PHENOTYPIC STABILITY ANALYSIS IN BACTERIAL WILT RESISTANT LINES OF BRINJAL (*Solanum melongena* L.)

By

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THESIS

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DECLARATION

I hereby declare that this thesis entitled 'Phenotypic stability analysis in [illegible] bacterial wilt resistant lines of brinjal (<u>Solanum melongena</u> L.)' is a bonafide record of research work done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

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CERTIFICATE

Certified that this thesis entitled 'Phenotypic stability analysis in bacterial wilt resistant lines of brinjal (*Solanum melongena* L.)' is a record of research work done independently by Miss. Ushamani, P. under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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To the fond memory of

my grandpa

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Introduction

INTRODUCTION

Crop productivity is the function of its adaptability, while adaptability is a compromise of fitness (stability) and flexibility. Stability may, in fact, depend on holding certain morphological and physiological attributes steady and allowing others to vary, resulting in predictable genotype x environment interaction for the ultimate trait, yield. A population which can adjust its genotypic or phenotypic state in response to environmental fluctuations in such a way that it gives high and stable economic return can be termed "well buffered" (Singh and Singh, 1980).

The reasons for yield stability often are unclear. Physiological, morphological and phenological mechanisms which impart stability are many and diverse. Mechanisms of yield stability fall into four categories; genetic heterogeneity, yield component compensation, stress tolerance and capacity to recover rapidly from stress (Heinrich _et. al._, 1983).

Brinjal (_Solanum melongena_ L.) is one of the most important warm season fruit vegetables grown throughout India. Many varieties were evolved in this crop, for higher yield and pest and disease resistance. There is need to identify phenotypically stable line(s) which could be recommended for cultivation in marginal lands, fertile lands and also in areas of stress, with no substantial reduction in performance. Work on these aspects are rather limited in brinjal. The present investigation was formulated with the following objectives:

(i) To classify the 26 lines of brinjal possessing resistance to bacterial wilt into groups suited for low, marginal, average and high yielding environments.

(ii) To attribute reasons for the stability of line(s), if any, and to identify stable lines with desirable fruit characteristics.

(iii) To estimate components of variability in the 26 lines which could be made use of in crop improvement programme.

(iv) To evaluate the lines for levels of resistance to bacterial wilt and root knot nematode.

(v) To study root characters and establish relation, if any, with yield.

Review of Literature

REVIEW OF LITERATURE

Parameters of genotype x environment (G x E) interaction are useful to measure adaptability and stability in crop plants. Information on stability of performance is vital in production and resistance breeding programmes. A number of attempts are made to assess the extent of G x E interaction in many of the crops.

Earlier methods of analysing G x E interaction were associated with the linear regression approach. This was first introduced by Mooers (1921) and was later given prominence by Yates and Cochran (1938) who used the mean performance of all genotypes in an environment as a suitable index of the environmental productivity. This did not provide necessary information on the interaction of individual varieties with individual environment, essential for the recommendation of varieties to different agroclimatic zones. Finlay and Wilkinson (1963) used the regression technique to find out the yield stability of barley genotypes, although they claimed that better fits were obtained with log transformed yield values. In assessing stability, they observed that a simple comparison of regression slopes was not enough; the overall yield level of a genotype also had to be considered. The slope of the regression line for each genotype was, accordingly, plotted against its mean yield over all environments. Genotypes with a slope nearing 1.0 and a high mean yield were regarded as being well adapted to all environments. As mean yield decreases, genotypes with high or low slopes were regarded as being specifically adapted to favourable or unfavourable environments respectively.

Eberhart and Russell (1966) also used the regression approach. They regarded deviation from regression as another important component of varietal stability, a stable variety being one with a regression line of unit slope, deviation from regression tending to zero, and a higher mean performance. Perkins and Jinks (1968) proposed that a regression of G x E interaction on environmental index should be obtained rather than the regression of mean performance on the environmental index. Tai (1971) used an essentially similar technique as that of Eberhart and Russell (1966). He employed an alternative method of fitting, using maximum likelihood estimates of a structural relationship, where an appropriate joint normal distribution was assumed. Based on the principle of structural relationship analysis, the G x E interaction effect of a variety is partitioned into two components.

They are the linear response to environmental effects, which is measured by a statistic $\hat{\alpha}$, and the deviation from the linear response, $\hat{\lambda}$. A perfectly stable variety has $(\alpha, \lambda) = (-1, 1)$ and a variety with average stability $(\alpha, \lambda) = (0, 1)$.

Ram *et.al*. (1970) proposed phenotypic index as a parameter to estimate stability. Chaudhury *et. al*. (1972) proposed adaptability index as a better and reliable estimate of phenotypic stability. Lewis (1954) suggested 'stability factor' (SF) as a simple measure of phenotypic stability. It is given by $SF = \frac{\bar{X}\ HE}{\bar{X}\ LE}$ where $\bar{X}$ HE and $\bar{X}$ LE are the mean values in the high and low yielding environments respectively. A value of 'unity' for the stability factor indicates maximum phenotypic stability. Genotypes with SF further away from unity can be considered unstable. This measure does not take the variability of the genotypes over the varying environments into account.

Plaisted and Peterson (1959) adopted the procedure of obtaining combined analysis of variance at all locations for each pair of varieties and computed variety x location component of variance for each pair. Mean value of this variance component was then taken as a measure of stability. The variety with the smallest mean was the most stable. The major drawback of this procedure is that computation becomes tedious with increased number of varieties.

Wricke (1966) developed a method to estimate the ecovalence (W_i) of genotypes grown over several environments, to measure the stability of performance. Ecovalence (W_i) is the percentage contribution of the i^{th} genotype to the G x E interaction sum of squares. The varieties with smaller W_i values were considered stable. This method allows the partitioning of the G x E interaction sum of squares into components attributable to the different genotypes, but it does not allow the prediction of the performance of genotypes over environments.

Abou-El-Fittouh <u>et</u>. <u>al</u>. (1969) applied cluster analysis to classify locations used in variety trials in the U.S.A. They used a distance coefficient and a correlation coefficient as a dissimilarity measure and a variable group clustering strategy. Hanson (1970) proposed that relative stability be measured as the euclidian distance of a genotype from the linear response of an ideal stable genotype in a space whose coördinate axes were environments and whose origin was the genotypic mean. The linear response of the stable ideal genotype is an arbitrary fraction of the average linear response of all genotypes. Hanson (1970) also proposed that comparative stability between genotypes be measured as euclidian distance between genotypes in the same space as defined for the determination of relative stability. This method gives full information on the relative magnitude of variation among genotypes but no information on similarity. Mungomery et. al. (1974), utilized cluster analysis to group genotypes on the basis of similarity. Similarity was defined as euclidian distance between genotypes in the space whose coördinate axes were environments and whose origin was zero. This method gives full information on similarity of response but no information on mean differences or magnitude of variation. Johnson (1977) developed an analysis providing full information on hybrid similarity and stability of response to environments. Genotypic similarity was defined as the euclidian distance between genotypes in the space whose coördinate axes were the number of locations. The cluster analysis arranged the lines into groups which were differentiable in terms of mean and stability.

Geometrical methods aim to represent each object (genotype or environment) by a point in some euclidian space so that objects which are similar to one another are represented by points which are close together. The configuration of points is then investigated in an attempt to detect any underlying structure. Thus, unlike cluster analysis, no structure is forced on the data. (Westcott, 1986).

Reports on G x E interaction and estimation of stability parameters are very few in solanaceous vegetables especially in brinjal. Andronicescu et. al. (1962) observed that ecological conditions effected the expression of heterosis in tomato. Ognyanova (1970) noted that growth period being a stable character in tomato was not influenced by variation in weather conditions. Peter and Rai (1976) studied 25 varieties of tomato and found that days to fruit maturity, primary branches/plant and inflorescences/plant were phenotypically stable characters. They also reported that the tomato varieties HS 101, S5 First, Momor and Marglobe were suited for high yielding environments while Pusa Early Dwarf, Roma and B 2247 grew well in poor environments. Kalloo and Pandey (1979) also observed that HS 101 was a highly stable variety. Olalde et. al. (1983) observed the effect of G x E interaction in 18 tomato varieties introduced from four countries, evaluated in three areas in three years. The most stable varieties were Nova 1 (Italy) and Campbell 28 (U.S.A). Sharma (1983) conducted stability analysis of 15 tomato varieties grown in Punjab. Sweet 72 and Angurlata were suited to high yielding environments. Stofella et. al. (1983) worked on stability differences for yield in fresh market tomatoes. Ten lines were evaluated. G x E interactions were significant for weight and number of fruits. Varieties Burgis, Castlehy 1035 and Duke were stable and suited to high yielding conditions while the cultivar Flora Dade was suited to low yielding environments. Chong et. al. (1984) studied the effects of genotype, environment and their interaction on biological earliness in tomato and found that effects of these three parameters were significant, the effect of environment being the greatest. Konstantinova et. al. (1984) observed that genotypes with exclusively Lycopersicon esculentum genetic background were more stable than those with Lycopersicon pimpinellifolium in their pedegree. Sharma and Nandpuri (1984) studied the stability of 15 tomato varieties in Punjab. Punjab Chouhara, Punjab Kesri and Punjab Tropic were considered stable.

The varietal trials under All India Co-ordinated Vegetable Improvement Project on round fruited varieties of brinjal identified T_3 and Arka Navneet to be high yielding (1977-78). During 1980-82, trials conducted at Indian Institute of Horticultural Research, Bangalore on long fruited brinjal indicated Arka Sheel and H_4 to be superior. Varietal trial conducted at Kerala Agricultural University, Vellanikkara showed that SM-6 and PBr 129-5 ranked high for yield in both the seasons and their performances were at par. Trials at Haryana Agricultural University, Hissar (1983) identified Azad Kranti (long brinjal) and PBr 91-2 and K 202-9 (round brinjal) for north-central regions.

Implications of Genetic divergence

Multivariate analyses utilising Mahalanobis D^2 statistics and canonical variate analysis (Rao, 1952) are useful to quantify the degree of divergence in the germplasm of various crop plants.

In tomato, genetic divergence was studied by Sachan and Sharma (1971). They worked with 20 varieties obtained from diverse geographical sources and grouped them into four distinct clusters. Genetic divergence was not observed to be related with geographical diversity.

Peter (1975) grouped 25 tomato varieties into nine clusters. They found Roma, an exotic introduction, genetically the most divergent from other exotic and indigenous lines. Cuartero *et. al*. (1983) grouped 28 varieties of green pepper, based on 22 characters into three groups. They found varieties with common parentage in same clusters.

Most studies on phenotypic stability are conducted in cereal crops. Published information are available only in a few vegetables. This study aimed to select stable lines from a set of 26 lines of brinjal known for their resistance to bacterial wilt.

Materials and Methods

MATERIALS AND METHODS

The present studies were conducted during two crop seasons, June-October, 1985 and November-May, 1985-86, in the Instructional Farm of Kerala Agricultural University, Vellanikkara. This farm is located at an altitude of 23 m. above MSL and is between 10°32" N and 76°16" E. It enjoys a warm humid tropical climate.

Experimental materials

The materials comprised of 26 lines of brinjal, resistant to bacterial wilt. Twenty five of the above lines were derived from SM-6, a highly segregating line reported resistant to bacterial wilt (Gopalakrishnan and Gopalakrishnan, 1985). The lines were evolved through mass, pureline, single plant and single seed descent method of selection practiced continuously for six generations. (Sheela, 1982; Asha Sankar, 1984; Jessykutty, 1985). Resistance of the selected lines was assured through growing in wilt sick soil and looking for plants unaffected and healthy. The genotype, pedigree and morphological descriptions of the lines are given in Table 1.

Experimental design

The 26 lines were grown in a randomised block design with two replications. Two contrasting environments,

Table 1. The genotype and Pedigree of the 26 Brinjal lines

Genotype		Pedigree	
1.	SM 6-6 PL	SM 6-npr/g^1/0^+-1-1-1-1	(ⓧ)
2.	SM 6-6 SP	SM 6-npr/g^1/0^+-1-1-1-1	(x)
3.	SM 6-6 M	SM 6-npr/g^1/0^+-1-1-1-1	(xx)
4.	SM 6-6 SSD	SM 6-npr/g^1/0^+-1-1-1-1	(SSD)
5.	SM 6-11 M	SM 6-npr/g^1/0 -1-1-1-1	(xx)
6.	SM 6-4 SP	SM 6-npr/g/0^+-1-1-1-1	(x)
7.	SM 6-4 M	SM 6-npr/g/0^+-1-1-1-1	(xx)
8.	SM 6-4 PL	SM 6-npr/g/0^+-1-1-1-1	(ⓧ)
9.	SM 6-4 SSD	SM 6-npr/g/0^+-1-1-1-1	(SSD)
10.	SM 6-9 SP	SM 6-npr/g/0 -1-1-1-1	(xx)
11.	SM 6-3 PL	SM 6-npr^+/g/0^+-1-1-1-1	(ⓧ)
12.	SM 6-3 SP	SM 6-npr^+/g/0^+-1-1-1-1	(xx)
13.	SM 6-3 SSD	SM 6-npr^+/g/0^+-1-1-1-1	(SSD)
14.	SM 6-8 PL	SM 6-npr^+/g/0 -1-1-1-1	(ⓧ)
15.	SM 6-8 M	SM 6-npr^+/g/0 -1-1-1-1	(xx)
16.	SM 6-8 SSD	SM 6-npr^+/g/0 -1-1-1-1	(SSD)
17.	SM 6-2 SP	SM 6-npr/g^+/0^+-1-1-1-1	(x)
18.	SM 6-2 M	SM 6-npr/g^+/0^+-1-1-1-1	(xx)
19.	SM 6-1 PL	SM 6-npr^+/g^+/0^+-1-1-1-1	(ⓧ)
20.	SM 6-1 SP	SM 6-npr^+/g^+/0^+-1-1-1-1	(x)
21.	SM 6-1 M	SM 6-npr^+/g^+/0^+-1-1-1-1	(xx)
22.	SM 6-7 PL	SM 6-npr/g^+/0 -1-1-1-1	(ⓧ)
23.	SM 6-7 SP	SM 6-npr/g^+/0 -1-1-1-1	(x)
24.	SM 6-7 M	SM 6-npr/g^+/0 -1-1-1-1	(xx)
25.	SM 6-7 SSD	SM 6-npr/g^+/0 -1-1-1-1	(SSD)
26.	PPC	npr/g^+/0^+	

npr - non-prickly; npr^+ - prickly

g^+ - purple; g - green; g^1 - white

0^+ - long; 0 - oval

(ⓧ) - Pure line selection

(x) - Single plant selection

(xx) - mass selection

(SSD) - single seed descent

high and low fertile, were developed in each of the two seasons. The high fertile environment was created through use of farmyard manure (20 t/ha) and a higher fertilizer dose of N, P_2O_5 and K_2O (75:40:25 kg/ha). The low fertile environment was developed with no application of farmyard manure and a reduced dose of fertilizer (37.5:20:12.5 kg/ha). There were two rows of length 7.5 m for each genotype/replication. Spacing was 75 cm x 60 cm. Ten plants were labelled randomly and observations recorded on these plants. The quantitative characters observed were days to flower, days to harvest, plant height, primary branches/plant, percentage of productive flowers, fruits/plant, average fruit weight and yield/plant.

Statistical analysis

a) Analysis of variance

Before proceeding with the detailed statistical analysis for the estimation of stability parameters, all the characters observed in each environment and in each season were analysed separately for the analysis of variance as described by Ostle (1966).

$$y_{ij} = \mu + t_i + b_j + e_{ij} \qquad i = 1 \ldots\ldots 26$$
$$j = 1 \ldots\ldots 2$$

Where,

y_{ij} = Performance of i^{th} variety in j^{th} block;

μ = General mean;

t_i = True effect of i^{th} variety;

b_j = True effect of j^{th} block and

e_{ij} = Random error. Restrictions are

$$\sum_{i=1}^{26} t_i = 0 \text{ and } \sum_{j=1}^{2} b_j = 0$$

The actual break up of the total variance into variance due to replications, varieties and error and their expectations are given in Table 2.

