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# Stability of Brinjal hybrids against fruit borer infestation in Gujarat

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**Abstract**
Forty-eight Brinjal hybrids were evaluated along with their fourteen parents for fruit borer infestation at three different locations (environments) of Sardarkrushinagar Dantiwada Agricultural University; located in three different districts, during late *rabi* 2021-22 in RBD. The significant G × E interactions for fruit borer infestation revealed that the genotypes had linear response to environmental change, while significant pooled deviation suggested that deviation from linear regression also contributed substantially towards the differences in the stability of genotypes. Further, linear and non-linear components contributed significantly to the differences in stability among the genotypes tested. From the point of view of resistance to fruit borer infestation, three hybrids *viz*., Ph-9 × GAOB-2, ABSR-2 × GRB-5 and Arka Komal × GAOB-2 were identified as most widely adapted hybrids on the basis of stability parameters. Thus, these hybrids could be used for resistance breeding and for exploitation of hybrid vigour in Brinjal.

**Keywords:** Fruit borer infestation, G × E, stability, *Solanum melongena*

## Introduction
The Brinjal (*Solanum melongena* L.) is one of the important indigenous vegetables grown all over India. This crop is attacked by more than 70 pests of which fruit borer (*Leucinodes orbonalis* Guenee) causes maximum damage to the fruit throughout the country and the total loss due to this has been estimated up to 70 percent. Because the population growth of *L. orbonalis* is triggered by high humidity and moderate temperature (Shukla and Khatri, 2010) [1], the damage caused by the pest varies from location to location and season to season. Due to lack of resistant varieties/hybrids, the farmers depend mostly on chemicals like carbaryl, quinalphos, Endosulfan and synthetic pyrethroids to control this serious pest. But development of resistant varieties/hybrids to this pest is an economical and long last way to limit the threat. Hence, the present investigation was initiated to isolate Brinjal hybrids, lines and testers with least incidence of fruit borer in various environments (locations).

## Materials and Methods
The experimental material comprised of 48 hybrids generated from 8 lines (Arka Komal, Ph-6, Ph-9, PPL, JDNB-16-1, ISD-006, $CO_2$ and ABSR 2) and six testers (GOB 1, GAOB 2, GAB 6, GRB 5, Arka Harshita and P. Anupam) by adopting line × tester mating design. The 14 parents and 48 hybrids were evaluated for fruit borer infestation using RBD with three replications during late *rabi* 2021-22 at three different locations, *viz*. (i) Horticulture Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University (S.D.A.U.), Sardarkrushinagar, District: Banaskantha ($E_1$) (ii) Seed Spices Research Station, S.D.A.U., Jagudan, District: Mehsana ($E_2$) (iii) Maize Research Station, S.D.A.U., Bhiloda, District: Aravalli ($E_3$).
Each genotype was grown in a single row plot at a spacing of 90 cm × 60 cm. Recommended cultural practices were followed to raise good crop in a given crop season. Data were recorded for fruit borer infestation (%) on five randomly selected competitive plants. In each picking, the total numbers of fruits of five randomly selected plants were first counted. Then, the numbers of fruits infested by fruit borer were counted and percent fruit borer infestation was calculated and averaged out. The data were analyzed on the basis of mean performance over all the environments as per the stability model suggested by Eberhart and Russell (1966) [2].

## Results and Discussion

Pooled analysis of variance (Table 1) revealed the presence of wide genetic variability among the genotypes. Significant mean square estimate due to environments (seasons) indicated substantial difference between the testing environments affecting the performance of the genotypes. The significant mean square due to genotype × environment (G × E) interaction indicated that the genotypes interacted considerably with the environments for expressing of both the characters and variable response of genotypes to changing environments. This result is in consonant with Sidhu (1989) [3], Mishra *et al*. (1998) [4], Mohanty and Prusti (2000) [5], Krishna Prasad *et al*. (2002) [6] and Vaddoria *et al*. (2009) [7].

**Table 1:** Analysis of variance over the environment for stability for fruit borer infestation in Brinjal

| Source | D.F. | Value |
|---|---|---|
| Genotype | 61 | 7.28**++ |
| Environment | 2 | 375.29**++ |
| G × E | 126 | 5.09**++ |
| Env. + (G ×E) | 124 | 11.06**++ |
| Env. (Lin) | 1 | 750.59**++ |
| G × E (Lin) | 61 | 7.95**++ |
| Pooled deviation | 62 | 2.20** |
| Pooled error | 366 | 0.08 |

*,** Significant at 5 and 1 percent level, respectively when tested against pooled error mean square for all the sources
+, ++ significant at 5 and 1 percent level, respectively when tested against pooled deviation mean square for all the sources
Figures in parenthesis "[ ]" showing degree of freedom of each source of variation

Partitioning of Env. + (G × E) mean square showed that environments (linear) differed significantly and were quite diverse in their effects on the performance of the genotypes. Higher magnitude of mean square due to environment (linear) compared with the G × E (linear) indicated that the linear response of the environment accounted for the major part of the total variation for the character which further substantiated that the environmental effects and their major influence on fruit borer infestation in Brinjal were quite real in nature. Significant mean squares due to pooled deviation suggested that the deviation from linear regression contributed substantially towards the differences in stability of genotypes. This suggested that predictable as well as unpredictable components were involved in the differential response of stability.

