RESISTANCE SOURCES OF OKRA GENOTYPES/CULTIVARS TO SHOOT AND FRUIT BORER (*Earias vittella* FABRICIUS)

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ABSTRACT

An experiment was conducted to screen 10 different genotypes/ cultivars of okra for their susceptibility to *E. vittella* under field condition at Main Vegetable Research Station, Anand Agricultural University, Anand during *summer* 2010. Out of ten genotypes/cultivars (AOL 03-1, AOL 05-1, AOL 08-2, AOL 08-5, AOL 08-10, AOL 09-2, AOL 09-4, JOL 55-3, Gujarat Okra 2 and Parbhani Kranti), genotypes AOL 05-1, Gujarat Okra-2 and AOL 08-2 recorded significantly lower number of larvae per plant and per cent shoot as well as fruit damage can be considered as less susceptible genotypes, while genotypes JOL 55-03, AOL 09-4 and AOL 09-2 recorded comparatively lower larval population, shoot as well as fruit damage than can be considered to be moderately susceptible and AOL 03-1, AOL 08-10, AOL 08-5 and Parbhani Kranti recorded higher larval population, shoot as well as fruit damage were considered to be susceptible to *E. vittella*. Moisture content was significantly positively correlated with all the three parameters (larval population, shoot and fruit damage) of infestation, whereas fiber and ash content were significantly negatively correlated with the infestation of *E. vittella*. It indicated that lower moisture (%), more fibrous varieties which containing more ash (%) in okra genotypes/cultivars provided resistance against *E. vittella* infestation.

KEY WORDS: Biochemical constituents, *Earias vittella*, okra, resistance, shoot and fruit borer,

INTRODUCTION

Okra [*Abelmoschus esculentus* (Linnaeus) Moench] is an important vegetable crop belonging to family Malvaceae. It is mostly grown for its immature green and non-fibrous edible fruits in the tropical and sub tropical regions of the world. Root and stems are used for cleaning sugarcane juice while preparing jaggery. It is quite popular in India because of easy cultivation, dependable yield and adaptability to varying moisture conditions. Okra has a vast potential as one of the foreign exchange of total export of fresh vegetables. It alone accounts for 21% of the exchange earnings from export of vegetables from India. India ranks first in the world with a production of 4.53 million tonnes of fruits (70% of the total world production) of okra from 0.43

million hectares land with a productivity of 10.5 tonnes/ha. In Gujarat, it is cultivated in the area of 0.44 lakh hectares with a production of 4.0 lakh tonnes of fruits and a productivity of 9.1 tonnes/ha (Anonymous, 2009).

There are many factors affecting the low productivity of okra. One of them is the losses caused by insect pests. The crop is affected by number of insect pest, mites and nematodes during different growth stages. Of these pests, shoot and fruit borer [*Earias vittella* (Fabricius)] is the most destructive pests causing economic damage to the crop at all the growth stages. Many researchers have attempted to estimate the losses in yield of okra due to *E. vittella* infestation. Yield losses up to 50% at Ludhiana, Punjab (Brar *et al.*, 1994), 30.81% at Coochbehar, West Bengal (Ghosh *et al.*, 1999); 52.33 to 70.75% and 48.97% at Udaipur, Rajasthan (Pareek and Bhargava, 2003 and Kanwar and Ameta, 2007) and fruit damage to extent of 91.6% at Anand, Gujarat (Shah *et al.*, 2001) was reported.

Host plant resistance, an important component of integrated pest management, which can be used very effectively when combined with selective pesticides and induced resistance technique. Resistance varieties provides insect control with no additional cost and acts as preventive measure against build up of insect with other method of pest control and are free from environmental pollution problems (Atwal and Dhaliwal, 1999). Hence, the present investigation was carried out to study the susceptibility of different genotypes/cultivars and bio-chemical source of resistance to *E. vittella* in okra

MATERIALS AND METHODS

The field experiment was conducted at Main Vegetable Research Station, Anand Agricultural University, Anand during *summer* 2010 in a Randomized Block Design replicated thrice keeping a plot size of 3.0 x 4.5 m with 60 x 30 cm row x plant spacing. Ten genotypes/ cultivars (AOL 03-1, AOL 05-1, AOL 08-2, AOL 08-5, AOL 08-10, AOL 09-2, AOL 09-4, JOL 55-3, Gujarat Okra – 2 and Parbhani Kranti) of okra were evaluated for their susceptibility to *E. vittella*. The susceptibility of okra genotypes / cultivars to *E. vittella* was evaluated on the basis of number of larvae per plant, per cent shoot as well as fruit damage and okra fruit yield. For recording observations on *E. vittella* larval population, five plants were selected randomly in each plot and observations on larval population were recorded at weekly interval from the same selected plants. Shoot damage was recorded by counting total and damaged shoots from the each plot. Recording of observations were started from first week after germination and continued till to the harvesting of the crop at the beginning of each standard meteorological week. The fruit damage was recorded by counting total and damaged fruits from each plot at each picking. Fruit yield was recorded picking wise. The whole experimental plot was kept free from spraying of any insecticides.