Table 2. Analysis of variance of the design

Source	df	Mean squares Observed	Mean squares Expected
Total	51		
Between replications	1	M_1	
Between genotypes	25	M_2	Error variance + (number of replications x genotypic variance)
Error	25	M_3	Error variance

b) Estimation of variability

Variability existing in the 26 lines for yield and its components were estimated as suggested by Burton (1952). The formula used in the estimation of genotypic, phenotypic and environmental levels are as follows.

(i) Genotypic coefficient of variation (gcv) =

$$\frac{\text{Genotypic standard deviation}}{\text{Mean}} \times 100$$

(ii) Phenotypic coefficient of variation (pcv) =

$$\frac{\text{Phenotypic standard deviation}}{\text{Mean}} \times 100$$

(iii) Environmental coefficient of variation (ecv) =

$$\frac{\text{Environmental standard deviation}}{\text{Mean}} \times 100$$

(iv) Standard error of mean =

$$\frac{\text{Environmental standard deviation}}{(\text{Number of replications})^{\frac{1}{2}}}$$

The above estimates of genotypic, phenotypic and environmental standard deviations were obtained by solving the following equations from the respective analysis of variance table for different characters.

M_3 = Error variance

M_2 = Error variance + (replications x genotypic variance)

$$\text{Genotypic variance} = \frac{M_2 - M_3}{\text{Number of replications}}$$

Phenotypic variance = Genotypic variance + error variance

c) Estimation of stability parameters and genotype x environment interactions.

The homogeneity of error variances in different environments was tested using Bartlett's test. Unweighted analysis of variance of the data was carried out in cases where the errors were homogeneous, to test the G x E interaction (Panse and Sukhatme, 1954). Weighted analysis was done in cases where the error variance was heterogeneous. (Table 3).

Table 3. Weighted analysis of variance of the pooled data

Source	df	SS
Total	St-1	$\sum_{j=1}^{S} W_j S_j - C$
Environments	S-1	$\frac{1}{t} \sum_{j=1}^{S} W_j P_j^2 - C$
Genotypes	t-1	$\frac{\sum_{i=1}^{t} (\sum_{j=1}^{S} W_j Y_{ij})^2}{\sum_{j=1}^{S} W_j} - C$
G x E interaction (I)	(S-1)(t-1)	Total SS - Environments SS - Genotypes SS

where $W_j = \frac{r}{s_j^2}$ $\quad s_j^2$ = Error mean square in the j^{th} environment

r = Number of replications in each environment

S = Number of environments

t = Number of genotypes

S_j = Crude SS for j^{th} environment

P_j = Total for the j^{th} environment

$$C = \frac{G^2}{t \sum_{j=1}^{S} W_j} \qquad G = \sum_{j=1}^{S} W_j P_j$$

Significance of G x E interaction was tested using the χ^2 test,

$$\chi^2 = \frac{(n-4)\ (n-2)}{n\ (n+t-3)} I \qquad \text{with df} = \frac{(s-1)\ (t-1)\ (n-4)}{(n+t-3)}$$

I = Interaction SS

n = Number of degrees of freedom on which error mean square was based in each environment.

Rank correlation : It is used to find the existance of G x E interaction. Here, the varieties are arranged in descending order of magnitude of the character, yield in the different environments, and the correlation measured using the formulae,

$$rs = 1 - \frac{6 \sum_{i=1}^{N} di^2}{N^3 - N} \quad \text{where,}$$

di = difference in the ranks of a particular genotype in the two environments

N = Total number of observations

This is compared with the table value and if found non significant, we can conclude the existance of interaction.

Once the G x E interaction was significant, stability of each genotype was assessed from the mean performance over the different environments using the following models.

1. Eberhart and Russell model (ER model)

$$Y_{ij} = \mu_i + b_i I_j + \delta_{ij} ,$$

where

μ_i = Mean of i^{th} variety over all environments,

b_i = Regression coefficient that measures the response of the i^{th} variety to varying environments,

I_j = Environmental index, obtained as deviation of the mean of all varieties at the j^{th} environment from the grand mean, and δ_{ij} = Deviation from regression of the i^{th} variety in the j^{th} environment.

I_j is obtained as,

$$I_j = \sum_{i=1}^{t} \frac{Y_{ij}}{t} - \sum_{i=1}^{t} \sum_{j=1}^{S} \frac{Y_{ij}}{st} \qquad \begin{array}{l} i = 1 \ldots\ldots 26 \\ j = 1 \ldots\ldots 4 \end{array}$$

So that, $\sum_{j=1}^{S} I_j = 0$

The two parameters of stability under this model are,

$$b_i = \frac{\sum_{j=1}^{S} Y_{ij}.I_j}{\sum_{j=1}^{S} I_j^2}$$

$$Sd_i^2 = \sum_{j=1}^{S} \frac{\delta_{ij}^2}{S-2} - \frac{Se^2}{r}$$

where $\sum_{j=1}^{S} \delta_{ij}^2 = \sigma_{V_i}^2 - b_i \sum_{j=1}^{S} Y_{ij} I_j$

$$\sigma_{V_i}^2 = \sum_{j=1}^{S} Y_{ij}^2 - \frac{Y_{i.}^2}{S}$$

$$b_{i}. \sum_{j=1}^{S} Y_{ij}.I_j = \frac{\left(\sum_{j=1}^{S} Y_{ij}.I_j\right)^2}{\sum_{j=1}^{S} I_j^2}$$

The detailed analysis of variance is given in Table 4.

Table 4. Analysis of variance under ER model

Source	df	SS	MS
Total	st-1	$\sum_{i=1}^{t}\sum_{j=1}^{S} Y_{ij}^2 - CF$	
Varieties	t-1	$\frac{1}{S}\sum_{i=1}^{t} Y_{i.}^2 - CF$	MS_1
Environment + Varieties x Environment	(S-1)+(t-1)(S-1)	$\sum_{i=1}^{t}\sum_{j=1}^{S} Y_{ij}^2 - \sum_{i=1}^{t}\frac{Y_{i.}^2}{S}$	
Environment (linear)	1	$\frac{1}{t}\frac{\sum_{j=1}^{S} Y_{ij}I_j)^2}{\sum_{j=1}^{S} I_j^2}$	
Variety x Environment (linear)	(t-1)	$\sum_{i=1}^{t}\frac{\left(\sum_{j=1}^{S} Y_{ij}I_j\right)^2}{\sum_{j=1}^{S} I_j^2}$ - SS due to environment (linear)	MS_2
Pooled deviation	t (S-2)	$\sum_{i=1}^{t}\sum_{j=1}^{S} \delta_{ij}^2$	MS_3
Variety 1	(S-2)	$\sum_{j=1}^{S} {}_1\delta_{ij}^2$	
⋮		⋮	
Variety t	(S-2)	$\sum_{j=1}^{S} {}_t\delta_{ij}^2$	
Pooled error	S(t-1)r-1)		$\frac{Se^2}{r}$

The following 'F' tests were made use of:

(1) $F = \frac{MS_2}{MS_3}$, to test the equality of regression coefficients

(2) $F = \sum_{j=1}^{S} \frac{\delta_{ij}^2/(S-2)}{Se^2}$, to test the individual deviation from regression.

A variety with unit regression coefficient ($b_i = 1$) and Sd_i^2 not significantly different from zero ($Sd_i^2 = 0$) could be considered as stable. To test whether the regression coefficients of individual varieties differed significantly from unity, the following 't' test was applied.

$$t = \frac{b_i - 1}{SE\ (b)}$$

where $SE\ (b) = \left[\frac{\text{MS due to pooled deviation}}{\sum_{j=1}^{S} I_j^2} \right]^{\frac{1}{2}}$

2. Perkins and Jinks model (PJ model).

$Y_{ij} = \mu + d_i + E_j + g_{ij} + e_{ij}$, where,

μ = grand mean of all genotypes over all environments

d_i = additive genetic effect of the i^{th} genotype

E_j = additive environmental effect of the j^{th} environment

g_{ij} = G x E interaction effect of the i^{th} genotype at the j^{th} environment.

The effects are defined as follows:

$$\mu = \frac{Y_{..}}{St}$$

$$d_i = \frac{Y_{i.}}{S} - \mu$$

$$E_j = \frac{Y_{.j}}{t} - \mu$$

$$g_{ij} = Y_{ij} - d_i - E_j + \mu$$

The regression coefficient under this model is nothing but that in ER model reduced by unity. Sd_i^2 remains exactly same as that of the ER model.

The analysis of variance under this model, adopting earlier notations is given in Table 5.

Table 5. Analysis of variance under PJ model

Source	df	SS
Genotypes	t-1	$\sum_{i=1}^{t} \frac{Y_{i.}^2}{S} - \frac{Y_{..}^2}{St}$
Environments (joint regression)	S-1	$\sum_{j=1}^{S} \frac{Y_{.j}^2}{t} - \frac{Y_{..}^2}{St}$
Genotype x Environment intersection (G x E)	(t-1)(S-1)	$\sum_{i=1}^{t} \sum_{j=1}^{S} Y_{ij}^2 - \sum_{i=1}^{t} \frac{Y_{i.}^2}{S} - \sum_{j=1}^{S} \frac{Y_{.j}^2}{t} + \frac{Y_{..}^2}{St}$
Heterogeneity among regressions	t-1	$\sum_{i=1}^{t} \frac{\left[\sum_{j=1}^{S} Y_{ij}\left(\frac{Y_{.j}}{t} - \frac{Y_{..}}{st}\right)\right]^2}{\sum_{j=1}^{S} I_j^2}$ - SS due to environment
Remainder	(t-1)(S-2)	SS due to G x E - SS due to heterogeneity
Error	S(t-1)(r-1)	$\frac{Se^2}{r}$

Here the G x E interaction SS is partitioned into two components, viz., heterogeneity among regressions with (t-1) df and remainder SS with (t-1)(S-2)df.

The environments (joint regression) SS with (S-1) df in this case is the same as the environments (linear) SS of ER model, with df = 1. Similarly, SS due to heterogeneity among regressions in this case is equal to the variety x environment (linear) SS of ER model, both with df = (t-1). The pooled deviation SS with t(S-2) df in the former case is equal to the remainder SS with (t-1)(S-2) df in this case.

3. Estimation of Phenotypic index (P_i)

Ram et. al. (1970) proposed phenotypic index as a better and the easiest estimate of phenotypic stability.

$$P_i = \frac{P_{ij}}{S}$$

where P_{ij} = difference between individual mean performance of i^{th} genotype in j^{th} environment and overall mean performance of all the genotypes in j^{th} environment.

S = Number of environments

4. Estimation of Adaptability index (A_i)

Chaudhury et. al. (1972) proposed adaptability index (A_i) for each genotype across all the environments.

It was estimated as

$$A_i = \sum_{j=1}^{S} \frac{A_{ij}}{S}$$

where $$A_{ij} = \frac{\bar{Y}_{ij}}{Y_{.j}} \times 100 - 100$$

$$\bar{Y}_{ij} = Y_{.j} + b_i I_j$$

The estimations of regression coefficient (b_i) and environmental index I_j are same as in ER model.

5. Wricke ecovalence ratio

Wricke (1966) suggested ecovalence ratio as the percentage contribution of a genotype to the SS due to G x E interaction.

Ecovalence for i^{th} genotype is

$$W_i = \sum_{j=1}^{S} (Y_{ij} - \frac{Y_{i.}}{S} - \frac{Y_{.j}}{t} + \frac{Y_{..}}{St})^2$$ expressed

as percentage of the total of all W_i's.

A variety having the least ecovalence was termed the most stable and a variety with large ecovalence value the least stable. A method was suggested by Laly John (1984) to form different groups of genotypes so that the G x E interaction is not significant within any group, but significant between any two groups. The genotypes within a group are considered having same stability or similar response to differing environments.

Component compensation analysis

Correlation coefficients were worked out between stability parameters (b_i's) for yield and its components to identify marker character(s) whose stability leads to yield homeostasis. Direct and indirect effects of component characters were estimated by the path-coefficient analysis, suggested by Dewey and Lu (1959). The following set of simultaneous equations were formed and solved to estimate the direct and indirect effects.

$$r_{1y} = P_{1y} + r_{12}P_{2y} + r_{13}P_{3y} + r_{14}P_{4y} + r_{15}P_{5y}$$

$$r_{2y} = P_{2y} + r_{21}P_{1y} + r_{23}P_{3y} + r_{24}P_{4y} + r_{25}P_{5y}$$

$$r_{3y} = P_{3y} + r_{31}P_{1y} + r_{32}P_{2y} + r_{34}P_{4y} + r_{35}P_{5y}$$

$$r_{4y} = P_{4y} + r_{41}P_{1y} + r_{42}P_{2y} + r_{43}P_{3y} + r_{45}P_{5y}$$

$$r_{5y} = P_{5y} + r_{51}P_{1y} + r_{52}P_{2y} + r_{53}P_{3y} + r_{54}P_{4y}$$

Where r_{1y} to r_{5y} denote coefficient of correlation between component characters (2= Primary branches/plant, 1= Plant height, 3 = Percentage of productive flowers, 4 = Fruits/plant and 5 = Average fruit weight) and yield homeostasis (y), r_{12} to r_{54} denote coefficient of correlation among all possible combinations of component characters, P_{1y} to P_{5y} denote direct effects of component characters on y.

The above equation is written in a matrix form shown as

$$\underset{A}{\begin{bmatrix} r_{1y} \\ r_{2y} \\ r_{3y} \\ r_{4y} \\ r_{5y} \end{bmatrix}} \quad \underset{B}{\begin{bmatrix} 1 & r_{12} & r_{13} & r_{14} & r_{15} \\ & 1 & r_{23} & r_{24} & r_{25} \\ & & 1 & r_{34} & r_{35} \\ & & & 1 & r_{45} \\ & & & & 1 \end{bmatrix}} \quad \underset{C}{\begin{bmatrix} P_{1y} \\ P_{2y} \\ P_{3y} \\ P_{4y} \\ P_{5y} \end{bmatrix}}$$

B matrix was inverted and this inverted matrix was multiplied by A matrix to obtain path coefficients.

Residual factor which measures the contribution of rest of the characters of the easual scheme, was obtained as given

Residual factor $h = (1 - R^2)^{\frac{1}{2}}$

where $R^2 = P^2_{1y} + P^2_{2y} + P^2_{3y} + P^2_{4y} + P^2_{5y} +$

$2P_{1y}\, r_{12}\, P_{2y} + 2P_{1y}\, r_{13}\, P_{3y} + 2P_{1y}\, r_{14}\, P_{4y} +$

$2P_{1y}\, r_{15}\, P_{5y} + 2P_{2y}\, r_{23}\, P_{3y} + 2P_{2y}\, r_{24}\, P_{4y} +$

$2P_{2y}\, r_{25}\, P_{5y} + 2P_{3y}\, r_{34}\, P_{4y} + 2P_{3y}\, r_{35}\, P_{5y} +$

$2P_{4y}\, r_{45}\, P_{5y}$

d) Analysis of genetic divergence

The genetic divergence existing among 26 lines was measured by Mahalanobis D^2 statistics and canonical variate analysis. The calculation of D^2 values involved the following steps (Murthy and Arunachalam, 1967).

a) The vector of means of different characters for each line and the common dispersion matrix was estimated.

b) This mean vectors in (a) were transferred to a new set of vectors of means of uncorrelated characters (Y's) by the method of pivotal condensation.

c) The D^2 between i^{th} and j^{th} variety for K characters was calculated as $D^2ij = \sum_{t=1}^{K} (Y_{it} - Y_{jt})^2$. The K component D-squares were calculated separately and added to get D^2ij.

d) Treating 'D' as the generalised statistical distance, all populations were grouped into a number of clusters. A computer oriented iterative algorithm for formation of clusters was used. (i) The two genotypes having maximum D^2 value between them were selected, they are the nuclei of the two clusters. (ii) Each genotype was considered in turn and allocated to the cluster for which its D^2 value with the nucleus genotype was minimum.

(iii) To increase the number of clusters by one the maximum D^2 within the above two clusters was found and the genotypes having maximum D^2 was considered as the nuclei in addition to the nucleus genotype of the remaining clusters. The genotypes were re-assigned as in (ii). To decide the optimum number of clusters, a graph was drawn with weighted arithmetic mean of average intracluster D^2 values against the number of clusters. The point just beyond the maximum curvature was taken as the optimum number of clusters to be formed (Suresh, 1986).

