Differential preference for oviposition — a potential indicator of antixenosis in maize genotypes against *Sesamia inferens* (Walker)

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Host choice for oviposition by insects is an indicator of the antixenotic factors present in a plant. The expression of antixenosis in 20 maize genotypes against *Sesamia inferens* (Walker) was measured by studying its relative ovipositional preference under multi-choice test and confirmed by no-choice test. The genotype WNZPBTL 6, E9-B and HKI 1040-11-7 expressed significantly high level of antixenosis in terms of less number of eggs (4.33, 4.67 and 5.33) under multi choice test. The genotype E37-A (O) displayed least antixenosis as indicated by the highest number of eggs (112.33) laid on it by the gravid females. The least number of plants (8.33 percent) utilized for egg laying in E9-B and E30 showed the ovipositional aversion of females on these genotypes. In no-choice test, the genotypes E9-B, AEB(Y)C5 55-1 and AEB(Y)C5 34-1 were found least preferable as only single egg mass per plant was deposited on these genotypes. The egg load per plant varied from 13.33 eggs in E9-B to 88.5 eggs in Hyd 05R/2-1. Significantly less number of plants of the genotypes E5-Q, E9-B, E30, AEB(Y)C5 55-1 and AEB(Y)C5 34-1 chosen for egg laying indicated their high degree of antixenosis. Relatively less egg load per plant in genotypes E9-B, AEB(Y)C5 55-1, AEB(Y)C5 34-1, HKI 1040-11-7 and PFSR S3 in both the test situations suggest high antixenosis in these genotypes. The results revealed that the genotypes E30, E 60(FC)O and HKI 164-7-4 ER-3 were not preferred for oviposition under multi-choice test while the female offloads some of its eggs on these genotypes in duress under no-choice test. The correlation coefficient of 0.59 between number of eggs per plant in multi-choice and no-choice test confirm the variable ovipositional preference among these germplasm.

Keywords: Biotic stress, Host plant resistance, IPM, Maize germplasm, Ovipositional aversion, Pest management, Pink stem borer, *Zea mays*

Maize (*Zea mays* L.) is one of the most important cereal crops in the world, cultivated for food, feed, fodder and industrial products. Despite the high yield potential, the average productivity of maize in our country is much lower because of losses due to various biotic and abiotic stresses. Insects attribute the major biotic stress and about 130 insect pests are reported to be causing varying degree of damage to maize crop in India. Pink stem borer, *Sesamia inferens* (Walker) is the key pest of rabi maize which occurs throughout the year particularly in peninsular India¹. It also causes extensive damage to the maize crop in several northern states during ‘Rabi’ (winter) season. The losses due to *S. inferens* in ‘Rabi’ season varies from 25.7 to 78.9% with an estimated annual loss of Rs.110.5 million in India². Use of insecticides for stem borer management is uneconomical and is largely beyond the means of poor farmers in India. Therefore, host plant resistance (HPR) assumes a pivotal role in limiting the loss caused by stem borer.

Breeding for host plant resistance holds immense potential in managing this pest in a durable and ecologically sustainable manner. An essential prerequisite of resistance breeding against *S. inferens* is to comprehend the principal mechanism of resistance involving antixenosis and antibiosis³. Knowledge of resistance mechanism and its associated factors is essential for effective utilization of resistant sources in crop improvement programme. Maize is known for greater genetic diversity and thus expected to hold a wide variety of resistance mechanisms in its gene pool⁴. All the three types of resistance mechanisms i.e. non-preference (antixenosis), antibiosis and tolerance interact, which determine the level of resistance in maize genotypes. Germplasm screening in maize against *Sesamia* is conventionally done by scoring the extent of damage inflicted on the crop by the pest in 1-9 scale⁵ 20 days after releasing neonates in the whorl of the plant, thus accounts only for

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antibiosis component of resistance. But under natural conditions, antixenosis displays the first line of defense as ovipositional aversion by gravid females before the larvae could infest the plant. Considering the importance of this trait and the lack of information pertaining to it, we planned this study to assess the suitability of ovipositional preference as a trait for germplasm screening of maize against *S. inferens*.

