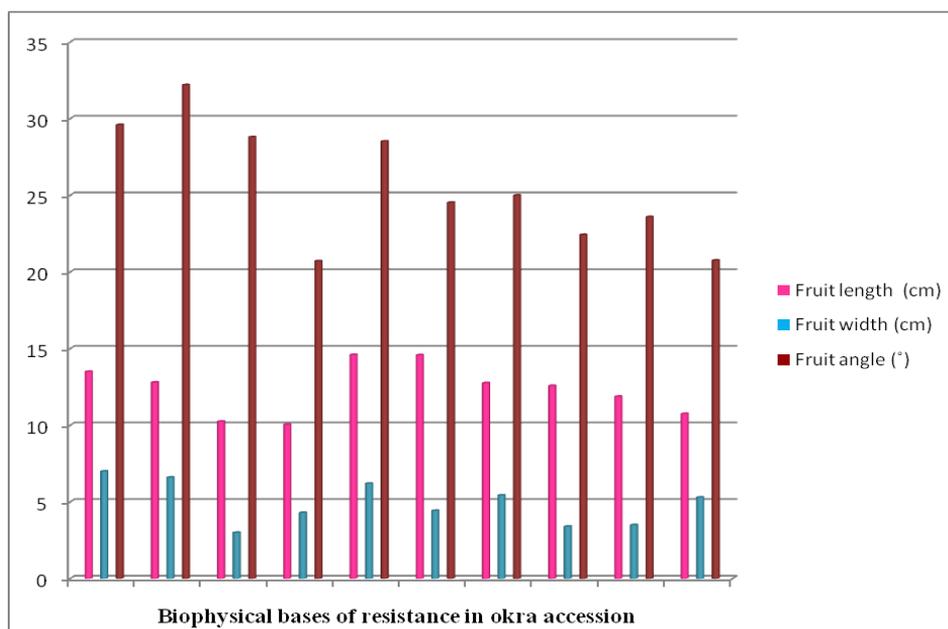
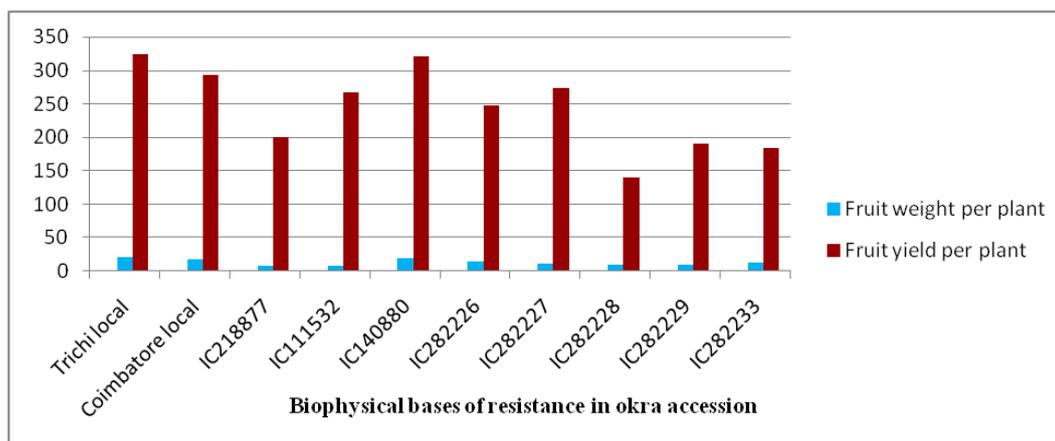
Feeding preferences of *E. vittella* towards fruits of okra accessions



Trichome density on the fruit surface of the selected okra accessions



Biophysical bases of resistance in okra accession



Sharma and Singh [14] reported a significant negative correlation between trichome density and borer infestation in okra. Similar observations were also documented by Halder *et al.* [15] where a significant negative correlation existed between trichome density in pods and pod borer infestation and damage severity in mungbean. Regarding fruit characters, fruit length of IC282228 was greater; fruit angle is recorded higher value in Coimbatore local and fruit width of Trichi local was greater than other accessions. Lengthy fruits were found more suitable for damage by *Earias* as they harboured more larvae/fruit. Present study related with Halder and Srinivasan [16] reported similar finding on *Maruca* infesting cowpea and also found that pod infestation was higher in genotypes that had highest pod length than other genotypes. The influences of host physical property on the degree of infestation were reported by Kamakshi and Srinivasan [17]. In overall observation, weight and yield of the fruit is high in IC 282228 followed by Trichi local.

CONCLUSION

It is concluded that, the accession Trichi local and IC 140880 was least preferred by *E. vittella*. Further, repeated field and glasshouse evaluations are necessary.

Only after determining the resistant potentials by repeated evaluation, a promising accession could be suggested for large scale cultivation. Many local cultivars and wild species are resistant against the pest. We must undergo detailed and repeated research in the field condition and recommend to farmers.

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