The computational method of canonical variate analysis involved the following steps (Arunachalam, 1967). Eigen vectors corresponding to the largest two eigen values was obtained. The principal components corresponding to these two vectors were generated for each variety from the uncorrelated mean values (Y's) and termed as Z_1 and Z_2. Z_1 and Z_2 values were computed for each variety. A scatter diagram was drawn with the 26 lines by taking Z_1 on X-axis and Z_2 on Y-axis.

e) Correlation (r) between yield and root characteristics

Simple correlations (r) were worked out between root characters, root length and volume with fruit yield.

f) Evaluation for wilt resistance

Wilt resistance was evaluated by spot planting a highly susceptible variety of brinjal - PPL with the 26 lines in a compact plot. Observations were recorded on number of healthy plants where PPL wilted.

g) Observations on root galls caused by *Meloidogyne incognita*

All the 26 lines of brinjal were evaluated for presence/absence of root galls caused by *M. incognita*. The plants were uprooted after the last harvest, roots were washed free of soil and observed for the presence/absence of galls.

h) Survey on preferences for fruit shape and color in brinjal

A survey was conducted to find out preferences for shape and color in brinjal. A total of 311 people responded to the proforma. The format given for marking the opinion was:

Vegetable	Color	Shape
Brinjal	1. Purple	1. Long
	2. Green	2. Oval
	3. White	3. Round

Results

RESULTS

The data recorded in the present study were analysed and the results are presented:

A. Estimation of variability in brinjal

B. Phenotypic stability analysis

C. Analysis of genetic divergence

D. Observations on bacterial wilt resistance and studies on root characteristics

A. Estimation of variability in brinjal

Before proceeding with the detailed statistical analysis, an analysis of variance was conducted for all the characters recorded in each environment in each season. The 26 brinjal lines exhibited highly significant differences for all characters studied. The differences were significant at 1% level (Table 6). This indicated that there were inherent genetic differences among the brinjal lines evaluated.

The extent of variability present for yield and its components were measured in terms of range, mean and coefficient of variation, at genotypic, phenotypic and environmental levels (Table 7). Considerable variations for all the characters under study were

Table 6. Analysis of variance for yield and its compoents in Brinjal

Source of variation	df		Mean squares: Days to fruit set	Days to harvest	Plant height (cm)	Primary branches/ plant	Percentage of productive flowers	Fruits/ plant	Average fruit weight (g)	Yield/ plant (g)
Replications	1	E_1	131.94	118.06	84.17	0.49	1.97	83.89	124.42	12238.15
		E_2	104.19	90.25	71.80	0.29	37.84	218.24	573.41	1118617.00
		E_3	9.41	3.38	780.91	1.79	3.38	565.29	133.11	1364339.00
		E_4	237.13	109.56	848.00	0.21	6.84	566.50	67.08	1031576.00
Genotypes	25	E_1	92.24*	57.58*	247.62**	0.50*	755.62**	41.33**	167.12**	89544.05**
		E_2	199.64*	66.71**	160.01**	0.71**	645.64**	46.36**	116.65**	74395.48**
		E_3	20.78**	51.37**	191.50**	1.29**	804.06**	154.46**	124.89**	238314.68**
		E_4	30.04**	76.77**	139.43**	1.47**	761.63**	54.85**	110.44**	65041.32**
Error	25	E_1	40.19	26.47	44.23	0.27	12.87	8.15	15.97	23840.63
		E_2	45.95	25.23	36.50	0.27	12.38	4.78	17.25	13328.68
		E_3	5.56	13.88	54.30	0.18	90.36	40.15	14.01	68955.74
		E_4	8.42	18.30	45.29	0.14	73.25	15.35	13.50	14179.56

E_1 = High fertile environment during June-October 1985
E_2 = Low fertile environment during June-October 1985
E_3 = High fertile environment during November-May 1985-86
E_4 = Low fertile environment during November-May 1985-86

* p = 0.05
** p = 0.01

Table 7. Range, mean, genotypic (gcv), phenotypic (pcv) and environmental coefficients of variation (ecv) with respect to yield and its components

Components of variation		Days to first fruit set	Days to harvest	Plant height (cm)	Primary branches/ plant	Percentage of productive flowers	Fruits/ plant	Average fruit weight (g)	Yield/ plant (g)
Range	E_1	71.00-116.90	101.00-131.60	39.70-91.74	4.60-7.30	14.75-86.07	10.69-35.90	30.31-76.68	601.30-1564.00
	E_2	72.40-113.30	102.00-135.00	37.40-77.58	3.70-6.60	16.13-83.43	5.40-34.20	27.34-66.37	237.70-1543.00
	E_3	85.30-99.78	99.44-121.40	41.33-95.57	3.67-7.30	25.00-100.00	12.50-54.11	17.46-64.97	346.25-2668.78
	E_4	85.60-100.56	99.20-129.78	36.86-91.40	3.00-7.20	25.15-100.00	4.38-30.80	15.85-58.55	141.00-1090.89
Mean	E_1	86.87±4.48	110.52±3.64	63.04±4.70	5.91±0.37	40.54±2.54	18.68±2.02	59.85±2.54	1099.88±109.18
	E_2	91.75±4.79	114.11±3.55	51.44±4.27	5.20±0.37	51.44±4.27	15.69±1.55	49.47±2.94	728.36±81.64
	E_3	99.63±1.67	109.70±2.63	67.24±5.21	5.96±0.30	67.24±5.21	28.90±4.41	37.93±2.65	1161.62±185.68
	E_4	96.35±2.05	113.34±3.02	62.01±4.76	4.94±0.27	62.01±4.76	17.91±2.79	36.97±2.65	639.34±84.20
gcv	E_1	5.87	3.57	16.00	5.72	47.54	21.81	14.53	16.48
	E_2	6.62	3.99	15.28	9.03	45.58	29.06	14.25	14.25
	E_3	2.98	3.95	12.32	12.51	32.71	26.16	19.63	25.05
	E_4	3.41	4.77	11.06	16.52	32.13	24.82	18.83	24.94
pcv	E_1	9.37	5.87	19.16	10.50	48.35	26.63	15.99	17.52
	E_2	9.92	5.94	19.27	13.46	46.46	32.24	16.54	21.65
	E_3	3.92	5.21	16.49	14.40	36.62	35.11	21.97	33.63
	E_4	4.55	6.08	15.50	18.18	35.38	33.08	21.30	93.08
ecv	E_1	7.30	4.66	10.55	8.80	8.85	15.28	6.68	14.04
	E_2	7.39	4.40	11.75	9.99	9.14	13.93	8.39	8.40
	E_3	2.55	3.40	10.96	7.13	16.46	21.92	9.87	22.61
	E_4	3.01	3.77	10.85	7.60	14.82	21.88	9.94	18.63

observed. The range for days to first fruit set was 71 (SM 6-8 PL) to 116.90 (SM 6-1 PL); days to harvest 99.20 (SM 6-6 PL) to 135.0 (SM 6-3 PL); plant height 36.86 cm (SM 6-7 PL) to 95.57 cm (SM 6-2 SP); primary branches/plant 3.0 (SM 6-6 SP) to 7.30 (PPC); percentage of productive flowers 14.75 (SM 6-11 M) to 100 (PPC); fruits/plant 5.40 (SM 6-1 M) to 54.11 (SM 6-6 PL); average fruit weight 15.85 g (PPC) to 76.68 g (SM 6-3 SP) and yield/plant 141.0 g (SM 6-6 SP) to 2668.78 g (SM 6-4 M). The highest estimate of genotypic coefficient of variation (gcv) was observed for percentage of productive flowers (47.54) followed by fruits/plant (29.06). The gcv was the lowest (2.98) for days to fruit set. The data indicated considerable variability for fruits/plant and fruit yield/plant.

B. Phenotypic stability analysis

1. Pooled analysis of variance

Pooled analysis of variance was done for all the quantitative characters. No significant genotype x environment (G x E) interaction was noted for days to fruit set and days to harvest. G x E interactions were significant at 1% level for plant height, primary branches/plant, percentage of productive flowers, fruits/plant, average fruit weight and yield/plant.

The association between two environments have been worked out with the help of rank correlation. Non significant rank correlation coefficients were obtained in all the cases. (Table 8)

Table 8. Rank correlation between varieties in different environments based on yield

Environments between which correlations were obtained	Coefficient of correlation
E_1 and E_2	0.279 NS
E_1 and E_3	0.030 NS
E_1 and E_4	0.042 NS
E_2 and E_3	0.146 NS
E_2 and E_4	0.020 NS
E_3 and E_4	0.072 NS

NS : Not significant

2. Pooled analyses of variance for stability

The analysis of variance of the pooled data under Eberhart and Russell (ER model) is given in Table 9. The pooled deviation was significant at 1% level when compared against pooled error for plant height, primary branches/plant; percentage of productive flowers;

Table 9. Pooled analysis of variance for yield and its components (ER model)

Source of variation	Mean squares: Plant height (cm)	Primary branches/ plant	Percentage of productive flowers	Fruits/plant	Average fruit weight (g)	Yield/plant (g)
Genotypes	249.01**	0.86**	1328.40**	70.52**	198.125**	75465.92**
Environment (linear)	3253.96	20.52	7155.10	2653.65	9090.48	39985840.00
Env.+(Geno.x Env.)	83.73	0.62	141.44	59.05	135.70	102109.03
Geno. x Env. (linear)	36.33	0.42	33.42	43.91**	32.12**	42476.32
Pooled deviation	40.36**	0.34**	41.99**	16.47**	9.95	55674.34**
Pooled error	22.54	0.11	23.61	9.05	7.59	15038.08

* p = 0.05
** p = 0.01

fruits/plant and yield/plant. The G x E (linear) interaction was significant at 1% level for fruits/plant and average fruit weight.

The analysis of variance under Perkins and Jinks (PJ model) is given in Table 10. Remainder term was significant at 1% level for plant height, percentage of productive flowers, fruits/plant and yield/plant and significant at 5% level for primary branches/plant and non significant for average fruit weight. Heterogenity among regressions was significant at 1% level for fruits/plant and average fruit weight and non significant for all characters when compared to the remainder part.

The ranking of lines based on Wricke's ecovalence ratio 'W_i' could be used as a clue for grouping them so that interaction within any group was non significant and that between any two groups was significant. The split up of the interaction SS in to between and within groups are given in Table 11 and Appendixes V, VI, VII, VIII and IX.

Table 10. Pooled analysis of variance for yield and its components (PJ model)

Source of variation	Mean squares					
	Plant height	Primary branches/ plant	Percentage of product-ive flowers	Fruits/plant	Average fruit weight (g)	Yield/plant
Lines	249.01**	0.86**	1328.40**	70.52**	198.12**	75465.92**
Environment (Joint regression)	1174.65	6.84	2385.03	2653.65	9090.48	39985840.00
Line x environment	76.69	0.76	75.41	60.38	42.07	98150.66
Heterogenity between regression	36.33	0.42	33.42	43.91**	32.12**	42476.32
Remainder	41.97**	0.352*	43.67**	17.13**	10.35	57901.32**
Error	22.54	0.11	23.61	9.05	7.59	15038.08

* p = 0.05

** p = 0.01

Table 11. Split up of interaction SS for yield/plant

Interaction	df	SS	MS	F
[1] within group 1	36	791608.74	21989.13	1.46
[2] within group 2	3	87431.40	29143.80	1.94
[3] within group 3	3	37309.48	12436.49	0.83
[4] within group 4	3	110123.86	36707.95	2.44
[5] within group 5	3	26346.72	8782.24	0.58
Between groups	27	2913099.8	107892.59	7.18**
Total	75	3965920.0	52878.93	3.52**

1 genotypes 16, 20, 26, 3, 14, 1, 12, 22, 8, 17, 19, 4 and 9 comes within group 1

2 genotypes 2 and 18 comes within group 2

3 genotypes 7 and 10 comes within group 3

4 genotypes 5 and 13 comes within group 4

5 genotypes 24 and 23 comes within group 5

** significant at 1% level

Stability parameters for plant height, primary branches/plant, percentage of productive flowers, fruits/plant, average fruit weight and yield/plant were estimated as proposed by Eberhart and Russell (1966), Perkins and Jinks (1968), Ram *et. al.* (1970), Chaudhury *et. al.*(1972) and Wricke (1966).

a) Plant height

Based on the grand mean over all the environments, PPC was the tallest (76.37 cm) and SM 6-6 SP the dwarfest (42.89 cm). Considering b_i 1; $_i$ 0, Sd_i^2 0; P_i -ve A_i -ve and W_i minimum, SM 6-6 (PL, M, and SSD), SM 6-11 M, SM 6-3 (SP, SSD), SM 6-8 (PL and SSD), SM 6-2 M, SM 6-7 (PL, M and SSD) were the stable genotypes. (Table 12).

b) Primary branches/plant

Primary branches/plant was the highest in SM 6-8 M (6.25) and the lowest in SM 6-6 SP (4.34). The lines SM 6-9 SP, SM 6-2 M, SM 6-7 (PL, SP and SSD), were stable. (Table 13).

c) Percentage of productive flowers

Percentage of productive flowers varied widely from 90.41 in PPC to 28.54 in SM 6-11 M. The lines SM 6-6 (PL, M, SP), SM 6-11 M, SM 6-4 (SP, M, PL), SM 6-3 (PL, SP, SSD), SM 6-8 (PL, SSD), SM 6-2 SP, and SM 6-7 M were stable (Table 14).

d) Fruits/plant

Fruits/plant varied from 15.98 in SM 6-8 PL to 31.51 in PPC. The lines SM 6-6 SSD, SM 6-4 SSD, SM 6-9 SP, SM 6-3 SP, SM 6-2 M, SM 6-1 SP and SM 6-7 (SSD, PL and SP) were stable (Table 15). From a graphical representation

Table 12. Stability parameters for plant height

Genotypes	Mean	b_i, i	Sd_i^2	P_i	A_i	W_i
SM 6-6 PL	59.74	0.96 -0.04	17.90	-1.192	-0.04	0.03
SM 6-6 SP	42.89	0.25* -0.75	-21.51	-18.05	-0.01	0.03
SM 6-6 M	60.67	0.85 -0.15	-12.15	-0.26	-0.03	0.01
SM 6-6 SSD	60.17	1.56 0.56	21.84	-0.77	-0.06	0.04
SM 6-11 M	57.58	0.20 -0.80	-16.36	-3.35	-0.01	0.03
SM 6-4 SP	63.19	1.38 0.38	-19.18	2.25	-0.05	0.01
SM 6-4 M	64.55	1.86 0.86	5.00	3.62	-0.07	0.05
SM 6-4 PL	68.82	1.42 0.42	25.74	7.89	-0.05	0.04
SM 6-4 SSD	56.71	0.88 -0.12	100.82**	-4.22	-0.03	0.08
SM 6-9 SP	66.82	0.99 -0.01	-3.04	5.88	-0.04	0.01
SM 6-3 PL	62.42	1.54** 0.54	-22.22	1.49	-0.06	0.01
SM 6-3 SP	60.67	0.67 -0.33	-15.16	-0.26	-0.03	0.1
SM 6-3 SSD	60.46	1.34 0.34	39.80	-0.48	-0.05	0.05
SM 6-8 PL	50.99	1.07 0.07	13.54	-9.94	-0.04	0.02
SM 6-8 M	65.04	1.66 0.66	124.26**	4.10	-0.06	0.12
SM 6-8 SSD	59.82	1.52 0.52	-9.08	-1.11	-0.06	0.02
SM 6-2 SP	65.84	1.17 0.17	-2.74	4.91	-0.04	0.01
SM 6-2 M	49.93	1.05 0.05	-19.18	-11.00	-0.04	0.03
SM 6-1 PL	67.58	-0.48 -1.48	40.06	6.54	0.02	0.14
SM 6-1 SP	71.95	0.79 -0.21	14.68	11.02	-0.03	0.03
SM 6-1 M	71.50	0.71 -0.29	97.45**	10.57	-0.03	0.08
SM 6-7 PL	45.17	0.59 -0.41	-17.43	-15.77	-0.02	0.01
SM 6-7 SP	61.75	1.24 0.24	1.99	0.82	-0.05	0.02
SM 6-7 M	60.13	1.35 0.35	-8.09	-0.81	-0.05	0.02
SM 6-7 SSD	53.53	0.89 -0.11	10.99	-7.41	-0.03	0.02
PPC	76.37	0.62 -0.38	69.25*	15.43	-0.02	0.07