**Materials and Methods**

**Culture of Sesamia inferens**

The nucleus culture of *S. inferens* was collected from National Dairy Research Institute, Karnal, and village Atterna near Sonepat, Haryana, India. The culture was multiplied in the Entomology Laboratory, ICAR-Indian Institute of Maize Research. It was maintained at a temperature of 26±2.0℃ and relative humidity of 65±5%. The field collected larvae were reared on fresh maize stalk and baby corn till pupation. After emergence, the male and female adults in equal numbers were released on potted maize plants (7-12 day old), kept in versatile insect rearing cage (VIRC) for egg laying. The larvae were reared on artificial diet from second generation onwards.

**Maize genotypes**

Twenty maize genotypes were procured from Winter Nursery Centre, ICAR-Indian Institute of Maize Research, Hyderabad, India to study their ovipositional preference against *S. inferens*.

**Experimental procedure**

The ovipositional preference of *S. inferens* was studied by two methods: multi-choice and no-choice conditions. In multi-choice condition, all the test genotypes had equal chance of being selected by the gravid females, whereas in no-choice condition plants of only one genotype were provided for egg laying. The adults of *Sesamia* for both the tests were released at 12 DAG (days after germination) maize plants. The standardized insect to plant ratio was kept at 1:4.

**Multi-choice Test**

The ovipositional preference of *S. inferens* was studied on twenty selected genotypes (Table A). The experiment consisted of 20 treatments (genotypes) replicated thrice. For each genotype, six seeds were sown in the pot (30 cm top diameter, 28 cm height, 14.5 L volume) filled with soil, coco peat, vermiculite in the ratio of 2:1:1 with no additional fertilizer. Four plants were retained and maintained under greenhouse conditions (28/24℃ day/night and 16/8 h light/dark).

One pot each of twenty genotypes was kept under screening cage (mosquito net) of size 180×180×120 cm which constituted one replication. Three such screening cages were set up in the glass house. Twenty freshly emerged pairs of moths were released inside the screening cage. The plants were watered regularly. Considering the total ovipositional period observed in earlier studies, all the plants were cut near the soil level five days after the release of adults and brought to the laboratory for observations. Plant height and stem diameter near first leaf sheath were recorded before releasing the adults.

**No-choice test**

The same set of 20 genotypes was planted in plastic pots (10×10×7.5 cm) with one plant per pot. Four pots with one 12-day old plant of each genotype kept in VIRC constituted one replication and each treatment was replicated thrice. One pair of laboratory-reared, 1-day old *S. inferens* moth was released in the oviposition cage in the morning at (09:00 h). After five days, the plants were cut near the soil surface, labeled and brought to the laboratory for observations.

The following observations: number of egg masses per genotype, eggs per genotype, eggs in each egg mass, leaf sheaths oviposited and plants oviposited were recorded in both the tests in each genotype.

**Statistical analysis**

The experiment was conducted in a completely randomized design (CRD). The data of all the parameters was subjected to Analysis of Variance (ANOVA) using SPSS16. The multiple correlations among the parameters were determined to assess the extent of relationship between the parameters and the relative variation in antixenosis among these genotypes. The germplasms were ranked on 0-100 scale based on number of eggs laid per plant. The germplasm receiving least number of eggs was ranked 0 and the one receiving highest number of eggs was ranked 100.

