Original Research Article

Screening of Okra Genotypes against Fruit Borer (Earias spp.) Infestation

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A B S T R A C T

The study on screening of okra genotypes against fruit borer (Earias spp.) infestation was conducted using 76 genotypes viz., 21 parents, 54 F1 hybrids and one commercial check (MHY-10) in a randomized block design and replicated twice. Analysis of variance revealed significant differences among the genotypes resulting in incidence of fruit borer ranged from 5 (KON-12) to 45 percent (KON-6) among the parents. However, parents KON-12 (5.00%), KON-5 (5.08%), KON-15 (7.50%) and KON-10 (10%) are the highly resistant which recorded the lowest fruit borer infestation. Among the hybrids, the minimum incidence (10.00%) was recorded in the cross KON-8 x AAN which proved to be highly resistant, whereas, the cross KON-12 x AAN showed susceptibility by recording maximum fruit borer infestation (87.50%). Compared to parents and hybrids, commercial check (MHY-10) reacted as tolerant by incidence of 28.75 per cent fruit borer infestation. Hence, the present study conclude that, genotypes which showed resistant reaction can be used in further breeding programmes to develop varieties / hybrids resistant to fruit borer along with good agronomic traits.

Keywords
Okra, Genotypes, Fruit borer, Parents and hybrids.

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Introduction

Okra [Abelmoschus esculentus (L.) Moench] belonging to the family Malvaceae is an important vegetable crop of the tropics and subtropics. Okra is specially valued for its tender, delicious green fruits which are cooked, canned and consumed in various forms in different parts of the country. India is the largest producer of okra covering an area of 0.530 million hectares with an annual production of 6.350 million tonnes (Anon., 2013). It is a potential export earner accounting for 13 per cent of export of fresh vegetables. The production of okra is constrained mainly by the infestation of leathopper, shoot and fruit borer and minor pest like whitefly (Chaudhary and Dadheech, 1989). Among them, fruit borer (Earias spp.) is the most devastating pest which causes severe loss to the farmers to an extent of 3.5-90% in Andhra Pradesh (Krishnaiah et al., 1976) and up to 69 per cent in Madhya Pradesh (Rawat and Sahu, 1973). In Karnataka and South India two majorspecies viz., Earias insulana Boisd and Earias vitella Fabricius have been reported (Patil et al., 1996).The larvae bore into the growing shoots, flower buds, flowers and tender fruits resulting in their shedding and consequently affecting the fruit quality and yield. In general, the major strategies are available to successfully management of this pest; prevention and the use of resistant varieties.
However, the latter one are highly preferred because the use of pesticides will cause the residual problems as it is harvested and consumed as tender pods. The regular and indiscriminate use of pesticides results in development of resistance in insects, resurgence and environmental pollution (Suneetha et al., 2007). Most of the present day okra hybrids/cultivars are susceptible to the fruit borers. Due to these factors, an emphasis is always being given to develop insect resistant varieties, which is an effective way to reduce the losses in the crop. However, some previous studies conducted by Koujalagi et al., (2009), Duggi et al., (2013), Afzal et al., (2015) and Akther et al., (2014) in okra reported genotypes resistant to fruit borer with desirable yield attributes. At Arabhavi several lines have been developed through bulk method of breeding. These lines have been crossed into line x tester design. Hence the present study was planned to identify the resistant sources among these genotypes and further to develop the hybrids/varities against fruit borer.

**Materials and Methods**

The investigation was conducted at the Department of Vegetable Science K.R.C. College of Horticulture, Arabhavi, Gokak Taluk, Belagavi district of Karnataka during the year 2013-2014. The experimental farm is situated in Northern Dry Zone of Karnataka state at 16°15’ N latitude, 74°45’ E longitude and at an altitude of 612.03 meters above the mean sea level. The experimental material comprised 76 genotypes of which 21 parents viz., KON-1, KON-2, KON-3, KON-4, KON-5, KON-6, KON-7, KON-8, KON-9, KON-10, KON-11, KON-12, KON-13, KON-14, KON-15, KON-16, KON-17 and KON-18(lines), and Arka Anamika (AAN), KON-19 and IC90174(testers), 54 F1 hybrids and a commercial check (MHY-10). The experiment was laid out in randomized block design with two replications. Each treatment in each replication was represented by 20 plants at a spacing of 60 x 30 cm. To record fruit borer incidence the fruits were observed for fruit borer infestation at each harvesting and finally mean of five harvests were subjected for data analysis. Total number of fruits and number of fruits infested with fruit borer were counted at each harvest. Fruit number over five harvests were added to get total and infested fruits per plot. Per cent incidence of borer was computed by using the following formula.

\[
\text{Fruit borer incidence} = \frac{\text{Number of fruits infested}}{\text{Total number of fruits}} \times 100
\]

The 1-6 grade suggested by Rai and Satpathy (1998) was used for screening okra germplasm against fruit borer (Table 1).