Table 13. Stability parameters for primary branches/plant

Genotypes	Mean	b_i/ $_i$	Sd_i^2	P_i	A_i	W_i
SM 6-6 PL	6.08	1.00 0.00	-0.11	0.58	-0.02	0.00
SM 6-6 SP	4.34	0.84 -0.15	0.38*	-1.16	-0.02	0.04
SM 6-6 M	5.87	0.20 -0.80	-0.05	0.37	0.00	0.02
SM 6-6 SSD	5.41	2.56* 1.56	-0.08	-0.09	-0.05	0.07
SM 6-11 M	5.75	0.27 -0.73	-0.03	0.25	-0.03	0.03
SM 6-4 SP	5.98	1.54 0.54	0.70**	0.48	-0.03	0.07
SM 6-4 M	5.85	1.57 0.57	0.25*	0.35	-0.03	0.03
SM 6-4 PL	6.04	1.57 0.57	0.25*	0.54	-0.03	0.04
SM 6-4 SSD	5.44	0.83 -0.17	0.43**	-0.06	-0.02	0.04
SM 6-9 SP	5.54	0.29 -0.73	0.04	0.04	-0.01	0.03
SM 6-3 PL	6.00	1.16 0.16	0.31*	0.49	-0.03	0.03
SM 6-3 SP	5.13	1.49 0.49	-0.07	-0.38	-0.04	0.01
SM 6-3 SSD	5.14	-0.17 -1.17	0.13	-0.36	0.00	0.06
SM 6-8 PL	4.70	0.75 -0.25	1.09**	-0.81	-0.02	0.09
SM 6-8 M	6.28	-0.66 -1.66	0.46**	0.78	0.02	0.12
SM 6-8 SSD	4.78	1.53 0.53	-0.08	-0.73	-0.04	0.01
SM 6-2 SP	5.11	1.20 0.20	0.70**	-0.40	-0.02	0.06
SM 6-2 M	5.52	1.80 0.80	0.11	0.01	-0.04	0.03
SM 6-1 PL	5.41	0.86 -0.14	0.24*	-0.09	-0.02	0.03
SM 6-1 SP	5.55	0.70 -0.30	0.32*	0.04	-0.01	0.03
SM 6-1 M	5.16	1.10 0.10	0.20	-0.34	-0.02	0.02
SM 6-7 PL	5.71	0.98 -0.02	0.10	0.21	-0.03	0.02
SM 6-7 SP	5.66	0.45 -0.55	-0.05	0.16	-0.01	0.01
SM 6-7 M	5.93	0.22 -0.78	0.20	0.42	0.01	0.04
SM 6-7 SSD	5.37	0.66 -0.34	-0.06	-0.14	-0.02	0.01
PPC	5.35	2.45 1.45	0.60**	-0.15	-0.06	0.11

Table 14. Stability parameters for percentage of productive flowers

Genotypes	Mean	b_i/ $_i$	Sd_i^2	P_i	A_i	W_i
SM 6-6 PL	36.60	1.12 0.12	8.80	-11.40	-0.13	0.02
SM 6-6 SP	34.75	0.33 -0.67	38.36	-13.25	-0.04	0.06
SM 6-6 M	36.50	1.15 0.15	20.76	-11.49	-0.13	0.03
SM 6-6 SSD	42.52	0.42 -0.58	60.68*	-5.48	-0.05	0.07
SM 6-11 M	28.54	1.35 0.35	-20.40	-19.46	-0.16	0.01
SM 6-4 SP	31.64	1.48 0.48	10.18	-16.35	-0.18	0.03
SM 6-4 M	30.34	1.15 0.15	-11.59	-17.66	-0.14	0.01
SM 6-4 PL	31.30	0.07 -0.93	0.51	-16.70	-0.01	0.07
SM 6-4 SSD	52.99	0.46 -0.54	9.43	4.99	-0.06	0.04
SM 6-9 SP	42.39	0.43 -0.57	82.88*	-5.61	-0.05	0.08
SM 6-3 PL	43.92	0.45 -0.55	27.14	-4.03	-0.05	0.05
SM 6-3 SP	43.92	1.76 0.76	-9.46	-4.07	-0.21	0.05
SM 6-3 SSD	45.16	0.98 -0.02	35.70	-2.83	-0.12	0.03
SM 6-8 PL	35.61	1.17 0.17	-18.03	-12.39	-0.14	0.01
SM 6-8 M	39.54	0.28 -0.72	159.15**	-8.46	-0.03	0.13
SM 6-8 SSD	44.30	1.22 0.22	-19.25	-3.69	-0.14	0.01
SM 6-2 SP	36.79	1.48 0.48	0.88	-11.20	-0.18	0.03
SM 6-2 M	67.62	1.29 0.29	-10.30	19.62	-0.15	0.01
SM 6-1 PL	38.99	1.77 0.77	63.10*	-9.01	-0.21	0.09
SM 6-1 SP	84.35	0.83 -0.17	6.64	36.35	-0.10	0.02
SM 6-1 M	87.88	1.41 0.41	-17.30	39.88	-0.17	0.02
SM 6-7 PL	58.85	0.62 -0.38	48.14	10.85	-0.07	0.05
SM 6-7 SP	49.19	1.80* 0.80	-18.73	1.19	-0.21	0.05
SM 6-7 M	38.41	1.13 0.13	6.93	-9.59	-0.13	0.02
SM 6-7 SSD	75.35	0.71 -0.29	43.49	27.35	-0.08	0.04
PPC	90.41	1.14 0.14	-18.00	42.41	-0.13	0.01

Table 15. Stability parameters for fruits/plant

Genotypes	Mean	b_i/ i	Sd_i^2	P_i	A_i	W_i
SM 6-6 PL	30.81	1.36 0.36	9.82	10.47	-0.27	0.03
SM 6-6 SP	16.01	0.72 -0.28	4.52	-4.33	-0.14	0.02
SM 6-6 M	23.31	1.82** 0.82	-8.48	2.97	-0.37	0.04
SM 6-6 SSD	19.54	1.25 0.25	13.40	-0.80	-0.25	0.03
SM 6-11 M	17.83	0.05* -0.95	-7.54	-2.51	-0.01	0.05
SM 6-4 SP	24.94	1.18 0.18	37.57**	4.60	-0.24	0.05
SM 6-4 M	23.55	1.43 0.43	-6.86	3.20	0.29	0.01
SM 6-4 PL	18.17	0.76 -0.24	25.06*	-2.17	-0.15	0.04
SM 6-4 SSD	19.08	0.48 -0.52	-6.84	-1.26	-0.10	0.02
SM 6-9 SP	20.42	1.28 0.28	-1.05	0.08	-0.26	0.01
SM 6-3 PL	18.75	0.13 -0.87	0.30	-4.23	-0.03	0.05
SM 6-3 SP	20.10	0.66 -0.34	0.37	-1.12	-0.13	0.01
SM 6-3 SSD	18.08	-0.12 -1.12	25.64*	-5.02	0.02	0.10
SM 6-8 PL	15.98	0.39 -0.61	-1.14	-4.36	-0.03	0.03
SM 6-8 M	19.36	-0.05 -1.05	23.74*	-0.98	0.01	0.09
SM 6-8 SSD	16.63	1.02 0.02	-7.90	-3.71	-0.21	0.00
SM 6-2 SP	18.81	1.09 0.09	36.19*	-1.53	-0.22	0.05
SM 6-2 M	18.30	1.59 0.59	0.62	-2.04	-0.32	0.03
SM 6-1 PL	18.75	0.67 -0.33	24.01*	-1.59	-0.14	0.04
SM 6-1 SP	20.10	1.15 0.15	2.37	-0.24	-0.24	0.01
SM 6-1 M	18-08	1.99 0.99	12.39	-2.26	-0.40	0.07
SM 6-7 PL	20.47	1.26 0.26	-0.97	0.13	-0.25	0.01
SM 6-7 SP	21.56	1.99 0.99	14.51	1.22	-0.40	0.08
SM 6-7 M	26.42	2.30 1.30	17.32	6.08	-0.46	0.11
SM 6-7 SSD	18.57	0.34 -0.66	0.31	-1.77	-0.07	0.03
PPC	31.51	1.26 0.26	-1.53	11.17	-0.26	0.01

as per ER model, it was observed that the lines SM 6-6 PL and PPC were suitable for above average environmental conditions, and the lines SM 6-6 (SP, SSD), SM 6-4 (M, SSD), SM 6-9 SP, SM 6-3 SP, SM 6-8 PL, SM 6-8 SSD, SM 6-2 M, SM 6-1 SP and SM 6-7 PL were suitable for average conditions (Fig.1).

e) Average fruit weight

It varied from 62.82 g in SM 6-3 SP to 24.33 g in PPC. The stable lines were SM 6-2 SP and SM 6-2 M (Table 16).

f) Yield/plant

The yield/plant ranged from 1208.38 g in SM 6-3 SP to 675.32 g in SM 6-1 M. The stable lines were SM 6-6 M, SM 6-6 SSD, SM 6-4 PL, SM 6-8 PL and SM 6-2 SP (Table 17). The graphical representation showed that the lines SM 6-6 PL and SM 6-3 SP were suited to above average conditions; the lines SM 6-6 M, SM 6-4 PL, SM 6-8 SSD, SM 6-2 SP, SM 6-7 PL and PPC suited to average conditions and the lines SM 6-8 PL and SM 6-1 SP were suited to below average conditions (Fig.2).

Component compensation analysis

There was significant correlation between stability for fruits/plant and primary branches/plant and stability

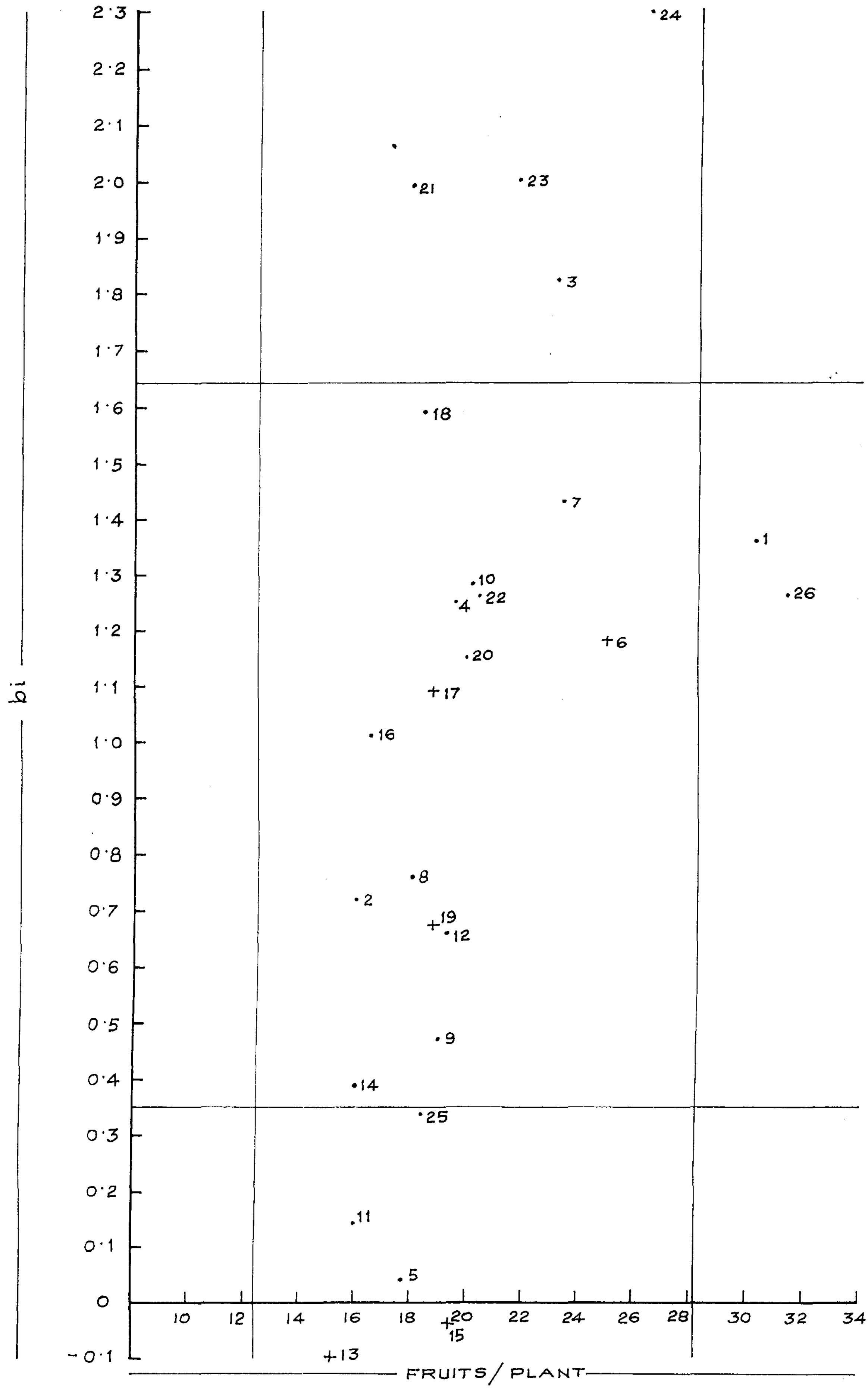


FIG. 1. THE RELATION OF FRUITS/PLANT AND STABILITY OF 26 LINES OF BRINJAL. ESTIMATES OF S^2di WERE SIGNIFICANT ($p = 0{\cdot}05$) ONLY FOR THOSE LINES INDICATED BY +.

Table 16. Stability parameters for average fruit weight

Genotypes	Mean	b_i/ $_i$	Sd_i^2	P_i	A_i	W_i
SM 6-6 PL	36.12	0.89* -0.11	-7.39	-9.87	-0.14	0.00
SM 6-6 SP	52.16	1.52 0.52	22.34*	6.17	-0.23	0.10
SM 6-6 M	39.72	1.27 0.27	4.74	-6.27	-0.20	0.02
SM 6-6 SSD	50.86	1.23 0.23	44.66**	4.87	-0.19	0.02
SM 6-11 M	42.13	0.58 -0.42	-36.42	-3.86	-0.09	0.07
SM 6-4 SP	39.69	0.72 -0.28	-5.84	-6.31	-0.11	0.05
SM 6-4 M	50.10	0.64 -0.36	-27.61	4.11	-0.10	0.04
SM 6-4 PL	49.24	0.55 -0.45	-15.50	3.25	-0.09	0.07
SM 6-4 SSD	52.25	1.17 0.17	-6.59	6.26	-0.18	0.02
SM 6-9 SP	43.93	0.65 -0.35	66.86**	-2.06	-0.10	0.04
SM 6-3 PL	53.97	1.27 0.27	11.12	7.98	-0.20	0.02
SM 6-3 SP	62.82	0.53 -0.47	-25.48	16.83	-0.08	0.08
SM 6-3 SSD	52.10	1.35 0.35	19.68*	6.11	-0.21	0.03
SM 6-8 PL	45.62	0.74 -0.26	-34.05*	-0.37	-0.12	0.07
SM 6-8 M	46.74	1.01 0.01	143.13**	0.75	0.16	0.01
SM 6-8 SSD	48.41	1.06 0.06	-35.27*	2.42	-0.16	0.01
SM 6-2 SP	47.60	0.86 -0.14	-16.89	1.61	-0.13	0.05
SM 6-2 M	45.43	1.36 0.36	-26.32	-0.57	-0.21	0.05
SM 6-1 PL	43.68	1.06 0.06	47.09**	-2.32	-0.16	0.02
SM 6-1 SP	41.45	1.13 0.13	-9.38	-4.54	-0.17	0.05
SM 6-1 M	42.28	1.22 0.22	-33.32*	-3.72	-0.19	0.05
SM 6-7 PL	48.58	1.12 0.12	32.12**	2.59	-0.17	0.02
SM 6-7 SP	46.85	0.78 -0.22	-34.75*	0.86	-0.12	0.02
SM 6-7 M	44.07	1.20 0.20	-9.09*	-1.92	-0.19	0.02
SM 6-7 SSD	45.65	1.46 0.46	27.47*	-0.35	-0.23	0.06
PPC	24.33	0.64 -0.36	-34.01*	-21.67	-0.10	0.04