**Results**

**Plant height and stem diameter**

All the genotypes varied significantly in plant height ranging from 9.20 cm in genotype PFSR S3 to 17.00 cm in AEB(Y)C5 55-1 (Table 1). The diameter of stem near first leaf sheath was minimum (0.41 cm) in PFSR R9 while maximum (0.80 cm) in E9-B, WNZPBTL6 and AEB(Y)C5 55-1.
Antixenotic response of maize genotypes

Multi-choice test

The number of egg masses laid showed significant variation among the test genotypes. The minimum number of egg masses (0.33) was observed in the genotype E9-B (Table 2). The number of egg masses recorded was highest (9.33) in E37-A(O) which was statistically at par with E 60(FC)O, HKI PC4B, E4-C, E57(O), Basi Local, PFSR R3, HKI 1040-5, HKI C323, E5-O, Hyd05R/2-1 and CM 202. The genotypes AEB(Y)C5 55-1, E30, HKI 164-7-4 ER-3, AEB(Y)C5 34-1, HKI 1040-11-7, PFSR-S3, AEB(Y)C5 34-1, HKI 1040-11-7 received more or less the same number of egg masses.

The least number of eggs masses (0.33) per plant were observed on the genotypes E9-B and WNZPBTL6 while the genotype HKI PC4B and E 37-A(O) received highest number of eggs masses per plant i.e. 3.33 and 3.5 respectively. The other genotypes received, more or less, the same number of eggs masses per plant (Table 2).

Number of eggs per genotype

There were significant differences in the number of eggs laid on different genotypes. The genotypes E9-B and HKI1040-11-7 received as few as 4.7 and 5.3 eggs, respectively. Highest number of eggs (338.0) was laid on genotype E-37(A) O (Table 2).

The number of eggs i.e. 227.7, 208.7, 200.3, 180.0 and 160.0 were observed on E 57(O), E4-C, HKI C323, Basi local and HKI 1040-5 respectively. The other genotypes received lesser number of eggs than these genotypes.

The significantly less number of eggs per plant viz., 4.33, 4.67 and 5.33 were observed in genotype WNZPBTL6, E9-B and HKI 1040-11-7 respectively while the genotype E37-A(O) receiving highest number of eggs per plant (112.0) was the most preferred by females. (Table 2).

Number of eggs per egg mass

The size of egg mass in terms of number of eggs per egg mass showed significant variation which ranges from 1.56 in E 9B to 38.56 in HKI C323 among the genotypes tested (Table 2).

Number of plants and leaf sheaths preferred for oviposition

The number of plants chosen for oviposition and the number of leaf sheaths used for distributing eggs in a plant revealed significant differences among maize germplasm. The minimum number (8.33) of plants chosen for oviposition is of genotypes E9-B and S. inferens assumes its antixenotic reaction. The highest number of plants were oviposited in E37-A(O) (91.67 per cent), which was statistically at par with genotypes HKI C323 (80.56), E5-O (75), CM 202 (72.22), E60(FC)O (66.67), PFSR R9 (66.67) and Basi Local (66.67). The minimum number of leaf sheaths (0.33) preferred for oviposition was in genotypes E9-B and WNZPBTL 6 while maximum number of leaf sheaths (3.3) were used in genotypes E4-C and E37-A(O).

No-choice test

Number of egg masses per genotype

Significant genotypic variation was observed in the number of egg masses received. The genotypes E9-B, AEB(Y)C5 55-1 and AEB(Y)C5 34-1 were found least preferred as only single egg mass was deposited on these genotypes under no choice situation (Table 2). The highest number of egg masses (7.67) was observed on HKI C 323. The number of egg masses laid per plant varied from 1.00 to 3.17. The results indicated that the genotypes E9-B, AEB(Y)C5 55-1 and AEB(Y)C5 34-1 were least suitable for oviposition as each plant of these genotypes recorded minimum number of egg masses.