The non-linear components of G × E interaction (pooled deviation) was significant against pooled error. This suggested that predictable as well as unpredictable components were involved in the differential response of stability for this trait. Similar results were reported by Rai *et al*. (1998) [8], Prasad *et al*. (2002) [9], Chaudhari *et al*. (2015) [10] and Sivakumar *et al*. (2017) [11].

Environmental indices for fruit borer infestation are presented in the Table 2. The result suggested variable response of the environments to the different traits studied. Rao (2003) [12], Vaddoria *et al*. (2009) [7] and Sivakumar *et al*. (2017) [11] in Brinjal also reported the same results. It was observed that Bhiloda (E3) was favourable for fruit borer infestation. While Sardarkrushinagar (E1) was found to be the most unfavourable for it.

**Table 2:** Environmental index for fruit borer infestation under various environments in Brinjal

| Locations (Environments) | Environmental Index |
|---|---|
| Sardarkrushinagar | 2.79 |
| Jagudan | -0.91 |
| Bhiloda | -1.88 |

A perusal of Table 3 indicated that, for fruit borer infestation, out of sixty-two genotypes, thirty genotypes recorded significant deviation from regression ($S^2d_i$) which showed that its performance cannot be predicted. Among hybrids, three hybrids [Ph-9 × GAOB-2 (2.28%), ABSR-2 × GRB-5 (2.30%) and Arka Komal × GAOB-2 (2.33%)] registered nearly unit regression coefficient ($b_i$) values, lower mean (desirable) and non-significant value of deviation from regression therefore, considered to be widely adaptable to different environments with average stability.

**Table 3:** Stability parameters for fruit yield per plant, plant spread and fruit borer infestation in Brinjal

| Sr. No. | Genotypes | Fruit borer infestation | | |
|---|---|---|---|---|
| | | $\mu_i$ (%) | $b_i$ | $S^2d_i$ |
| 1. | Arka Komal | 5.85 | 2.927++ | 1.428** |
| 2. | Ph-6 | 2.47 | 0.757 | 0.495** |
| 3. | Ph-9 | 5.20 | 2.740++ | 1.067** |
| 4. | PPL | 2.92 | 1.403++ | 0.121 |
| 5. | JDNB-16-1 | 1.96 | 0.777++ | -0.065 |
| 6. | ISD-006 | 4.60 | 1.818++ | -0.008 |
| 7. | CO2 | 2.37 | 1.213 | 0.782** |
| 8. | ABSR-2 | 2.18 | 1.049 | 0.252* |
| 9. | GOB-1 | 4.73 | 1.802++ | 0.774** |
| 10. | GAOB-2 | 4.22 | 1.887++ | -0.050 |
| 11. | GAB-6 | 2.11 | 1.203 | 0.687** |
| 12. | GRB-5 | 5.41 | 3.104++ | 2.311** |
| 13. | Arka Harshita | 2.22 | 0.447++ | 0.061 |
| 14. | P. Anupam | 2.64 | 1.432 | 1.063** |
| 15. | Arka Komal × GOB-1 | 2.15 | 0.835++ | -0.053 |
| 16. | Arka Komal × GAOB-2 | 2.33 | 0.891 | 0.211 |
| 17. | Arka Komal × GAB-6 | 2.47 | 1.496 | 1.001** |
| 18. | Arka Komal × GRB-5 | 1.52 | 0.302++ | 0.082 |
| 19. | Arka Komal × Arka Harshita | 2.00 | 0.661++ | 0.058 |
| 20. | Arka Komal × P. Anupam | 1.44 | 0.441++ | 0.120 |