**Results and Discussion**

Analysis of variance revealed significant differences among the genotypes for fruit borer incidence (Table 2). The mean fruit borer incidence among the parents ranged from 5 (KON-12) to 45 (KON-6) per cent. Among the parents, two reacted as highly susceptible, five as susceptible, four as tolerant, six as fairly resistant and four as highly resistant. None of the parents and hybrids was immune to fruit borer infestation. The parents KON-12 (5.00%), KON-5 (5.08%), KON-15 (7.50%) and KON-10 (10%) showed highly resistant by recording lowest fruit borer infestation (Table 3). The mean fruit borer incidence among the hybrids varied from 10.00 (KON-8 x AAN) to 87.50(KON-12 x AAN)per cent. Among 54 hybrids studied 11 reacted as highly susceptible, eight as susceptible, 17 as tolerant, 17 as fairly resistant and a hybrid (KON-8 x AAN) as highly resistant (10%) to fruit borer infestation. However in comparison with the parents and hybrids the
commercial check MHY-10 reacted as tolerant with 28.75 per cent fruit borer infestation (Table 3). The line KON-5 which recorded lowest fruit borer infestation in the present study was also found to be the good general combiner for fruit length, fruit diameter, and average fruit weight, total yield per plant and total yield per hectare (Nagesh et al., 2014). Hence this line can be exploited in further breeding programmes to develop varieties/hybrids resistant to fruit borer along with good fruit yield.

In the present study the parents KON-8 and AAN and their crosses were found to be the fairly resistant. The present result is full agreement with the findings of Mazed (2009) and Rehman et al., (2015) as they found Arka Anamika as highly preferable among the parents yielded moderately resistant hybrids.

The facts may be due to both experiments and present experiment was conducted in the same season (May to September). The study also in conformity with Memon et al., (2004) and Aziz (2010) who reported Arka Anamika as the least susceptible and the Desi germplasm was the most preferable variety by okra shoot and fruit borer. However the results are in contradictory with Sharma and Jat (2009), Rahman et al., (2012) as they found Arka Anamika as the least preferable variety to okra shoot and fruit borer.

### Table 1 Scale for fruit borer resistance (Based on fruit damage)

| Grade Category | Fruit infestation (%) | Reaction            |
|----------------|-----------------------|---------------------|
| 1              | 0                     | Immune (I)          |
| 2              | 0.1-10                | Highly resistant (HR)|
| 3              | 10.1-20               | Fairly resistant (FR)|
| 4              | 20.1-30               | Tolerant (T)        |
| 5              | 30.1-40               | Susceptible (S)     |
| 6              | 40.1 and above        | Highly susceptible (HS)|

### Table 2 Analysis of VAriance for fruit borer infestation in okra

| Source of variation | Degrees of freedom | Sum of squares | Mean sum of squares | F cal | F prob |
|---------------------|--------------------|----------------|---------------------|-------|--------|
| Replications        | 1                  | 606.941        | 606.941             | 9.557 | 0.003  |
| Treatments          | 75                 | 22955.795      | 306.077             | 4.820 | 0.000  |
| Error               | 75                 | 4762.987       | 63.506              | -     | -      |
| Total               | 151                | -              | -                   | -     | -      |
Table 3  Fruit borer infestation (%) in different okra genotypes

| Genotype | Fruit Borer infestation (%)* | Grade | Reaction ** |
|----------|-----------------------------|-------|------------|
| KON-1    | 23.28 (28.84)               | 4     | T          |
| KON-2    | 23.33 (28.83)               | 4     | T          |
| KON-3    | 26.92 (31.10)               | 4     | T          |
| KON-4    | 35.63 (36.61)               | 5     | S          |
| KON-5    | 5.08 (12.98)                | 2     | HR         |
| KON-6    | 45.83 (42.37)               | 6     | HS         |
| KON-7    | 42.86 (40.85)               | 6     | HS         |
| KON-8    | 19.26 (25.90)               | 3     | FR         |
| KON-9    | 20.00 (26.39)               | 3     | FR         |
| KON-10   | 10.00 (18.44)               | 3     | FR         |
| KON-11   | 26.25 (30.27)               | 4     | T          |
| KON-12   | 5.00 (12.92)                | 2     | HR         |
| KON-13   | 13.75 (21.746)              | 3     | FR         |
| KON-14   | 33.93 (35.45)               | 5     | S          |
| KON-15   | 7.50 (15.68)                | 2     | HR         |
| KON-16   | 40.00 (39.11)               | 6     | HS         |
| KON-17   | 20.00 (26.39)               | 3     | FR         |
| KON-18   | 32.50 (34.62)               | 5     | S          |
| AAN      | 12.50 (20.61)               | 3     | FR         |
| KON-19   | 40.00 (39.11)               | 5     | S          |
| IC90174  | 12.50 (20.61)               | 3     | FR         |
| KON-1 x AAN | 13.06 (21.13)           | 3     | FR         |
| KON-1 x KON-19 | 25.00 (29.89)     | 4     | T          |
| KON-1 x IC90174 | 42.50 (40.38)   | 6     | HS         |
| KON-2 x AAN | 15.00 (22.50)           | 3     | FR         |
| KON-2 x KON-19 | 77.50 (61.72)       | 6     | HS         |
| KON-2 x IC90174 | 12.50 (20.61)       | 3     | FR         |
| KON-3 x AAN | 26.25 (30.27)           | 4     | T          |
| KON-3 x KON-19 | 37.50 (37.50)       | 5     | S          |
| KON-3 x IC90174 | 17.50 (24.68)       | 3     | FR         |
| KON-4 x AAN | 21.54 (27.64)           | 4     | T          |
| KON-4 x KON-19 | 22.21 (27.81)       | 4     | T          |
| KON-4 x IC90174 | 11.50 (19.61)       | 3     | FR         |
| KON-5 x AAN | 40.00 (38.67)           | 5     | S          |
| KON-5 x KON-19 | 23.96 (28.86)       | 4     | T          |
| KON-5 x IC90174 | 25.00 (30.00)       | 4     | T          |
| KON-6 x AAN | 18.33 (25.33)           | 3     | FR         |
| KON-6 x KON-19 | 12.50 (20.61)       | 3     | FR         |
| KON-6 x IC90174 | 21.59 (27.62)       | 4     | T          |
Table 3 Cotnd……