Number of eggs per genotype

There was significant difference in the number of eggs laid on different genotypes which ranged from
Table 2—Antixenosis parameters of maize genotypes against *Sesamia inferens* under multi-choice & no-choice tests

<table>
<thead>
<tr>
<th>Germplasm</th>
<th>No. of egg masses/germplasm</th>
<th>No. of egg masses/Plant</th>
<th>No. of eggs/germplasm</th>
<th>No. of eggs/Plant</th>
<th>No. of eggs/egg mass</th>
<th>No. of leaf sheaths oviposited</th>
<th>No. of plants oviposited (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HKI C323</td>
<td>2.61±0.38ab</td>
<td>208.67±39.56ef</td>
<td>76.89±6.35de</td>
<td>31.13±6.5abcdef</td>
<td>3.33±0.33e</td>
<td>66.67±8.33de</td>
<td>105±20</td>
</tr>
<tr>
<td>HKI 164-7-4</td>
<td>2.83±1.16</td>
<td>103.00±8.54abde</td>
<td>45.37±10.52bc</td>
<td>22.62±8.1abde</td>
<td>2.33±0.67</td>
<td>75.00±14.4de</td>
<td>20±4</td>
</tr>
<tr>
<td>HKI 1040-7-5</td>
<td>0.33±0.33a</td>
<td>4.67±4.67d</td>
<td>4.67±4.66d</td>
<td>1.56±1.5a</td>
<td>0.33±0.33a</td>
<td>8.33±8.33c</td>
<td>2±0</td>
</tr>
<tr>
<td>HKI 1040-10-5</td>
<td>2.33±2.33ab</td>
<td>17.33±17.33abcd</td>
<td>17.33±17.33abcd</td>
<td>2.48±2.4abde</td>
<td>1.00±1.00c</td>
<td>8.33±8.33c</td>
<td>2±0</td>
</tr>
<tr>
<td>HKI 1040-11-7</td>
<td>9.33±1.76d</td>
<td>38.00±9.76ab</td>
<td>112.33±19.1f</td>
<td>37.29±9.1e</td>
<td>3.33±0.33c</td>
<td>91.67±8.33e</td>
<td>2±0</td>
</tr>
<tr>
<td>E57(0)</td>
<td>3.50±1.25b</td>
<td>227.67±16.15f</td>
<td>85.78±8.9ef</td>
<td>38.29±8.9ef</td>
<td>2.33±0.88bde</td>
<td>66.67±8.33de</td>
<td>2±0</td>
</tr>
<tr>
<td>WNZPBTTL6</td>
<td>0.67±0.67bc</td>
<td>8.67±8.67a</td>
<td>4.33±4.33a</td>
<td>4.33±4.33abcde</td>
<td>0.33±0.33a</td>
<td>16.67±16.67b</td>
<td>1±0</td>
</tr>
<tr>
<td>E60(FCOJ</td>
<td>2.58±0.65b</td>
<td>96.33±45.75abde</td>
<td>32.58±7.76abde</td>
<td>13.71±3.7abde</td>
<td>1.67±0.67</td>
<td>66.67±8.33de</td>
<td>2±0</td>
</tr>
<tr>
<td>AEB(Y)C5 55-1</td>
<td>2.00±0.57f</td>
<td>24.67±9.83bc</td>
<td>23.50±10.89bc</td>
<td>7.44±4.7abcde</td>
<td>1.00±0.58</td>
<td>33.33±8.33ab</td>
<td>1±0</td>
</tr>
<tr>
<td>AEB(Y)C3 34-1</td>
<td>0.83±0.44a</td>
<td>18.33±15.43abc</td>
<td>10.17±7.37abde</td>
<td>10.22±5.4f</td>
<td>0.33±0.33ab</td>
<td>58.33±16.6f</td>
<td>1±0</td>
</tr>
<tr>
<td>HKI PC4B</td>
<td>3.33±2.52</td>
<td>91.00±33.29ab</td>
<td>40.56±8.62abde</td>
<td>9.14±11.8gbcde</td>
<td>3.00±0.57</td>
<td>66.67±8.33de</td>
<td>2±0</td>
</tr>
<tr>
<td>E505R-2/1</td>
<td>2.50±0.76</td>
<td>113.67±12.54abde</td>
<td>75.17±18.48bcde</td>
<td>34.49±11.0gde</td>
<td>0.67±0.33ab</td>
<td>44.33±29.49b</td>
<td>2±0</td>
</tr>
<tr>
<td>HKI C323</td>
<td>2.17±0.60</td>
<td>66.33±7.67f</td>
<td>38.56±14.31f</td>
<td>2.33±0.88bde</td>
<td>80.56±10.01de</td>
<td>25.00±0.00f</td>
<td>1±0</td>
</tr>
<tr>
<td>HKI164-7-4 ER3</td>
<td>2.50±0.57f</td>
<td>30.33±10.10hbc</td>
<td>22.44±13.12abcde</td>
<td>1.67±0.33abcde</td>
<td>16.67±8.33bc</td>
<td>66.67±8.33de</td>
<td>2±0</td>
</tr>
<tr>
<td>PFSR S3</td>
<td>1.33±0.88a</td>
<td>22.67±17.09abde</td>
<td>22.47±17.47abde</td>
<td>25.33±7.75f</td>
<td>2.00±0.00e</td>
<td>33.33±8.33ab</td>
<td>2±0</td>
</tr>
<tr>
<td>PFSR R9</td>
<td>3.11±0.94e</td>
<td>125.00±16.25df</td>
<td>45.99±16.2e</td>
<td>18.11±5.8abcd</td>
<td>3.00±0.57</td>
<td>66.67±8.33de</td>
<td>2±0</td>
</tr>
<tr>
<td>Basi Local</td>
<td>2.39±0.05</td>
<td>180.00±36.90ef</td>
<td>28.80±5.4fde</td>
<td>2.67±0.88</td>
<td>66.67±8.33de</td>
<td>27.22±24.04</td>
<td>2±0</td>
</tr>
<tr>
<td>CM 202</td>
<td>1.50±0.5b</td>
<td>133.00±62.88def</td>
<td>66.50±31.44de</td>
<td>3.33±0.33cde</td>
<td>5.40±0.80</td>
<td>15.40±10.95</td>
<td>8±0</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>4.26±2.08</td>
<td>105</td>
<td>46.55</td>
<td>20.58±1.78</td>
<td>1.78</td>
<td>50.40±10.62</td>
<td>1±0</td>
</tr>
</tbody>
</table>