Biochemical constituents:

The samples of okra fruits were collected randomly and plucked from each plot under each genotype in the first week of March when incidence of *E. vittella* was at the peak. These

samples of fruits were dried in oven at 60^0C, powdered using electric mixture and subjected to biochemical analysis for 3 repetitions in each genotype. Moisture content (%) and crude fibre (%) was determined as per the methodology described by Anonymous (1980), whereas total ash content was estimated as described methodology by Anonymous (1965). Chlorophyll 'a', chlorophyll 'b' and total chlorophyll content were estimated by methodology described by Hiscox and Israelstam (1979).

RESULTS AND DISCUSSION

The data on number of larvae of *E. vittella* presented in Table 1 indicated significant difference among the genotypes fpr larval population. Among the different genotypes, AOL 05-1 (0.14 larvae per plant) recorded significantly lower larval population as compared to rest of the genotypes/cultivars screened. Variety Gujarat Okra - 2 (0.29 larvae per plant) and AOL 08-2 (0.35 larvae per plant) were at par with each other, but recorded significantly lower larval population than remained genotypes and proved them more tolerant in comparison to other genotypes. Genotype AOL 08-5 (0.99 larvae per plant) recorded significantly higher number of larvae but, it was at par with AOL 08-10 (0.89 larvae per plant).

The data on per cent shoot damage (Table 1) indicated that all the genotypes/cultivars differed significantly from each other. AOL 05-1 (3.03%) recorded significantly lower shoot damage as compared to rest of the genotypes/cultivars screened. Gujarat Okra 2 (4.21 %) and AOL 08- 2 (5.06%) were the next two best genotypes with respect to shoot damage. There was a significant difference among the genotypes for the fruit damage (Table 1). Genotypes, AOL 05-1 (7.50%), Gujarat Okra-2 (9.72%) and AOL 08-2 (11.53%) were at par with each other.

As far as okra fruit yield is concerned (Table 1), there was significant difference among the genotypes for fruit yield. However, genotype AOL 05-1 (73.53 q/ha), AOL 08-2 (66.87 q/ha) and check variety Gujarat Okra-2 (65.64 q/ha) did not differ significantly from each otherwere the three best genotypes. Genotype JOL 55-3 was at par with AOL 08-2 and Gujarat Okra - 2 on one side and with AOL 09-4, AOL 09-2, Parbhani Kranti and AOL 03-1 on other side of chronological order. Similarly, genotypes AOL 09-4, AOL 09-2, Parbhani Kranti, AOL 03-1, AOL 08-10 and AOL 08-5 were at par with each other for okra fruit yield.

Overall, in nut shell, genotypes AOL 05-1, Gujarat Okra-2 and AOL 08-2 recorded significantly lower number of larvae per plant and per cent shoot as well as fruit damage can be considered as less susceptible genotypes to this important pest of okra. Genotypes JOL 55-03, AOL 09-4 and AOL 09-2 recorded comparatively lower larval population, shoot as well as fruit damage than AOL 03-1, AOL 08-10, AOL 08-5 and Parbhani Kranti can be considered to be moderately susceptible, The later four genotypes/cultivar recorded higher larval population, shoot as well as fruit damage considered to be susceptible to *E. vittella*.

Information on evaluation of okra varieties for their susceptibility to *E. vittella* is scanty. AOL 05-1 recorded lower shoot and fruit damage at Anand (Anonymous, 2008). This report is strongly accordance with the present findings. The higher shoot and fruit damage was

recorded in Parbhani Kranti [Papal and Bharpoda (2009) and Sharma and Jat (2009)]. Thus, the present results in case of Parbhani Kranti are close in agreement with the findings drawn by above research workers.

Correlation between biochemical constituents and *E. vittella* infestation

The correlation between *E. vittella* infestation and biochemical constituents (moisture, fiber and ash) was significant. Moisture was significantly positively correlated with all the three parameters (larval population, shoot and fruit damage) of infestation (Table 1). Thus, increased in moisture, infestation of *E. vittella* increased or vice versa. Fiber and ash content (Table 1) in fruits were significantly negatively correlated with the infestation of *E. vittella*. It indicated that increase in fiber content and ash content in the fruits, infestation of *E. vittella* decreases. Thus, the higher amount of fiber and ash were responsible for imparting resistance. The correlation between amount of chlorophyll (a, b, total and a/b) content in the fruits and *E. vittella* infestation (Table 1) was non-significant indicating the negligible role of chlorophyll content in the fruits on infestation of *E. vittella*. Overall, it can be concluded from the above results that the biochemical constituents *viz.*, lower moisture (%), more fibrous varieties which containing more ash (%) in okra genotypes/cultivars provided resistance against *E. vittella* infestation. On opposition to this, genotype/cultivars having high moisture (%), less fiber (%) and less ash (%) are susceptible to *E. vittella*.