Table 17. Stability parameters for yield/plant

Genotypes	Mean	b_i / $_i$	Sd_i^2	P_i	A_i	W_i
SM 6-6 PL	1093.72	1.05 0.05	11946.51	201.58	-0.21	0.01
SM 6-6 SP	827.98	1.48 0.48	42473.81*	-64.16	-0.30	0.04
SM 6-6 M	869.58	1.47 0.47	-12154.30	-22.56	-0.30	0.01
SM 6-6 SSD	921.97	1.73 0.73	2858.56	29.83	-0.35	0.03
SM 6-11 M	853.86	0.55 -0.45	87600.38**	-38.28	-0.11	0.06
SM 6-4 SP	984.71	1.35 0.35	79427.45**	92.57	-0.27	0.05
SM 6-4 M	1188.48	1.19 0.19	78748.30**	296.35	-0.24	0.05
SM 6-4 PL	841.89	1.31 0.31	16766.45	-50.25	-0.27	0.02
SM 6-4 SSD	976.32	0.71 -0.29	43048.51*	84.18	-0.14	0.03
SM 6-9 SP	848.01	0.53 -0.47	53583.19*	-44.13	-0.13	0.04
SM 6-3 PL	896.22	1.02 0.02	86498.39**	4.08	-0.21	0.05
SM 6-3 SP	1208.38	1.40 0.40	719.41	316.24	-0.29	0.01
SM 6-3 SSD	762.54	-0.40* -1.40	578.51	-129.60	0.08	0.08
SM 6-8 PL	730.25	0.76 -0.24	745.02	-161.89	-0.15	0.01
SM 6-8 M	860.22	0.04 -0.96	156993.95**	-31.92	-0.01	0.12
SM 6-8 SSD	776.57	0.89* -0.11	-15007.81	-115.57	-0.18	0.00
SM 6-2 SP	882.56	1.51 0.51	8247.10	-9.58	-0.31	0.02
SM 6-2 M	831.99	1.90* 0.90	-12701.81	-60.15	-0.39	0.03
SM 6-1 PL	790.99	0.40 -0.60	4154.33	-101.15	-0.08	0.02
SM 6-1 SP	749.84	0.71 -0.29	-18274.56	-142.30	-0.14	0.01
SM 6-1 M	675.32	0.78 -0.22	61889.15**	-216.82	-0.16	0.04
SM 6-7 PL	955.27	1.03 0.03	17805.60	63.13	-0.21	0.02
SM 6-7 SP	1000.66	1.45 0.45	153101.99**	108.52	-0.30	0.09
SM 6-7 M	1088.62	1.45 0.45	136699.93**	196.48	-0.30	0.08
SM 6-7 SSD	823.02	0.80 -0.20	66043.38**	-69.12	0.16	0.04
PPC	756.66	0.89 -0.11	4751.48	-135.48	-0.18	0.01

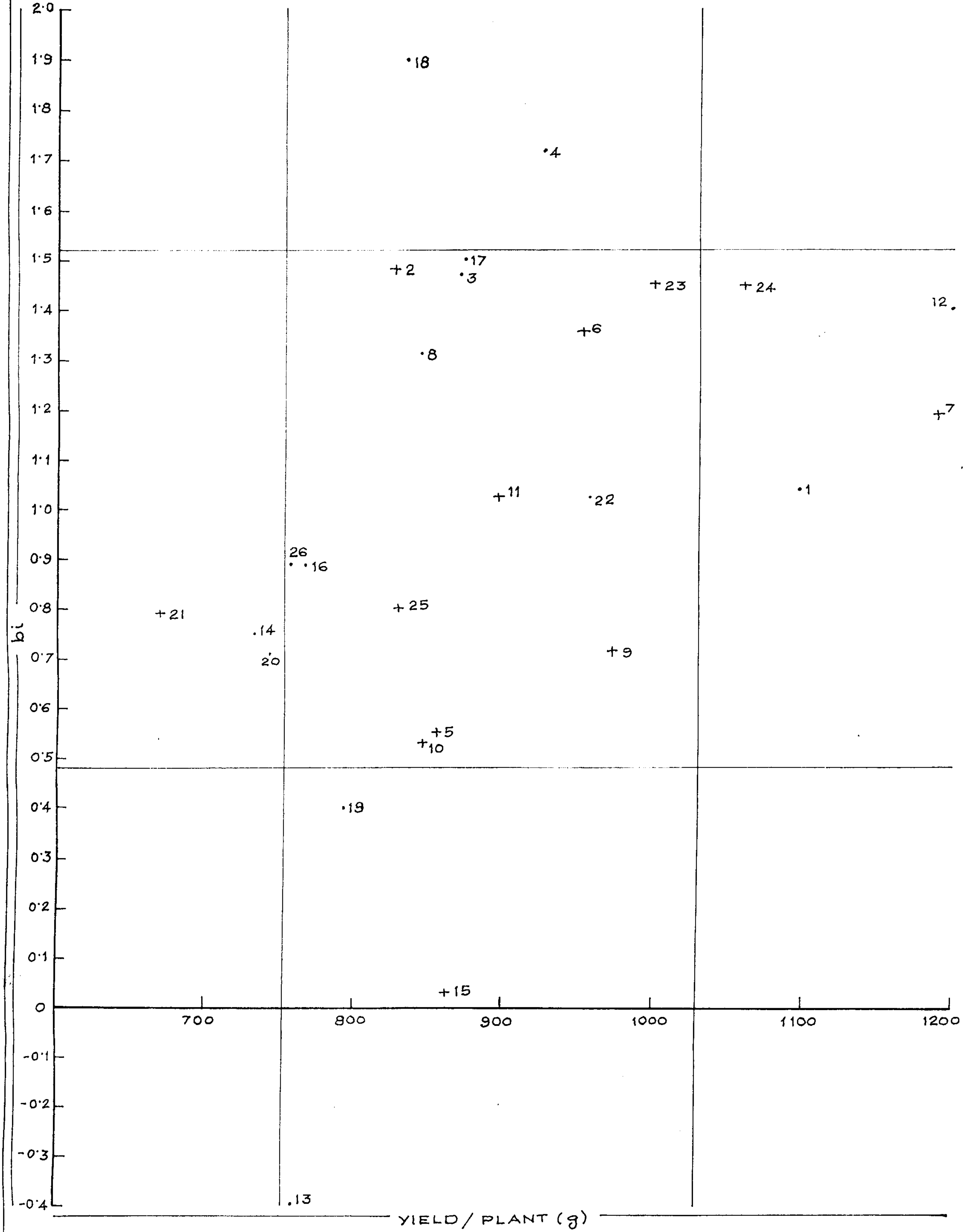


FIG. 2. THE RELATION OF YIELD AND STABILITY OF 26 LINES OF BRINJAL ESTIMATES OF S^2di WERE SIGNIFICANT ($p = 0.05$) ONLY FOR THOSE LINES INDICATED BY +.

for yield (Table 18). Stability of primary branches/ plant and fruits/plant contributed maximum direct effect. (0.548 and 0.464 respectively).

C. Analysis of genetic divergence

1. Estimation of genetic divergence through Mahalanobis D^2 statistics.

The extent of genetic divergence among the 26 lines of brinjal was estimated utilising Mahalanobis D^2 statistics as described by Rao (1952). For this analysis, seven characters - days to fruit set, days to harvest, plant height, primary branches/plant, percentage of productive flowers, fruits/plant, and yield/plant - were utilised. The 26 lines were classified into four clusters, viz., A, B, C and D during all the environments. During E_1, cluster D was the largest with 12 lines. This was followed by cluster A with 7 lines, cluster C with 4 lines and cluster B with 3 lines (Fig.3). During E_2, cluster B had the largest number of 10 lines, followed by cluster C with 9, cluster D with 4 and cluster A with 3 lines (Fig.4). In E_3 also, cluster B had largest number of 11 lines, followed by cluster C with 9, cluster D with 4 and finally cluster A with 2 lines (Fig.5). In E_4, cluster C had 15 lines, followed by cluster B with 6, cluster D with 3 and finally, cluster A with 2 lines (Fig.6).

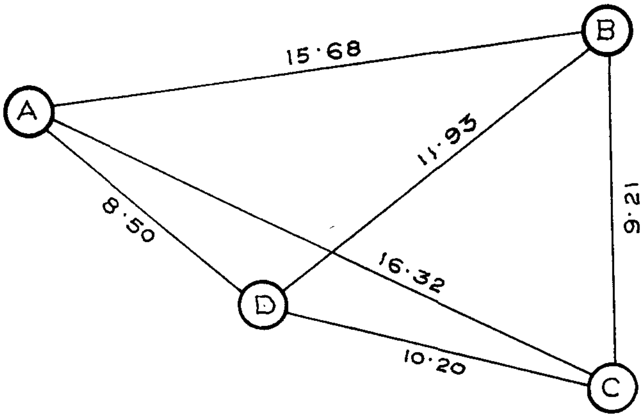
Table 18. Direct and indirect effects of the component characters to induce homeostasis in brinjal

	1	2	3	4	5	Correlation with genetic homeostasis of yield
Height (cm)	0.137	0.004	-0.020	0.037	-0.029	0.130
Primary branches/plant	0.001	0.548	0.009	0.089	-0.101	0.546**
Percentage of productive flowers	-0.038	0.066	0.071	0.154	-0.114	0.139
Fruits/plant	0.011	0.105	0.024	0.464	-0.001	0.603**
Average fruit weight (g)	-0.010	-0.134	-0.020	-0.001	0.411	0.246

Residual effect = 0.292

** p = 0.01

The underlined figures indicate the direct effect, the remaining ones (1 to 5) are the indirect effect.



CLUSTER VARIETIES

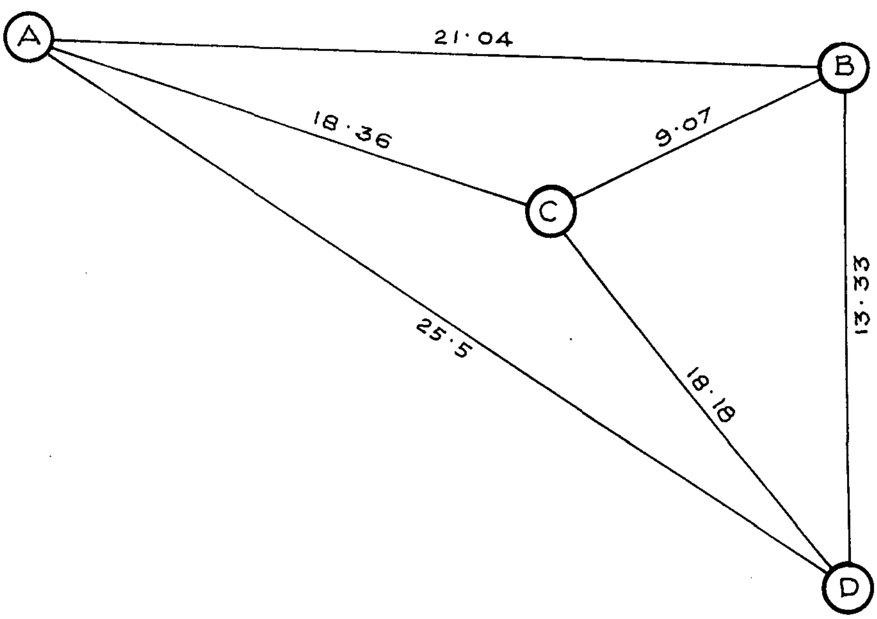
A–[10, 13, 14, 15, 16, 19, 23]

B–[20, 21, 26]

C–[9, 18, 22, 25]

D–[1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 17, 24]

FIG. 3. STATISTICAL DISTANCE AMONG 26 LINES OF BRINJAL DURING E_1.



CLUSTER VARIETIES

A–[1, 12, 15]

B–[2, 4, 9, 10, 11, 13, 16, 18, 22, 23]

C–[3, 5, 6, 7, 8, 14, 17, 19, 24]

D–[20, 21, 25, 26]

FIG. 4. STATISTICAL DISTANCE AMONG 26 LINES OF BRINJAL DURING E_2.

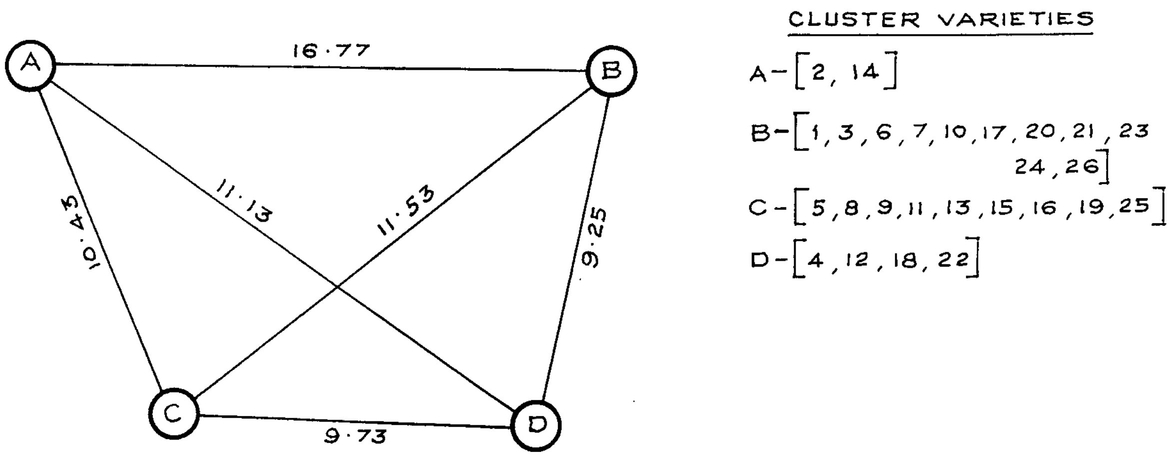


FIG. 5. STATISTICAL DISTANCE AMONG 26 LINES OF BRINJAL DURING E_3.

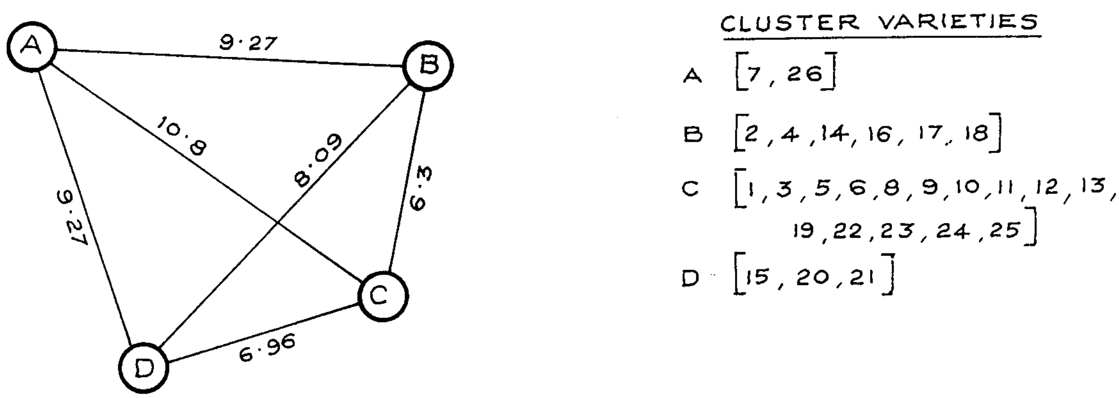


FIG. 6. STATISTICAL DISTANCE AMONG 26 LINES OF BRINJAL DURING E_4.

The intra and inter cluster average D values are presented in Tables 19, 20, 21 and 22. In the first environment, distance was maximum (16.32) between clusters B and D. In E_2, the maximum intercluster average D value (25.5) was observed between clusters A and D. In E_3, intercluster distance was maximum between clusters A and B (16.77) and in E_4, it was maximum between A and C (10.8).