[Mean ± S.E. of three replications. *Mean followed by same letter are statistically at par. **Mean of parameter for twenty genotypes]

13.33 to 243. The genotypes E 37-A(O), HKI C323, PFSR R9, Hyd 05R/2-1 and E 60 (FC) O received 243, 240, 215, 165 and 125 eggs, respectively, while all other genotypes received less eggs and statistically at par. Number of eggs laid per plant, ranges from 13.33 to 88.5 in E9-B and Hyd 05R/2-1 respectively. The genotypes Hyd 05R/2-1, E 37-A (O), Basi Local, HKI C323 and HKI 164-7-4 and PFSR R9 received 88.5, 83.9, 76.3, 76.3 and 73.7 eggs per plant, respectively whereas remaining genotypes received lesser eggs and their number was statistically at par (Table 2).

**Number of eggs per egg mass**

The size of egg mass in terms of number of eggs per egg mass under no-choice test did not vary significantly among the genotypes. Minimum
number of eggs (8.50) was observed in the egg mass laid on genotype HKI 1040-11-7 which was statistically at par with size of egg mass in all other genotypes except E37-A (O) where the highest number of eggs per egg mass (157.77) was recorded (Table 2).

Number of plants and leaf sheaths preferred for oviposition

The percentage of plants chosen for egg laying ranged from 25 to 80.56, the lowest percent of plants being in E30 (25), AEB(Y)C5 55-1 (25) and AEB(Y)C5 34-1 (25) (Table 2). More number of plants of genotype PFSR R9 (80.56%) and Hyd 05R/2-1 (77.78) were chosen for laying eggs indicated the suitability of the genotypes for progeny development.