| | | | | |
|---|---|---|---|---|
| 21. | Ph-6 × GOB-1 | 4.75 | -0.034 | 28.300** |
| 22. | Ph-6 × GAOB-2 | 3.60 | 1.315++ | -0.027 |
| 23. | Ph-6 × GAB-6 | 2.21 | 0.181++ | -0.071 |
| 24. | Ph-6 × GRB-5 | 4.56 | 2.287++ | 2.692** |
| 25. | Ph-6 × Arka Harshita | 3.79 | 1.379 | 0.519** |
| 26. | Ph-6 × P. Anupam | 1.90 | 0.596++ | 0.055 |
| 27. | Ph-9 × GOB-1 | 10.27 | 3.374+ | 10.799** |
| 28. | Ph-9 × GAOB-2 | 2.28 | 0.925 | 0.008 |
| 29. | Ph-9 × GAB-6 | 4.16 | -0.642 | 52.841** |
| 30. | Ph-9 × GRB-5 | 3.24 | 0.927 | 0.503** |
| 31. | Ph-9 × Arka Harshita | 2.58 | 0.018 | 4.047** |
| 32. | Ph-9 × P. Anupam | 1.43 | 0.583++ | -0.011 |
| 33. | PPL × GOB-1 | 1.21 | 0.197++ | 0.062 |
| 34. | PPL × GAOB-2 | 2.54 | 1.468 | 1.056** |
| 35. | PPL × GAB-6 | 1.59 | 0.480++ | -0.054 |
| 36. | PPL × GRB-5 | 2.19 | 0.102 | 2.731** |
| 37. | PPL × Arka Harshita | 1.89 | 0.462++ | -0.072 |
| 38. | PPL × P. Anupam | 1.47 | 0.358++ | 0.101 |
| 39. | JDNB-16-1 × GOB-1 | 2.88 | 0.892 | 0.089 |
| 40. | JDNB-16-1 × GAOB-2 | 2.79 | 0.569++ | 0.150 |
| 41. | JDNB-16-1 × GAB-6 | 2.37 | 1.093 | 0.229* |
| 42. | JDNB-16-1 × GRB-5 | 4.76 | 1.789++ | 0.048 |
| 43. | JDNB-16-1 × Arka Harshita | 3.15 | 1.445++ | -0.051 |
| 44. | JDNB-16-1 × P. Anupam | 2.32 | 1.202 | 0.549** |
| 45. | ISD-006 × GOB-1 | 3.05 | -0.186 | 10.946** |
| 46. | ISD-006 × GAOB-2 | 5.84 | 2.577++ | 0.170 |
| 47. | ISD-006 × GAB-6 | 2.12 | 0.578++ | -0.054 |
| 48. | ISD-006 × GRB-5 | 1.18 | 0.484++ | 0.129 |
| 49. | ISD-006 × Arka Harshita | 3.41 | 0.509 | 1.026** |
| 50. | ISD-006 × P. Anupam | 2.64 | 1.258+ | 0.049 |
| 51. | CO2 × GOB-1 | 1.72 | 0.713 | 0.247* |
| 52. | CO2 × GAOB-2 | 1.81 | 0.375+ | 0.813** |
| 53. | CO2 × GAB-6 | 1.10 | 0.446++ | 0.030 |
| 54. | CO2 × GRB-5 | 2.05 | 1.011 | 0.559** |
| 55. | CO2 × Arka Harshita | 2.76 | 1.632 | 1.348** |
| 56. | CO2 × P. Anupam | 1.69 | 0.813+ | -0.005 |
| 57. | ABSR-2 × GOB-1 | 1.97 | 0.730 | 0.337* |
| 58. | ABSR-2 × GAOB-2 | 1.40 | 0.535++ | -0.070 |
| 59. | ABSR-2 × GAB-6 | 0.56 | 0.163++ | -0.068 |
| 60. | ABSR-2 × GRB-5 | 2.30 | 0.978 | 0.124 |
| 61. | ABSR-2 × Arka Harshita | 2.10 | 1.153 | 0.275* |
| 62. | ABSR-2 × P. Anupam | 1.84 | 0.078++ | 0.904** |
| | Mean | 2.81 | 1.000 | |
| | S.Em.± | 1.05 | 0.426 | |

* and**: significant at 5 and 1 percent levels of significance, respectively as tested as $b_i$/S.E. of $b_i$
+ and ++: significant deviation of bi from unity at 5 and 1 percent levels of significance, respectively as tested as 1-$b_i$/S.E. of $b_i$

One hybrid [ISD-006 × P. Anupam (2.64%)] registered significantly higher regression coefficient than unity, lower mean (desirable) and deviation from regression nearly zero. This condition reflects less than average stability of genotypes which means hybrid was sensitive to environmental changes but adaptable to favourable environments.

Total two parents [JDNB-16-1 (1.96%) and Arka Harshita (2.22%)] and eighteen hybrids registered significantly lower regression coefficient than unity, lower mean (desirable) and deviation from regression nearly zero. This condition reflects more than average stability of genotypes with adaptable nature to poor environments. Top three hybrids with these conditions were ABSR-2 × GAB-6 (0.56%), CO2 × GAB-6 (1.10%) and ISD-006 × GRB-5 (1.18%). Rai *et al*. (2000) [13]; Sharma *et al*. (2000) [14] and Singh (1983) [15] had suggested the utilization of stable and potential genotypes in breeding programmes for incorporation of stability.

## Conclusion

By studying all the genotypes, it can be concluded that, for the resistance to fruit borer infestation, three hybrids *viz*., Ph-9 × GAOB-2, ABSR-2 × GRB-5 and Arka Komal × GAOB-2 were identified as most widely adapted hybrids on the basis of stability parameters. Thus, these hybrids could be used for resistance breeding and for exploitation of hybrid vigour in Brinjal.

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