2. Estimation of genetic divergence through canonical variate analysis.

The extent of diversification, expressed as percentage contribution of canonical roots indicated that more than 80% of total genetic diversity present in 26 lines of brinjal were accounted for by the first two roots in all environments except in E_4 where the contribution was 69%. The relative disposition of varieties in Z_1 - Z_2 graph is given in Figs.7, 8, 9 and 10. This reflected a broad parallelism between clusters obtained by Mahalanobis D^2 analysis and canonical variate analysis. However, some discrepancy was observed with clusters B and C during E_1 and B and C during E_2 with disposition as in D^2 analysis.

D. Association between root characteristics, and primary branches/plant, plant height and fruit yield.

Table 19. Genetic distance (D) between and within clusters during E_1

Name of cluster	Lines within cluster	Inter and intra cluster distances			
		A	B	C	D
A	SM 6-9 SP, SM 6-3 SSD, SM 6-8 PL, SM 6-8 M, SM 6-8 SSD, SM 6-1 PL, SM 6-7 SP	3.98	15.68	11.93	8.50
B	SM 6-1 SP, SM 6-1 M, PPC		6.50	9.21	16.32
C	SM 6-4 SSD, SM 6-2 M, SM 6-7 PL, SM 6-7 SSD			4.40	10.20
D	SM 6-6 PL, SM 6-6 SP, SM 6-6 M, SM 6-6 SSD, SM 6-11 M, SM 6-4 SP, SM 6-4 M, SM 6-4 PL, SM 6-3 PL, SM 6-3 SP, SM 6-2 SP, SM 6-7 M				4.82

The underlined values indicate the intra cluster distances.

Table 20. Genetic distance (D) between and within clusters during E_2

Name of cluster	Lines within cluster	Inter and intra cluster distances			
		A	B	C	D
A	SM 6-6 PL, SM 6-3 SP, SM 6-8 M	7.86	21.04	18.36	25.50
B	SM 6-6 SP, SM 6-6 SSD, SM 6-4 SSD, SM 6-9 SP, SM 6-3 PL, SM 6-3 SSD, SM 6-8 SSD, SM 6-2 M, SM 6-7 PL, SM 6-7 SP		5.71	9.07	13.33
C	SM 6-6 M, SM 6-11 M, SM 6-4 SP, SM 6-4 M, SM 6-4 PL, SM 6-8 PL, SM 6-2 SP, SM 6-1 PL, SM 6-7 M			6.41	18.18
D	SM 6-1 SP, SM 6-1 M, SM 6-7 SSD, PPC				8.99

The underlined values indicate intra cluster distances

Table 21. Genetic distance (D) between and within clusters during E_3

Name of cluster	Lines within cluster	Inter and intra cluster distances			
		A	B	C	D
A	SM 6-6 SP, SM 6-8 PL	4.68*	16.77	10.41	11.13
B	SM 6-6 PL, SM 6-6 M, SM 6-4 SP, SM 6-4 M, SM 6-9 SP, SM 6-2 SP, SM 6-1 SP, SM 6-1 M, SM 6-7 SP, SM 6-7 M, PPC.		6.95	11.53	9.25
C	SM 6-11 M, SM 6-4 PL, SM 6-4 SSD, SM 6-3 PL, SM 6-3 SSD, SM 6-8 M, SM 6-8 SSD, SM 6-1 PL, SM 6-7 SSD.			5.41	9.57
D	SM 6-6 SSD, SM 6-3 SP, SM 6-2 M, SM 6-7 PL				5.68

The underlined values indicate the intracluster distances.

Table 22. Genetic distance (D) between and within clusters during E_4

Name of cluster	Lines within cluster	Inter and intra cluster distances			
		A	B	C	D
A	SM 6-4 M, PPC	5.43	9.27	10.80	9.27
B	SM 6-6 SP, SM 6-6 SSD, SM 6-8 PL, SM 6-8 SSD, SM 6-2 SP, SM 6-2 M.		4.71	6.30	8.09
C	SM 6-6 PL, SM 6-6 M, SM 6-4 SP, SM 6-4 PL, SM 6-4 SSD, SM 6-9 SP, SM 6-3 PL, SM 6-3 SP, SM 6-3 SSD, SM 6-1 PL, SM 6-7 PL, SM 6-7 SP, SM 6-7 M, SM 6-7 SSD, SM 6-11 M.			4.14	6.96
D	SM 6-8 M, SM 6-1 SP, SM 6-1 M.				5.46

The underlined values indicate the intra cluster distances.

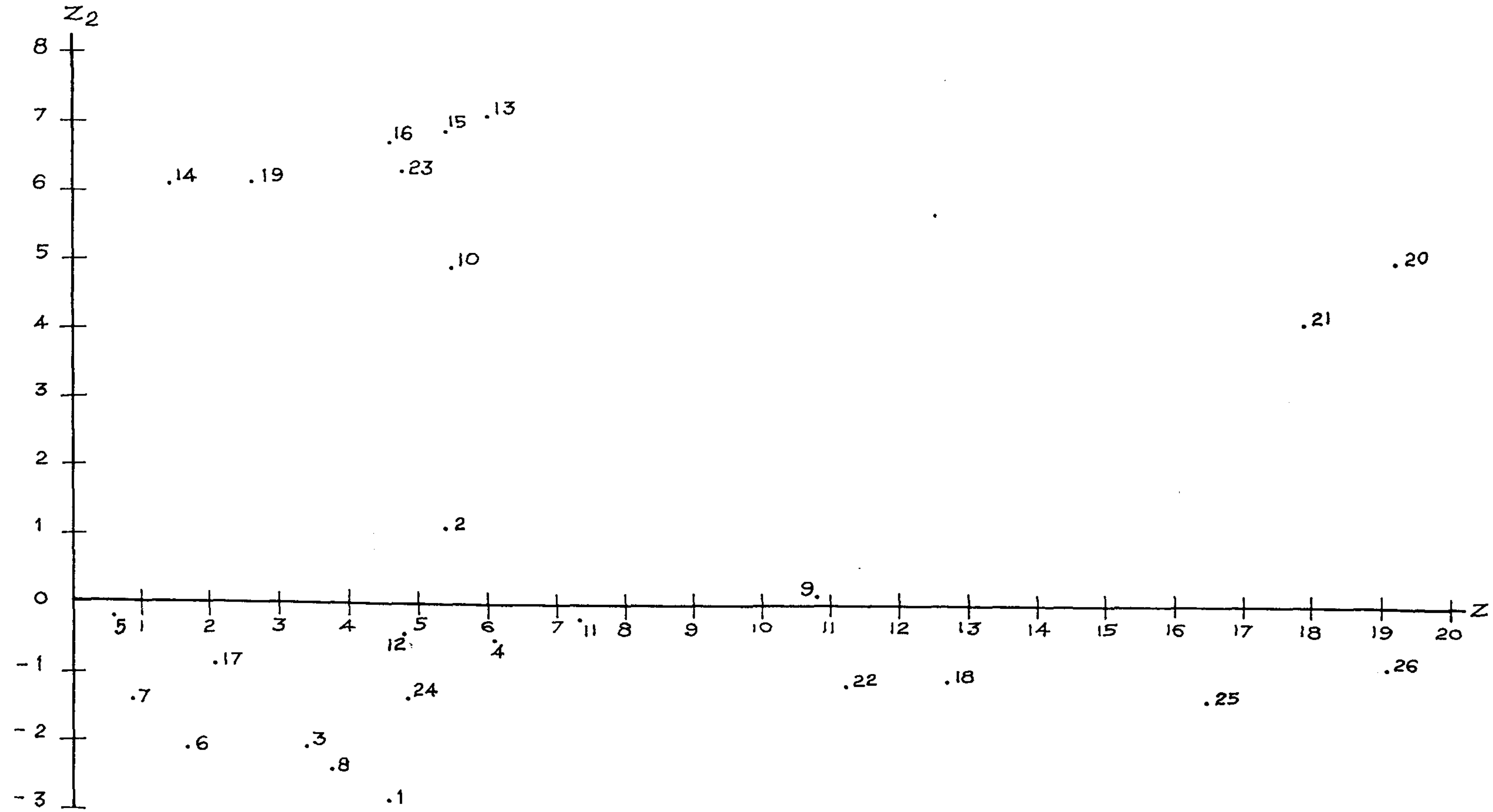


FIG. 7. CANONICAL ANALYSIS OF DIVERGENCE IN 26 LINES OF BRINJAL DURING E_1.

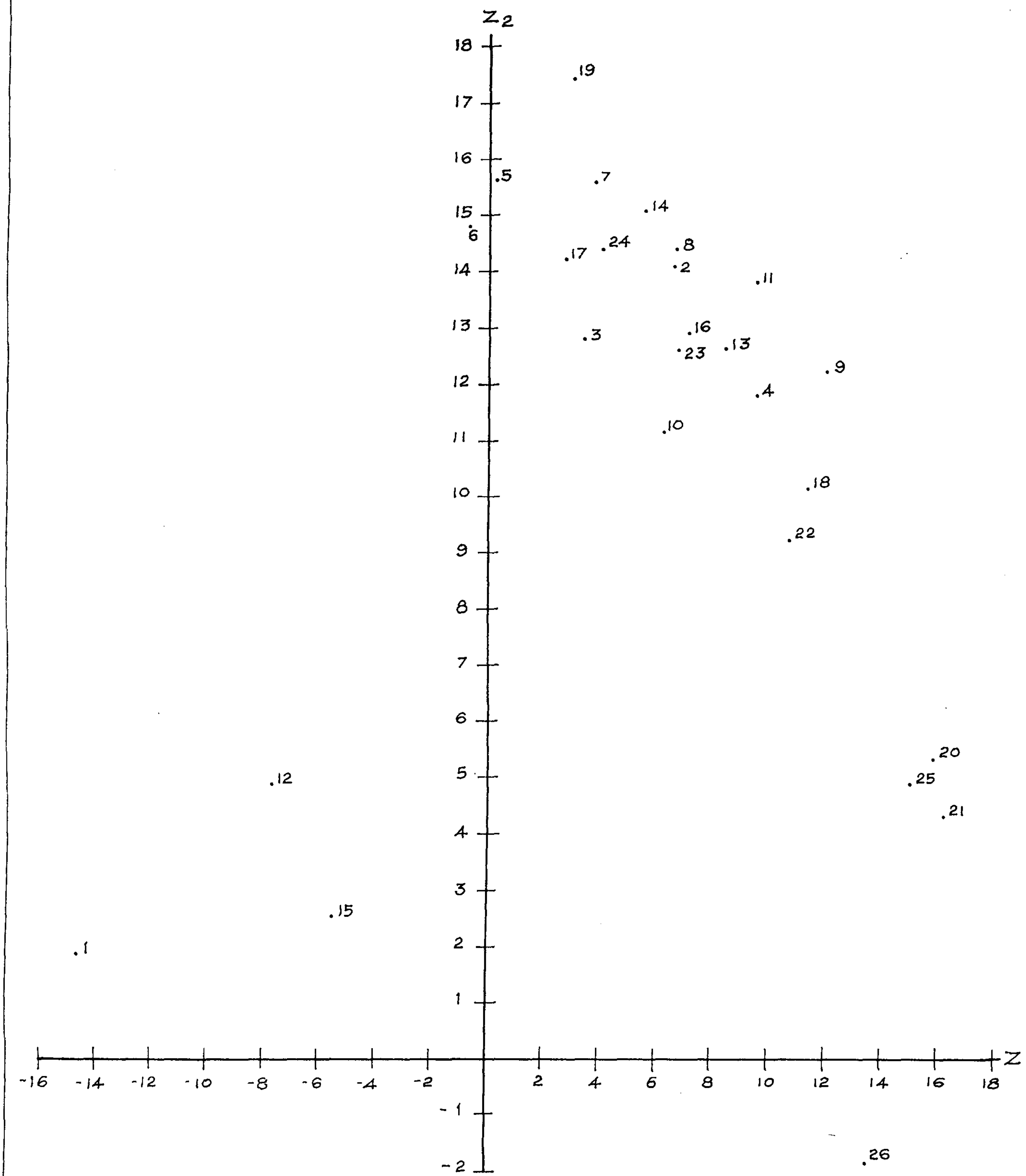


FIG. 8. CANONICAL ANALYSIS OF DIVERGENCE IN 26 LINES OF BRINJAL DURING E_2.

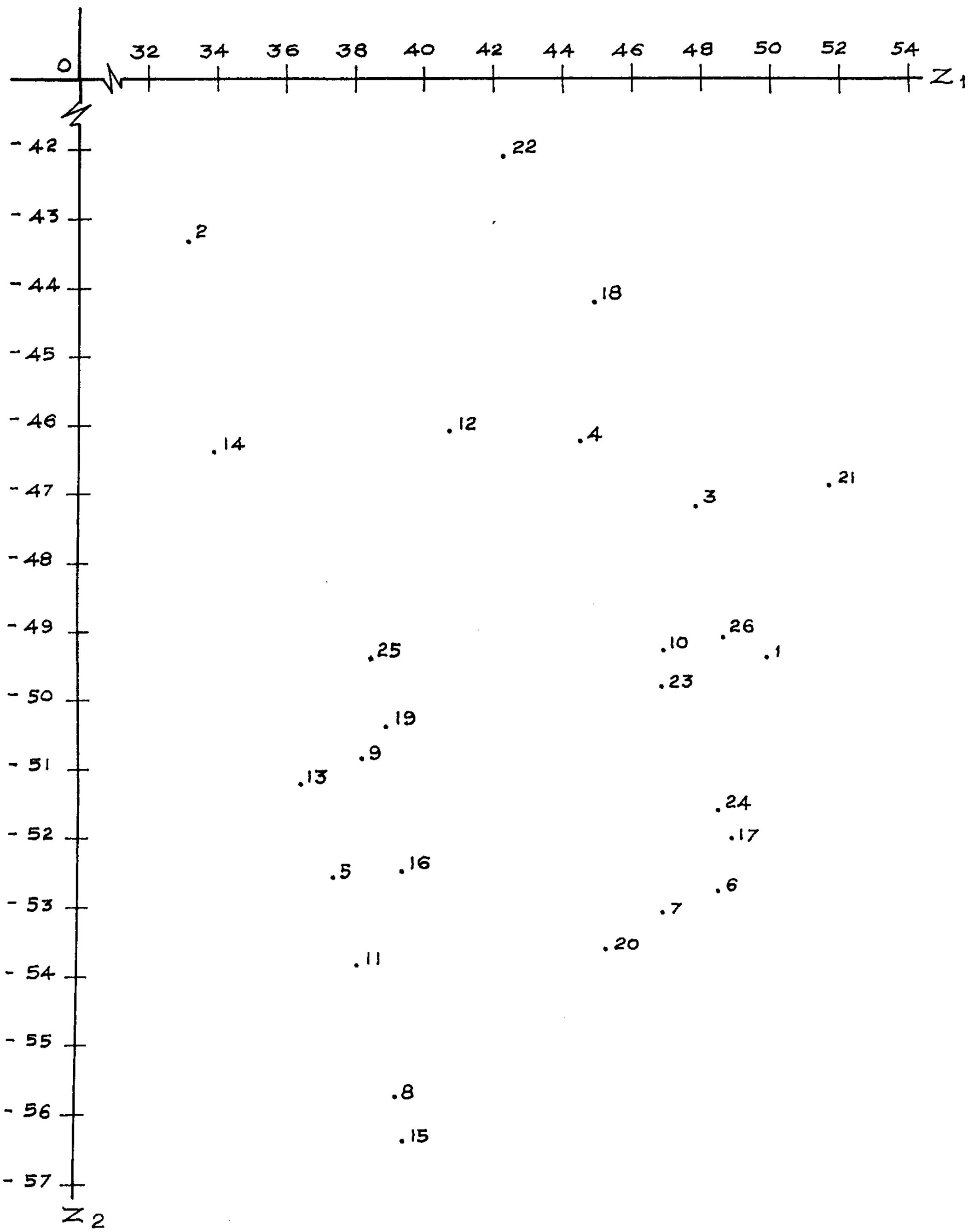


FIG. 9. CANONICAL ANALYSIS OF DIVERGENCE IN 26 LINES OF BRINJAL DURING E_3.