Least number of sheaths were preferred for oviposition in that the genotypes E5-O, E9-B, E30, AEB(Y)C5 55-1 and AEB(Y)C5 34-1 where only single leaf sheaths was found to be loaded with the eggs. As much as 2.67, 2.33, 2.33 leaf sheaths were used in genotypes E 37-A(O), E60 FC(O) and HKI 1040-10-5, respectively (Table 2).

Correlation among different parameters of antixenosis

Multi-choice test

The results of the correlation among the parameters associated with preference in oviposition observed in 20 maize genotypes are presented in Table 3. The number of eggs per plant was found significantly correlated with other parameters i.e. number of eggs mass per plant (0.712**), number of eggs per egg mass (0.824**), number of plants oviposited (0.750**) and leaf sheaths oviposited (0.682**) in multi-choice test. The average number of eggs per plant showed poor correlation with plant height (0.215) and stem diameter (0.09).

No-choice test

Under no choice conditions, the correlation of number of eggs per plant with number of eggs masses per plant, number of eggs per egg mass, number of leaf sheaths used for oviposition and number of plants oviposited was 0.80**, 0.452** 0.657** and 0.773**, respectively (Table 3).

Differential preference of genotypes for oviposition

The correlation between oviposition parameters studied in multi-choice condition with that of parameters studied in no-choice condition was worked out to assess the differential preference of genotypes for oviposition. The correlation of number of egg mass per plant, number of eggs per plant, size of egg mass, number of leaf sheaths oviposited and number of plants oviposited in multi choice test with the corresponding parameters observed in no-choice test were 0.406, 0.597, 0.324, 0.299 and 0.428, respectively (Table 4).

The relative preference in oviposition (Fig. 1) of genotypes in terms of average number of eggs per plant showed that the genotypes E9-B, E37-A(O), AEB(Y)C5 55-1, AEB(Y)C5 34-1, HKI PC4B, HKI 1040-11-7, PFSR S3 and CM 202 showed similar antixenosis under both the tests. The results indicated that the genotypes E30, WNZPBTL6, E60 FC(O) and HKI 164-7-4 ER-3 were least preferred for oviposition when in multi-choice condition because of

<table>
<thead>
<tr>
<th>Antixenotic parameters</th>
<th>Plant height</th>
<th>Stem diameter</th>
<th>No. of egg masses/plant</th>
<th>No. of eggs/plant</th>
<th>No. of eggs/Egg mass</th>
<th>No. of leaf sheaths oviposited</th>
<th>Percent plants oviposited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant height (1.0)</td>
<td>0.799**</td>
<td>0.082</td>
<td>0.215</td>
<td>0.095</td>
<td>0.0129</td>
<td>0.106</td>
<td>0.106</td>
</tr>
<tr>
<td>Stem diameter (1.0)</td>
<td>-0.178</td>
<td>1.0</td>
<td>0.712**</td>
<td>0.292</td>
<td>0.824**</td>
<td>0.526*</td>
<td>0.526*</td>
</tr>
<tr>
<td>No. of egg masses/plant</td>
<td>-0.09</td>
<td>0.712**</td>
<td>1.0</td>
<td>0.824**</td>
<td>1.0</td>
<td>0.750**</td>
<td>0.750**</td>
</tr>
<tr>
<td>No. of eggs/Egg mass</td>
<td>0.292</td>
<td>0.767**</td>
<td>0.682**</td>
<td>0.526*</td>
<td>1.0</td>
<td>0.817**</td>
<td>0.817**</td>
</tr>
<tr>
<td>No. of leaf sheaths oviposited</td>
<td>-0.129</td>
<td>-0.254</td>
<td>0.767**</td>
<td>0.682**</td>
<td>0.526*</td>
<td>1.0</td>
<td>0.817**</td>
</tr>
<tr>
<td>Percent plants oviposited</td>
<td>0.106</td>
<td>-0.145</td>
<td>0.643**</td>
<td>0.750**</td>
<td>0.652**</td>
<td>0.817**</td>
<td>1.0</td>
</tr>
</tbody>
</table>

[Table 3—Correlation among different antixenotic parameters under choice tests]

[* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.001 level (2-tailed)*]
preference hierarchy but when the same genotypes were offered under no-choice condition, the female off loads some of its eggs on these genotypes under duress. The least preference of the genotypes E9-B, AEB(Y)C5 55-1, AEB(Y)C5 34-1, HKI 1040-11-7 and PFSR S3 for oviposition under multi-choice as well as in no-choice conditions confirm their significant antixenotic expression. The variable ovipositional behaviour of these genotypes resulted in 0.59** correlation between average number of eggs per plant in multi-choice and no-choice test (Table 4).