| Genotype | Fruit Borer infestation (%) | Grade | Reaction |
|----------|-----------------------------|-------|----------|
| KON-7 x AAN | 16.50 (23.95) | 3 | FR |
| KON-7 x KON-19 | 20.00 (26.39) | 3 | FR |
| KON-7 x IC90174 | 17.33 (24.60) | 3 | FR |
| KON-8 x AAN | 10.00 (18.44) | 2 | HR |
| KON-8 x KON-19 | 29.17 (32.63) | 4 | T |
| KON-8 x IC90174 | 24.17 (29.02) | 4 | T |
| KON-9 x AAN | 80.00 (63.61) | 6 | HS |
| KON-9 x KON-19 | 28.75 (32.16) | 4 | T |
| KON-9 x IC90174 | 31.79 (34.29) | 5 | S |
| KON-10 x AAN | 25.00 (29.68) | 4 | T |
| KON-10 x KON-19 | 22.50 (28.28) | 4 | T |
| KON-10 x IC90174 | 75.00 (67.30) | 6 | HS |
| KON-11 x AAN | 67.50 (55.26) | 6 | HS |
| KON-11 x KON-19 | 15.00 (22.50) | 3 | FR |
| KON-11 x IC90174 | 17.50 (24.68) | 3 | FR |
| KON-12 x AAN | 87.50 (69.39) | 6 | HS |
| KON-12 x KON-19 | 30.00 (33.14) | 4 | T |
| KON-12 x IC90174 | 70.00 (57.10) | 6 | HS |
| KON-13 x AAN | 22.50 (28.28) | 4 | T |
| KON-13 x KON-19 | 12.50 (20.61) | 3 | FR |
| KON-13 x IC90174 | 25.15 (29.62) | 4 | T |
| KON-14 x AAN | 30.00 (33.14) | 4 | T |
| KON-14 x KON-19 | 45.00 (42.12) | 6 | HS |
| KON-14 x IC90174 | 10.71 (18.86) | 3 | FR |
| KON-15 x AAN | 24.26 (29.35) | 4 | T |
| KON-15 x KON-19 | 32.21 (34.56) | 5 | S |
| KON-15 x IC90174 | 35.00 (35.78) | 5 | S |
| KON-16 x AAN | 32.86 (34.95) | 5 | S |
| KON-16 x KON-19 | 47.50 (43.28) | 6 | HS |
| KON-16 x IC90174 | 20.00 (26.39) | 3 | FR |
| KON-17 x AAN | 75.00 (67.30) | 6 | HS |
| KON-17 x KON-19 | 34.17 (35.77) | 5 | S |
| KON-17 x IC90174 | 57.50 (49.32) | 6 | HS |
| KON-18 x AAN | 29.17 (32.63) | 4 | T |
| KON-18 x KON-19 | 15.00 (22.50) | 3 | FR |
| KON-18 x IC90174 | 16.69 (24.10) | 3 | FR |
| CC (MHY-10) | 28.75 (32.16) | 4 | T |

F value **4.82**
CD @ 5% 15.87
CV (%) 24.85

Note: The Values in the Parentheses are Arc Sin transformed.

* Mean of 5 plants/replication and 10 observations

HR- Highly Resistant, FR- Fairly Resistant, T- Tolerant, S- Susceptible and HS- Highly Susceptible
AAN- Arka Anamika
The parents and crosses which showed resistant reaction and efficient utilization of these Desi/Local germplasm lines as superior pre-breeding lines/hybrids can accelerate further breeding work. Since there is no stable source of resistance, the new sources of resistance identified in the present study can be further exploited to achieve durable resistance to fruit and shoot borer in okra.

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