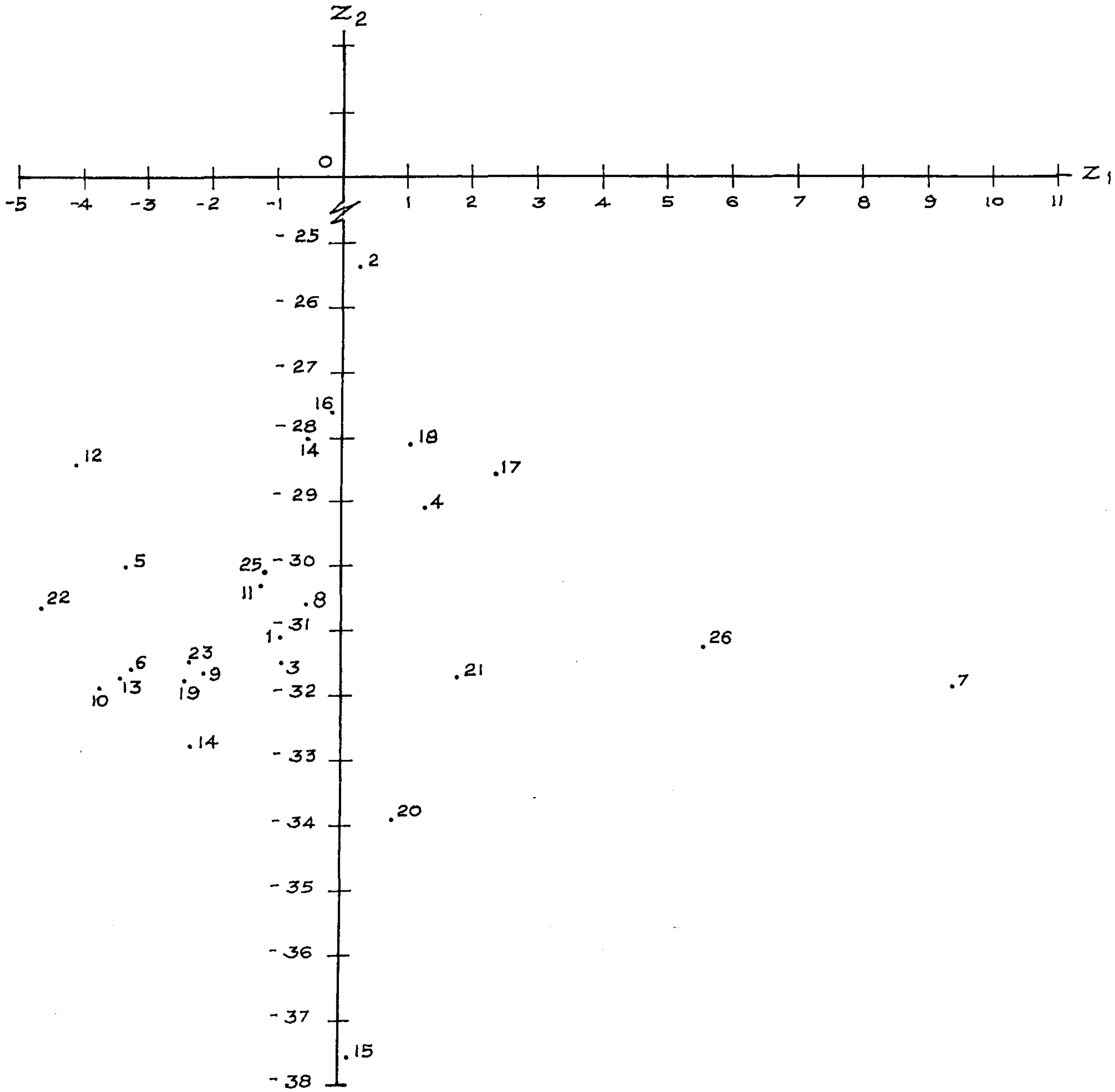


FIG. 10. CANONICAL ANALYSIS OF DIVERGENCE IN 26 LINES OF BRINJAL DURING E_4.

Significant positive correlation was observed between root volume and fruit yield/plant. (Table 23). Correlations between root volume and primary branches/plant, root volume and plant height, root length and yield, primary branches/plant and height were not significant.

Table 23. Correlation between root characteristics and plant height, primary branches/plant and yield/plant.

Characters	Root volume(ml)	Root length(cm)
Plant height (cm)	0.090	0.152
Primary branches/plant	0.226	0.065
Yield/plant (g)	0.662**	0.151

p = 0.01

Observations on root galls caused by *Meloidogyne incognita*.

Among the 26 lines, galls were present on the roots except in SM 6-7 PL and SM 6-11 M in all the replications.

Evaluation for wilt resistance

The 26 brinjal lines were evaluated under field conditions along with susceptile check Pusa Purple Long during October-May 1985-'86. The lines SM 6-6 PL (15%), SM 6-1 SP (5%), SM 6-1 M (5%), SM 6-7 SP (10%)and

SM 6-8 M (20%) were resistant to wilt. The lines SM 6-6 M (25%), SM 6-11 M (40%), SM 6-4 M (40%), SM 6-4 PL (30%), SM 6-4 SSD (35%), SM 6-3 SSD (30%), SM 6-8 PL (40%), SM 6-8 SSD (30%), SM 6-2 SP (30%), SM 6-2 M (40%), SM 6-7 M (30%), SM 6-7 SSD (25%) and PPC (40%) were moderately resistant. The lines SM 6-6 SSL (50%), SM 6-4 SP (45%), SM 6-9 SP (50%), SM 6-3 PL (45%), SM 6-3 SP (45%), SM 6-1 PL (45%) and SM 6-7 PL (45%) were moderately susceptible to bacterial wilt (Table 24). The susceptible check Pusa Purple Long showed 100% wilt incidence.

Survey on preference to colour and shape in brinjal

The survey showed that there was high preference for white long (23.79%) fruits followed by purple long (22.5%) fruits. (Table 25).

Table 24. Evaluation of brinjal lines for reaction to bacterial wilt

Lines	Total number of plants	Number of plants wilted	Disease reaction (%)
SM 6-6 PL	20	3	15 (R)
SM 6-6 SP	20	10	50 (MS)
SM 6-6 M	20	5	25 (MR)
SM 6-6 SSD	20	10	50 (MS)
SM 6-11 M	20	8	40 (MR)
SM 6-4 SP	20	9	45 (MS)
SM 6-4 M	20	8	40 (MR)
SM 6-4 PL	20	6	30 (MR)
SM 6-4 SSD	20	7	35 (MR)
SM 6-9 SP	20	10	50 (MS)
SM 6-3 PL	20	9	45 (MS)
SM 6-3 SP	20	9	45 (MS)
SM 6-3 SSD	20	8	30 (MR)
SM 6-8 PL	20	6	40 (MR)
SM 6-8 M	20	4	20 (R)
SM 6-8 SSD	20	6	30 (MR)
SM 6-2 SP	20	6	30 (MR)
SM 6-2 M	20	8	40 (MR)
SM 6-1 PL	20	9	45 (MS)
SM 6-1 SP	20	1	5 (R)
SM 6-1 M	20	1	5 (R)
SM 6-7 PL	20	9	45 (MS)
SM 6-7 SP	20	2	10 (R)
SM 6-7 M	20	6	30 (MR)
SM 6-7 SSD	20	5	25 (MR)
PPC	20	8	40 (MR)

R - Resistant, 20% plants wilted
MR - Moderately resistant, 20-40% plants wilted
MS - Moderately susceptible, 40-60% plants wilted (Mew and Ho, 1976)

Table 25. Preference to fruit color and shape in brinjal

Characters	Total number of respondants	Number of people prefering this character	Percentage preference
Purple long	311	70	22.5
Purple oval	311	58	18.65
Purple round	311	35	11.25
Green long	311	39	12.54
Green oval	311	7	2.25
Green round	311	0	0.00
White long	311	74	23.79
White oval	311	19	6.11
White round	311	9	2.89

Discussion

DISCUSSION

Brinjal (*Solanum melongena* L.) is one of the most important warm season fruit vegetables grown throughout India. A good number of varieties are evolved to suit local conditions and aesthetic preferences. Presence of a large number of varieties creates managerial problems particularly in a seed industry catering to requirements of different farming systems and conditions. Identification of a phenotypically stable variety is all the more important in such situations. Phenotypically stable varieties are particularly of great importance in countries like India, where environmental conditions differ from one geographic zone to another and even within one geographic zone itself. A breeding programme aimed at developing phenotypically stable varieties, requires information on the extent of G x E interactions for yield and more particularly the interactions between component characters of yield and environment. This programme could have two approaches. One is to identify developmental sequences which can counteract the fluctuations in environmental conditions. The other approach may be identifying component characters, whose stability, if manipulated and regulated, could bring out stability for the expression of yield. It is also likely that phenotypic stability for yield could be due to mutual balance of different rates of changes in stability for the characters contributing to yield. (Rana and Murthy, 1971). The other approach may be genetical, where buffering capacity is created through genetic mixtures or through gene pools from contrasting environments as a means to reduce G x E interaction (Allard and Bradshaw, 1964). This suggestion is perhaps not tenable here and would perhaps be ruled out in a crop like brinjal, where much differences exist in size, color, shape and plant characters like presence or absence of prickles. The viable alternative is to identify component characters whose stability, if regulated, could bring out stability for the expression of yield.

No detailed information is available in brinjal regarding G x E interactions. This called for a detailed study.

In the present investigation, G x E interaction was significant for plant height, primary branches/plant, percentage of productive flowers, fruits/plant, average fruit weight and yield/plant. This indicated that the above characters ware unstable and could considerably fluctuate with a change in environment. Significant genetic differences among varieties for their regression coefficients for fruits/plant and average fruit weight, were observed.

A combination of the concept of Eberhart and Russell (1966), Perkins and Jinks (1968), Ram et. al. (1970), Chaudhury et. al. (1972) and Wricke (1966) was used to classify 26 genotypes under study for their adaptability to low, medium and high yielding environments. The detailed analysis indicated that SM 6-6 PL and SM 6-3 SP could be recommended for high yielding environments, they have higher mean, regression coefficient tends to one and deviation from regression approaching zero. Genotypes suited to average yielding environments were SM 6-6 M, SM 6-4 PL and SM 6-2 SP. SM 6-8 PL and SM 6-1 SP were suited to low yielding environments. They retained and manifested inherent potentialities fully well in low yielding environments.

In the analyses of variance under ER and PJ models, heterogeneity among regressions was not significant and deviation from regression was significant as seen from Tables 9 and 10. This showed the inadequacy of the linear regression coefficients to account for the G x E interaction. By the method of grouping of genotypes using Wricke's ecovalence ratio, it was found that the

26 brinjal lines came under five groups. Genotypes SM 6-6 (PL, SSD, SP), SM 6-4 (PL, SSD), SM 6-8 (PL, SSD), SM 6-2 SP, SM 6-1 (PL, SP), SM 6-7 PL, and PPC came within one group, genotypes SM 6-2 M, SM 6-6 SP in another group, genotypes SM 6-4 M and SM 6-9 SP in another group, genotypes SM 6-11 M, SM 6-3 SSD in one group and genotypes SM 6-7 SP and M came under one group. Genotypes within a single group showed similar responses and sensitivity to environmental changes.

As a first step towards identifying component characters, whose stability contributes to stability of yield, the correlations were worked out between stability parameters (b_i's) among yield and its components. Yield stability was related to the stability of primary branches/plant and fruits/plant. Path coefficient analyses revealed that stability of primary branches/plant had maximum positive direct effect on yield stability. This indicates the possibility that if we can achieve stability in these two characters, by genetical or even by agronomical manipulations, to a certain extent, we can bring out stability for fruit yield.

The information about the genetic divergence based on D^2 estimates in a number of unstable varieties fluctuated considerably over the years and in such a situation it could be rather difficult to conclude clearly on the genetic divergence. The most stable varieties like SM 6-6 M, SM 6-4 PL and SM 6-2 SP clustered together in most of the environments. Except this, no similarity was observed in the clustering pattern over the different environments. The clustering pattern was quite arbitrary. This is due to high G x E interactions.

The contribution of the first two canonical roots, reveals the extent of divergence occurred in the primary axis and secondary axis of diversification. In the present study, during E_1, E_2 and E_3, more than 80% and in E_4 69% of divergence was contributed by the first two roots. There was a slight deviation in the relative disposition of the varieties as compared to D^2 analysis. This could be attributed to the fact that the first two roots accounted only about 80% in first 3 environments and 69% in 4th environment. For getting a close resemblance with D^2 statistics, contribution of the first two vectors should have been more than 95%.

The 25 lines of SM 6, evaluated, were evolved through different methods of selection over years giving emphasis on bacterial wilt resistance. The lines were progressed through selection methods by Sheela (1982), Asha Sankar (1984) and Jessykutty (1985). Evaluation for wilt resistance showed that SM 6-6 PL, SM 6-8 M, SM 6-1 (SP, M), SM 6-7 SP were resistant to wilt. The stable lines SM 6-6 M, SM 6-4 PL and SM 6-2 SP were moderately resistant to wilt. Thirteen out of 26 lines were moderately susceptible. This observation of a moderately high percentage of susceptibility is due to the fact that only a lower number of plants (20) were taken for evaluation. In the first season (June-October 1985) the field observation for wilt was only 1.2% and in the second season (October-April, 1985-86) it was about 18%.

A survey on preference to color and shape in brinjal showed that the best preferred characters are white long and purple long. SM 6-6 M was white long and SM 6-2 SP was purple long. These two stable lines are also highly preferred in the market.

Plate 1. SM 6-4 PL

Plate 2. SM 6-6 M


SM 64(PL)


SM 6·6 (M)

Plate 3. SM 6-2 SP

Plate 4. SM 6-6 PL


SM 6-2(SP)


SM 6-6 (PL)

Plate 5. SM 6-3 SP

Plate 6. SM 6-8 PL


SM 6-3 (SP)


SM 6-8 (PL)

Plate 7. SM 6-1 SP

Plate 8. Spot planting with
the suscept wilted


SM 6 I (SP)

Summary

SUMMARY

The 26 improved lines of brinjal were grown in a randomised block design with two replications during two crop seasons (June-October, 1985 and November-May, 1985-86) in the Instructional Farm of Kerala Agricultural University, Vellanikkara. Two contrasting environments - high fertile and low fertile - were created in each season by manurial and fertilizer dose variations. Observations were recorded on yield and its seven components - days to set, days to harvest, primary branches/plant, plant height, percentage of productive flowers, fruits/plant and average fruit weight. The lines were evaluated for wilt resistance by spot planting. The root characters tap root length, root volume, and presence/absence of root galls were also observed.

2. The brinjal lines exhibited highly significant differences for all the characters studied in all the four trials.

3. The G x E interaction which measures the deviation from the additive effects of genotype and environment was highly significant for plant height, primary branches/plant, percentage of productive flowers, fruits/plant, average fruit weight and yield/plant.

4. The pooled data were analysed as per Eberhart and Russell (1966), Perkins and Jinks (1972). The lines SM 6-6 PL and SM 6-3 SP were suited to high yielding environments, SM 6-6 M, SM 6-4 PL and SM 6-2 SP for average conditions and SM 6-8 PL and SM 6-1 SP were suited to low yielding conditions. The stable lines were also highly preferred in the market.

5. The lines were grouped into different clusters using Wricke's ecovalence ratio, so that interaction within any group was non-significant and that between any two groups was significant.

6. It was observed that stability for yield, in general, depended on the stability of primary branches/plant (r = 0.55) and fruits/plant (r = 0.60).

7. The 26 brinjal lines were classified into four clusters during all the four environments. The lines within a cluster and inter-cluster distances were found to vary in all four trials.

8. The spot planting of susceptible with lines under evaluation indicated that the lines SM 6-6 PL, SM 6-8 M, SM 6-1 (SP, M) and SM 6-7 SP were resistant to wilt. The stable lines were moderately resistant to wilt.

9. Root volume had a positive correlation with yield. Root galls were observed in all the lines except in SM 6-7 PL and SM 6-11 M.