**Discussion**

Antixenosis by allelochemicals or morphological traits makes the plant refractory to pest when it comes in contact with the host without affecting the metabolism of both the pest and the plant. It includes the potential plant-characteristics/traits that impair or alter insect behaviour towards the host preference in such a way to lessen the chances of using a host plant for oviposition\(^9\), food, damage or shelter by the insects\(^10\). The oviposition deterrents from plants also play an important role in cues that inhibit egg laying and thus survival of phytophagous insects\(^11\).

In multi-choice test situation, the females were in the company of several males, thereby getting better choice of male selection for mating. This is likely to improve their reproductive potential as compared to no-choice test, wherein the females may be constrained to mate with the single male made available for mating. In such situation, there may be lack of synchrony in reproductive maturity and fitness, etc. might play negative role. This is evident from the means of each parameters of all the genotypes, such as number of egg masses laid which was 4.26 in multi-choice against 3.63 in no-choice test; number of eggs per genotype was 105 in multi-choice against 93.7 in no-choice test. Similarly, in cases of number of leaf sheaths and the number of plants used for oviposition, the preference of females

<table>
<thead>
<tr>
<th>Choice test</th>
<th>Antixenotic parameters</th>
<th>No. of egg masses/plant</th>
<th>Av. no. of eggs/plant</th>
<th>No. of eggs/egg mass</th>
<th>No. of leaf sheaths oviposited</th>
<th>No. of plants oviposited (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi choice</td>
<td>Egg masses/plant</td>
<td>0.406</td>
<td>0.558*</td>
<td>0.453*</td>
<td>0.36</td>
<td>0.481*</td>
</tr>
<tr>
<td></td>
<td>Eggs/plant</td>
<td>0.550*</td>
<td>0.597**</td>
<td>0.490*</td>
<td>0.638**</td>
<td>0.572**</td>
</tr>
<tr>
<td></td>
<td>Eggs/Egg mass</td>
<td>0.470*</td>
<td>0.494*</td>
<td>0.324</td>
<td>0.555*</td>
<td>0.433</td>
</tr>
<tr>
<td></td>
<td>Leaf sheaths oviposited</td>
<td>0.201</td>
<td>0.464*</td>
<td>0.436</td>
<td>0.299</td>
<td>0.299</td>
</tr>
<tr>
<td></td>
<td>Plants oviposited</td>
<td>0.383</td>
<td>0.490*</td>
<td>0.418</td>
<td>0.506*</td>
<td>0.428</td>
</tr>
</tbody>
</table>

[* Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.001 level (2-tailed)*]
in multi-choice test was better than in no-choice test situation (Table 2).

Since the pest gets biochemical cues from the host plants, in two different types of test situations, the biochemical cues might greatly influence the ovipositional behaviour of gravid females. In multi-choice test, the pool of genotypes offers the blend of volatile biochemicals where as in no choice test the volatiles are from one specific genotype. In the former case, the blend of volatile may blur the specific antixenosis attributes of the genotypes where as in no-choice test, the antixenosis attributes of genotypes is properly expressed. Further in multi-choice test, the females have choice to reject the plant with undesired traits but in no-choice test, females may have to lay the eggs unwillingly on the available plants of such genotype. The variable number of eggs and egg masses on the genotypes may also be because of the host suitability for offspring development as the females are assumed to maximize the fitness of their offspring by ovipositing on high-quality hosts.