No work on this aspect has been done in okra. However, the positive correlation between moisture and shoot and fruit borer infestation in brinjal was reported (Hazra *et al.* (2004), Chandrashekhar *et al.* (2008) and Elanchezhyan *et al.* (2009). The above three reports are in close conformity with present findings. Crude fiber and ash content negatively correlated with shoot and fruit borer infestation in brinjal (Shinde, 2007; Warade *et al.*, 2008 and Padgilwar and Mahorkar, 2008). Fiber content manifested significantly negative correlations with per cent fruit infestation by shoot and fruit borer in brinjal (Chandrashekhar *et al.*, 2008). There was negative correlation between ash and shoot and fruit borer infestation in brinjal was observed (Elanchezhyan *et al.*, 2009, Shinde *et al.*, 2009). Thus, the above reports are in close agreement with present findings. Chlorophyll 'a' content was negatively correlated with brinjal shoot and fruit borer infestation (Hossain *et al.*, 2002). In present finding chlorophyll exhibited non significant but negatively correlated with infestation level of *E. vittella* to shoot and fruit. Thus, the above report is also corroborating the results obtained in present investigation.

CONCLUSION

Out of 10 genotypes/cultivars screened, genotype AOL 05-1, Gujarat Okra-2 and AOL 08-2 recorded significantly lower number of larvae per plant and per cent shoot as well as fruit damage can be considered as less susceptible, whereas AOL 03-1, AOL 08-10, AOL 08-5 and Parbhani Kranti considered as susceptible to *E. vittella*. Varieties having lower moisture (%), more fibrous and ontaining more ash (%) provided resistance against *E. vittella* infestation in okra.

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Table 1: Infestation level of *E. vittella* in different genotypes/cultivars of okra and their correlation with biochemical constituents

Genotypes/ Cultivars	Infestation level of *E. vittella*			Fruit yield (q/ha)	Biochemical constituents						
	No. of larvae /plant*	Shoot damage (%)**	Fruit damage (%)**		Moisture (%)	Fiber (%)	Ash (%)	Chlorophyll (mg/g)			
								a	b	Total	a / b
1	2	3	4	5	6	7	8	9	10	11	12
AOL 03-1	1.14^{ef} (0.80)	18.50^{f} (10.07)	23.98^{cd} (16.52)	41.56^{cd}	89.80	1.74	1.60	0.15	0.03	0.18	5.52
AOL 05-1	0.80^{a} (0.14)	10.02^{a} (03.03)	15.89^{a} (7.50)	73.53^{a}	85.33	2.64	2.41	0.31	0.12	0.43	2.67
AOL 08-2	0.92^{b} (0.35)	13.00^{c} (05.06)	19.85^{abc} (11.53)	66.87^{ab}	88.57	1.84	2.08	0.29	0.10	0.39	2.92
AOL 08-5	1.22^{g} (0.99)	18.48^{f} (10.05)	23.35^{cd} (15.71)	37.52^{d}	89.03	1.55	1.71	0.43	0.13	0.56	3.44
AOL 08-10	1.18^{fg} (0.89)	20.12^{g} (11.83)	28.45^{e} (22.70)	37.65^{d}	90.41	0.75	1.36	0.16	0.08	0.24	1.97
AOL 09-2	1.04^{d} (0.59)	16.67^{e} (08.23)	22.51^{cd} (14.66)	48.77^{cd}	89.14	1.52	1.40	0.14	0.08	0.22	1.77
AOL 09-4	1.00^{cd} (0.50)	16.60^{e} (08.16)	21.93^{bcd} (13.95)	52.26^{bcd}	90.12	1.47	2.06	0.16	0.07	0.23	2.60
JOL 55-3	0.97^{c} (0.44)	14.31^{d} (06.11)	20.81^{bc} (12.62)	55.28^{bc}	88.14	1.43	2.10	0.12	0.03	0.15	4.59
Guj Okra -2	0.89^{b} (0.29)	11.84^{b} (04.21)	18.17^{ab} (09.72)	65.64^{ab}	87.67	2.36	2.17	0.20	0.12	0.32	3.04
ParbhaniKranti	1.13^{e} (0.78)	18.95^{f} (10.55)	25.34^{de} (18.32)	42.39^{cd}	90.30	0.49	1.37	0.20	0.08	0.41	2.40
S. Em. ±	0.02	00.31	01.42	05.11							
C.D. (5%)	0.04	00.93	04.21	15.18							
C.V. (%)	6.16	08.49	11.15	16.97							

Infestation levels (Y)	Correlation coefficients (r)						
Number of larvae /plant (Y_1)	0.77094**	-0.71980**	-0.83482**	0.06183	-0.18177	-0.02306	0.08426
Per cent shoot damage (Y_2)	0.87571**	-0.83247**	-0.89053**	-0.15981	-0.32555	-0.22752	-0.02353
Per cent fruit damage (Y_3)	0.85980**	-0.87903**	-0.88599**	-0.26168	-0.33749	-0.29983	-0.12157

Significant at 0.05% level of significance** ** Significant at 0.01% level of significance**

Notes: 1. Treatment means with letter(s) in common are not significant at 5 % level of significance in respective column

2. Figures in parentheses are retransformed values; those outside are $\sqrt{X+0.5}$* and arc sin** transformed values

[MS received: November 18, 2012] *[MS accepted: December 11, 2012]*