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Appendices

Appendix I. Mean performance of 26 lines of brinjal during June-October 1985 under high fertility

Lines	Days to set	Days to harvest	Plant height (cm)	Primary branches/ plant	Percentage of productive flowers	Fruits/ plant	Average fruit weight (g)	Yield/ plant
1	80.30	104.20	54.15	6.45	31.88	26.08	48.79	1234.05
2	81.25	103.75	44.33	5.05	35.62	18.95	71.38	1345.30
3	86.15	106.75	65.98	6.20	25.56	20.10	58.55	1148.30
4	90.65	111.25	60.35	6.30	36.10	17.05	67.33	1156.45
5	81.10	106.55	60.76	5.95	17.37	18.23	51.89	1277.55
6	85.80	113.20	68.30	6.35	22.63	27.10	52.22	1381.80
7	82.20	107.15	62.35	6.40	18.47	20.10	60.68	1220.35
8	96.10	116.20	80.00	7.20	27.58	23.35	54.40	1271.70
9	83.75	109.25	52.25	6.50	54.41	19.55	70.44	1347.45
10	94.40	117.40	69.70	5.60	35.92	15.60	54.34	751.40
11	82.75	107.50	66.23	6.20	40.42	19.15	72.32	1389.70
12	77.75	102.70	64.88	5.75	31.04	19.50	71.84	1385.10
13	89.35	112.65	55.97	5.55	38.67	11.20	71.41	794.20
14	73.20	104.20	46.37	6.10	24.86	18.60	51.97	989.40
15	88.80	116.55	57.50	5.95	38.31	15.10	59.90	916.20
16	88.10	111.20	63.98	5.40	33.25	15.30	63.61	963.85
17	88.75	118.55	64.35	5.35	23.86	17.90	63.10	1099.30

(Contd.)

Appendix I contd..

Lines	Days to set	Days to harvest	Plant height (cm)	Primary branches/ plant	Percentage of productive flowers	Fruits/ plant	Average fruit weight (g)	Yield/ plant
18	88.85	113.45	60.30	6.00	60.29	18.55	62.66	1165.50
19	99.05	112.60	74.99	5.99	24.34	16.50	55.78	954.65
20	95.75	116.35	70.21	5.45	83.44	17.10	53.75	909.70
21	102.00	123.90	85.99	5.10	76.90	11.13	56.05	623.75
22	80.55	104.95	43.98	6.45	54.91	16.15	65.75	1041.70
23	85.10	109.70	59.00	5.70	34.51	15.07	58.90	905.30
24	87.60	109.50	59.28	5.45	31.52	17.16	61.33	1046.10
25	80.20	105.60	59.20	5.75	72.06	19.01	66.32	1265.70
26	89.20	108.35	88.67	5.55	80.12	32.25	31.45	992.40
Mean	86.87	110.52	63.04	5.91	40.54	18.68	59.85	1099.88
CD p=0.05	13.06	10.60	13.70	1.07	7.39	5.88	8.23	318.07
CD p=0.01	17.67	14.34	18.54	1.45	10.00	7.95	11.14	430.32
SE	4.48	3.64	4.70	0.37	2.54	2.02	2.83	109.18

Appendix II. Mean performance of 26 lines of brinjal during June-October 1985 under low fertility

Lines	Days to set	Days to harvest	Plant height (cm)	Primary branches/ plant	Percentage of productive flowers	Fruits/ plant	Average fruit weight (g)	Yield/ plant
1	88.85	109.95	51.68	5.80	24.08	29.25	38.51	1129.65
2	79.45	103.95	40.15	4.70	27.46	12.00	60.31	716.75
3	93.65	114.00	52.59	5.80	29.38	15.05	41.68	629.20
4	93.85	111.50	43.53	4.60	40.23	18.35	55.94	749.75
5	90.75	112.40	54.97	5.60	17.10	16.55	41.17	706.10
6	95.75	115.80	49.70	4.60	17.51	12.50	36.95	473.45
7	85.40	110.35	48.23	6.05	23.31	16.75	48.83	830.80
8	101.30	121.35	54.66	5.85	34.19	13.90	55.80	726.15
9	83.75	110.30	45.61	5.35	45.16	15.65	52.28	926.65
10	96.10	116.70	58.98	5.05	39.75	14.50	43.38	640.70
11	93.10	115.65	47.60	6.35	38.83	15.15	56.78	866.30
12	84.70	108.30	53.43	4.45	27.31	18.02	61.06	1037.50
13	87.15	109.80	46.87	4.95	36.96	13.60	55.31	755.05
14	92.85	114.70	43.18	4.60	27.23	12.60	55.56	691.95
15	92.40	111.75	47.87	5.65	38.62	25.48	51.72	1308.95
16	95.25	115.15	46.63	4.50	35.29	12.60	51.01	654.50
17	92.50	113.10	56.44	5.75	24.44	19.55	43.60	828.90

(Contd..)

Appendix II contd..

Lines	Days to set	Days to harvest	Plant height (cm)	Primary branches/ plant	Percentage of productive flowers	Fruits/ plant	Average fruit weight (g)	Yield/ plant
18	93.50	122.10	39.47	5.45	54.60	11.55	52.74	614.25
19	108.15	129.10	72.29	4.50	22.84	11.15	51.97	602.95
20	103.30	122.45	66.93	4.80	71.83	12.55	51.53	630.30
21	107.80	124.85	63.47	4.65	75.22	7.70	52.17	418.00
22	84.20	111.70	40.27	5.00	51.24	14.00	49.08	700.60
23	78.70	107.05	51.53	5.35	34.57	17.70	46.83	864.65
24	84.10	112.10	48.63	6.10	27.36	16.50	46.62	773.20
25	84.40	110.40	42.75	5.35	68.53	14.00	49.85	682.85
26	93.85	112.30	69.93	4.40	81.51	25.70	29.66	778.25
Mean	91.75	114.11	51.44	5.20	39.04	15.69	49.47	728.36
CD p=0.05	13.96	10.35	12.45	1.07	7.25	4.50	8.56	237.83
CD p=0.01	18.89	13.10	16.84	1.45	9.81	6.09	11.58	321.76
SE	4.79	3.55	4.27	0.37	2.49	1.55	2.94	81.64

Appendix III. Mean performance of 26 lines of brinjal during November-May 1985-'86 under high fertility

Lines	Days to set	Days to harvest	Plant height (cm)	Primary branches/ plant	Percentage of productive flowers	Fruits/ plant	Average fruit weight (gm)	Yield/ plant
1	89.60	108.33	69.44	6.57	38.75	43.44	28.90	1310.22
2	87.17	99.42	43.50	4.23	44.29	21.71	43.30	836.56
3	91.10	105.20	65.33	5.73	37.73	38.89	29.45	1166.44
4	87.23	105.30	66.83	6.75	55.00	31.10	42.56	1344.73
5	93.21	111.78	56.78	6.45	39.28	18.02	34.47	637.35
6	90.37	112.90	70.80	7.17	35.36	33.45	36.30	1187.78
7	92.78	108.39	80.15	6.48	36.89	35.83	45.76	1686.89
8	93.32	112.01	74.68	6.20	28.02	24.06	43.66	883.56
9	96.51	113.68	57.89	5.10	51.73	22.88	43.00	847.00
10	92.61	109.06	75.95	5.82	56.25	31.49	38.32	1202.61
11	95.22	114.95	71.62	6.60	54.66	16.95	43.33	742.22
12	90.27	106.85	62.47	5.86	59.65	25.12	62.67	1559.68
13	91.55	105.94	68.69	4.67	43.36	14.17	41.15	584.82
14	88.37	100.62	62.20	3.96	42.22	18.77	37.91	734.95
15	96.35	113.24	74.93	6.25	26.78	20.35	35.60	686.63
16	94.80	112.40	71.64	5.43	51.67	25.42	36.91	930.00
17	98.63	115.86	77.39	5.63	51.65	29.12	40.88	1209.52

(Contd..)

Appendix III contd..

Lines	Days to set	Days to harvest	Plant height (cm)	Primary branches/plant	Percentage of productive flowers	Fruits/plant	Average fruit weight (gm)	Yield/plant
18	90.00	104.71	53.92	6.46	72.73	31.82	36.32	1199.50
19	93.92	111.19	63.17	5.75	60.86	23.72	34.38	810.84
20	98.31	120.04	82.70	6.37	91.62	29.61	29.37	867.72
21	95.95	115.39	70.80	6.20	100.00	35.10	29.66	1085.75
22	87.55	100.17	50.83	5.94	71.97	31.22	41.90	1306.22
23	92.12	110.45	73.78	6.06	59.34	39.76	42.00	1667.11
24	93.49	110.76	72.14	6.50	40.00	46.53	37.09	1748.66
25	94.05	111.55	53.60	5.51	71.28	20.87	31.29	675.54
26	93.89	111.94	77.02	7.30	100.00	42.11	19.19	817.93
Mean	92.63	109.70	67.24	5.96	57.74	28.90	37.93	1161.62
CD p=0.05	4.86	7.67	15.18	0.87	19.58	13.05	7.71	540.94
CD p=0.01	6.57	10.38	20.54	1.18	26.49	17.66	10.43	731.85
SE	1.67	2.63	5.21	0.30	6.72	4.48	2.65	185.68

Appendix IV. Mean performance of 26 lines of brinjal during 1985-'86 November-May under low fertility

Lines	Days to set	Days to harvest	Plant height (cm)	Primary branches/ plant	Percentage of productive flowers	Fruits/ plant	Average fruit weight (g)	Yield/ plant (g)
1	89.20	104.30	63.69	5.50	51.67	24.47	28.29	700.95
2	90.76	106.48	43.56	3.39	31.63	11.39	33.66	413.30
3	89.85	104.70	58.77	5.75	53.34	19.19	29.21	534.39
4	95.10	106.78	69.95	4.00	38.75	11.65	37.60	436.95
5	96.38	111.05	57.82	5.00	40.39	18.50	41.00	794.44
6	90.24	106.63	63.94	5.80	51.07	26.72	33.27	895.82
7	95.66	110.67	67.47	4.47	42.67	21.51	45.12	1015.90
8	96.08	111.08	65.93	4.92	35.39	11.36	43.11	486.14
9	102.05	116.83	71.08	4.82	60.65	18.23	43.27	784.17
10	96.05	111.44	62.63	5.69	37.64	20.08	39.67	797.31
11	96.58	114.14	64.22	4.83	41.95	13.17	43.46	586.67
12	93.70	108.37	61.91	4.45	57.69	14.25	55.72	801.25
13	95.60	112.25	70.29	5.40	61.66	22.29	40.54	916.07
14	93.70	109.94	52.22	4.13	48.13	13.94	37.03	504.70
15	101.50	124.58	79.84	7.27	54.45	16.49	39.74	529.09
16	97.00	115.38	57.04	3.77	57.00	13.21	42.09	557.92
17	99.45	120.46	65.19	3.69	47.22	8.67	42.83	392.50

(Contd...)

Appendix IV contd..

Lines	Days to set	Days to harvest	Plant height (cm)	Primary branches/ plant	Percentage of productive flowers	Fruits/ plant	Average fruit weight (g)	Yield/ plant (g)
18	95.70	115.83	46.04	4.15	82.86	11.29	29.98	328.71
19	97.84	115.59	59.83	5.40	47.90	23.61	32.57	795.52
20	103.47	124.48	67.96	5.57	90.51	21.15	31.14	591.63
21	103.10	128.64	65.73	4.70	99.40	18.38	31.22	573.76
22	97.34	114.21	45.58	5.45	57.28	20.49	37.60	772.54
23	94.99	108.45	62.68	5.55	68.33	13.72	39.65	565.56
24	99.85	116.10	60.45	5.65	54.25	25.49	31.25	786.50
25	94.35	111.75	58.55	4.85	89.52	20.40	35.12	668.00
26	99.43	116.67	69.84	4.17	100.00	26.00	17.00	438.07
Mean	96.35	113.34	62.00	4.94	57.74	17.91	36.97	639.34
CD p=0.05	5.98	8.81	13.86	0.77	17.63	8.07	7.57	254.30
CD p=0.01	8.09	11.92	18.76	1.05	23.85	10.92	10.24	331.87
SE	2.05	3.02	4.76	0.27	6.05	2.77	2.60	84.20

Appendix V. Split up of interaction SS for plant height

Interaction	df	SS	MS	F
*1				
Within group	69	1573.84	22.81	1.43
between groups	6	1433.14	238.86	3.97**
Total	75	3006.98	40.09	1.78**

*1 All genotypes except 15 and 19 were within one group

** Significant at 1% level

Appendix VI. Split up of interaction SS for primary branches/plant

Interaction	df	SS	MS	F
1				
within group 1	33	4.97	0.15	1.40
2				
within group 2	9	1.27	0.14	1.31
between groups	33	21.82	0.66	6.13**
Total	75	28.05	0.37	3.47**

1 genotypes 1, 5, 25, 16, 12, 23, 22, 21, 3, 10, 11 and 19 comes under group 1

2 genotypes 2, 7, 8 and 9 comes under group 2

** significant at 1% level

Appendix VII. Split up of interaction SS for percentage of productive flowers

Interaction	df	SS	MS	F
1 within group 1	60	1845.65	30.76	1.30
2 within group 2	9	320.62	35.62	1.51
between groups	6	1710.67	285.11	12.08**
Total	75	3876.94	51.69	2.19**

1 genotypes 1, 2, 3, 5, 6, 7, 9, 11, 12, 13, 14, 16, 17, 18, 20, 21, 22, 23, 24, 25 and 26 comes under group 1

2 genotypes 4, 8, 10 and 19 comes under group 2

** significant at 1% level

Appendix VIII. Split up of interaction SS for fruits/plant

Interaction	df	SS	MS	F
1				
within group 1	45	593.59	13.19	1.46
2				
within group 2	3	10.0	3.33	0.37
3				
within group 3	3	55.19	18.40	2.03
between groups	24	1293.8	53.91	5.95**
Total	75	1952.58	26.03	2.88**

1 genotypes 16, 26, 22, 10, 20, 7, 12, 9, 2, 4, 1, 14, 18, 25, 3 and 8 comes within group 1

2 genotypes 5 and 11 included under group 2

3 genotypes 21 and 23 comes under group 3

** significant at 1% level

Appendix IX. Split up of interaction SS for average fruit weight

Interaction	df	SS	MS	F
[1] within group 1	39	418.61	10.73	1.41
[2] within group 2	3	30.84	10.28	1.35
[3] within group 3	3	25.12	8.37	1.10
[4] within group 4	3	11.71	3.90	0.51
[5] within group 5	3	57.27	19.09	2.52
between groups	24	950.84	39.62	5.22**
Total	75	1494.39	19.93	2.63**

1 genotypes 1, 15, 16, 22, 11, 4, 23, 24, 9, 3, 19, 13, 10 and 26 comes within group 1

2 genotypes 26 and 7 comes under group 2

3 genotypes 18 and 21 comes under group 3

4 genotypes 14 and 8 comes under group 4

5 genotypes 8 and 12 comes under group 5

** significant at 1% level

PHENOTYPIC STABILITY ANALYSIS IN BACTERIAL WILT RESISTANT LINES OF BRINJAL (*Solanum melongena* L.)

By

USHAMANI. P.

ABSTRACT OF A THESIS

Submitted in partial fulfilment of the requirements for the degree of

Master of Science in Horticulture

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Department of Olericulture
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ABSTRACT

Twenty six genotypes of brinjal (*Solanum melongena* L.) were grown continuously in two seasons each under two contrasting environments in a randomised block design. Observations were recorded on yield and seven of its component characters. Significant variations among the genotypes were observed. G x E interaction was significant for plant height, primary branches/plant, percentage of productive flowers, fruits/plant, average fruit weight and yield/plant. The 26 lines were classified as suited to low, medium and high yielding environments. SM 6-6 M, SM 6-4 PL and SM 6-2 SP were suited to average environments; SM 6-6 PL and SM 6-3 SP suited to high yielding environments and SM 6-8 PL and SM 6-1 SP suited to low yielding environments. The path analysis revealed fruits/plant and primary branches/plant having maximum direct effect on yield.

The 26 lines were grouped into 4 clusters in each environment based on Mahalanobis D^2 statistics. The intra and inter cluster distances and genotypes within clusters differed in the four trials.

The stable lines were moderately resistant to bacterial wilt. They had root galls caused by *Meloidogyne incognita*. Root volume was positively correlated with yield. Survey conducted on preference to color and shape showed that white long and purple long fruits were the most prefered. The stable brinjal lines possessed this economic value also.