The trend of number of eggs per plant (Fig. 1) under both the test conditions indicated relatively less preference of genotypes E9-B, HKI 1040-11-7, WNZPBTL6, AEB(Y)C5 55-1, AEB(Y)C5 34-1 and PFSR S3. The genotypes have displayed highest level of antixenosis in terms of minimum number of plants oviposited, minimum number of leaf sheaths used for oviposition, least number and smallest size of egg mass. The genotypes E9-B, AEB(Y)C5 55-1 and PFSR S3 have recorded strong antibiosis in terms of prolonged larval period of Sesamia inferens in earlier studies. On the contrary, the genotype E37-A(O), HKI C323, PFSR R9, E4-C displayed lowest level of antixenosis in terms of high number of egg load and maximum number of leaf sheaths used for oviposition. The genotypes WNZPBTL6, E9-B and HKI 1040-11-7-14 received 4.33, 4.67 and 5.33 eggs per plant respectively in multi-choice test situation but under no-choice test, they received 42, 13 and 14 eggs per plant, respectively. The moths might have rejected these genotypes to other available genotypes in multi-choice because of preference hierarchy but under no-choice condition, the female was constrained to shed its eggs willingly on the available genotype. The results are supported by the findings of Sailaja et al. who reported that the genotype, Madhuri was less preferred (44.0 eggs per plant) under choice test but received more eggs (119.4 eggs per plant) under no choice conditions while studying the differential preference of ten maize genotypes to S. inferens. The poor egg laying on E4-C, E 50, E57 (O) and HKI 104010-5 in no choice test in spite of good number of eggs on these germplasms in multi-choice test, may be attributed to the effect of volatiles which get concentrated in the enclosed environment of oviposition cage. The same volatile effect may get masked in the presence of volatile mixtures in the multi-choice test. Sekhar et al. (2009) observed significant differences between the genotypes with respect to total number of S. inferens eggs laid/plant and attributed this differential egg laying to non-preference of the genotypes by the ovipositing females.

Number of eggs per plant has significant correlation in both multi choice and no choice situation with number of egg mass per plant (0.712 and 0.808); with number of eggs per egg mass (0.824 and 0.452); with number of plants oviposited (0.750 and 0.773, respectively). Number of eggs per egg mass has significantly high correlation coefficient (0.652) with number of plants oviposited in multi choice test but the correlation was not significant (0.415) in no choice test. The gravid female in no choice test, if encounters a resistant plant, is likely to lay few eggs in an egg mass and may become disinterested in egg laying and attempt fewer plants for oviposition. This phenomenon is displayed in germplasm E9B and HKI 1040-11-7. The female, when encounters a susceptible plant, may lay more number of eggs per egg mass (E37-A (O), HKI C323 and PFSR R9) hence no correlation was observed in no choice test. The above explanation is also reflected in E 37-A(O) and E4C where minimum number of leaf sheath were oviposited but maximum number of eggs (112) were laid.

The genotypes E30, WNZPBTL6, E60 FC(O) and HKI 164-7-4 ER-3 displaying antixenosis in terms of number of eggs per plant in multi choice but not in no choice (Fig. 1) need to be studied for their antibiotic reaction as well. The genotypes E9-B, AEB(Y)C5 55-1, AEB(Y)C5 34-1, HKI 1040-11-7 and PFSR S3 showing least preference in oviposition under both the test situations can be the potential sources of antixenotic resistance mechanism in maize.

**Conclusion**

The differential reaction of genetically diverse maize genotype for oviposition by gravid females of *S. inferens* reveals that that antixenosis is an important component in determining resistance/susceptibility status of maize germplasm against pink stem borer.
Being the first line of defense against pink stem borer attack, the differential ovipositional responses in maize genotypes can be used to formulate a susceptibility index which will strengthen the present germplasm screening programme for pink stem borer resistance. The results suggest the need to identify the physiochemical factors involved in host plant selection by pink borer for oviposition.

References