COLLECTION AND CHARACTERIZATION OF LANDRACES OF BRINJAL (*Solanum melongena* L.) IN KERALA

By

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THESIS

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To

Almighty

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I hereby declare that this thesis entitled "**Collection and characterization of landraces of brinjal (*Solanum melongena* L.) in Kerala**" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar title, of any other university or society.

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CERTIFICATE

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INTRODUCTION

INTRODUCTION

Vegetables play an indispensable role in our daily balanced diet. They are cheap sources of nutrients, minerals and vitamins. Most of the vegetables are often recognised as the protective food.

Brinjal or eggplant (*Solanum melongena* L.) is an important commercial vegetable crop belonging to the family Solanaceae. The crop is grown throughout the tropical and subtropical regions of the world. It is highly productive and rated as poor man's tomato. The fruits, used as a delicious vegetable is rich in protein, minerals, vitamins and dietary fibre. Apart from this, it has some medicinal properties also (Choudhury, 1976).

A number of high yielding varieties of brinjal have been identified for various agroclimatic zones of the country. However, in Kerala, the yield of the crop is hampered by various biotic stresses. It includes shoot and fruit borer (*Leucinodes orbonalis* Guen.), bacterial wilt (*Ralstonia solanacearum* Yabuuchi), phomopsis blight (*Phomopsis vexans* (Sacc.& Syd.) Hartar) and little leaf (mycoplasma). Control measures using chemicals are not only uneconomical but invite environmental pollution also. Therefore, development of high yielding varieties resistant to major pests and diseases has been contemplated in many long term breeding programmes.

The success of any crop improvement programme largely depends on the extent of genetic variability available in a breeding population. Pooling of desirable genes into the adapted types is always considered as the thrust area in brinjal breeding programme. The landraces and wild related species of brinjal

distributed in most of the developing countries are worth in this regard. Though it is poor in yield, their adaptability is always found superior over the high yielding varieties evolved in other places (Labrada *et al.*, 1998). The Western Ghats of Kerala and the neighbouring states are considered as the natural bioreserves for the landraces of brinjal (Velayudhan *et al.*, 1996). No systematic work has been carried out in Kerala to characterize this genetic wealth. Genetic erosion is quite rampant in this region due to change in land use pattern, cropping pattern and habitat distribution. Hence, there is an urgent need to collect and conserve this genetic wealth which otherwise may be lost forever. Describing this genotypes using descriptors which are internationally accepted will help in easy exchange of information about the germplasm.

Understanding the genetic variability available in a population and transmission of these characters from one generation to next is important. An estimate of the interrelationship between yield and other traits is of immense value to a breeder for selecting best genotypes. Apart from these, path analysis and discriminant function analysis will also help to determine the extent of improvement that could be made in yield contributing characters.

Hence, present study was attempted for the collection and characterization of brinjal landraces distributed in different parts of Kerala. Also, an attempt was made to assess the variability existing in this germplasm for morphological characters, yield attributes and resistance to various biotic stresses so as to utilize them in future breeding programmes.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

Brinjal (*Solanum melongena* L.) is an important vegetable crop grown throughout the warmer regions of the world. The crop has been reported to be originated in India (Vavilov, 1928). Despite its wide genetic variability, very little work has been done on the improvement of yield and multiple resistance. The available literature on brinjal relevant to the present study is reviewed under the following heads :

2.1 Germplasm collection and characterization

2.1.1 Growth and yield characters

Crop yield, a complex character, is determined by various yield components (Singh, 1983).

Martin and Rhodes (1979) classified eggplant collections into

11 groups based on 18 growth and fruiting characteristics using numerical taxonomic methods. Some of the groups were also characterized by specific geographical origins. Fourty accessions of brinjal from several Italian regions were collected and characterized using 41 descriptors (Perrino *et al.*, 1992).

Velayudhan *et al.* (1996) conducted five explorations and collection trips in southern peninsular region and collected 216 accessions of brinjal and 134 lines belonging to 25 wild species. This included a number of rare genotypes / landraces of eggplant.

Anserwadekar *et al.* (1979) compared growth and yield of five cultivated varieties of eggplant and found significant difference in plant height between varieties. The cultivated variety 'Gondegaon' produced maximum leaves. Mediterranean varieties were found to be more vigorous with more leaves and higher total leaf area compared to the varieties from far east. There were no difference within or between two groups in stomatal regulation (Daunay,1986).

Turchenkov *et al.* (1986) reported that Soviet eggplant variety 'Al. Batros' derived by individual selection from the cv. 'K 2460' recorded a plant height of 50 – 60 cm. It produced fruits weighing 400 – 600 g with firm white flesh lacking any bitterness.

Magtng (1936) classified the flowers of eggplant with regard to the position of the stigma in relation to anther tips into long and short styled flowers. Krishnamoorthy and Subramoniam (1953) classified the flower types

in brinjal into four groups *viz.* short styled, pseudo short styled, medium styled and long styled. They showed that under natural conditions, 27 per cent of flowers set fruits and 93 per cent of these came from long styled flowers.

Quagliotti (1967) studied flower production in four eggplant varieties and found that it was maximum at a plant age of 201 to 208 days. Developing eggplant fruits reduced the pistil growth in flowers formed later on the same plant (Lenz, 1970).

Tanaka (1972) reported that 'Waimanalo long' a new eggplant variety surpassed 'Molokoi long' in earliness and marketable yield. Mohideen *et al.* (1977) evaluated various cultivars of brinjal and found that fruit set varied from 11.5 per cent to 27.7 per cent. The total number of flowers per plant was highest in 'Pusa Purple Long' (322). *In vivo* assessment of three genotypes revealed that fruit set was 86.6 per cent in the genotype 'BL_4' (Randhawa *et al.*, 1988)

Nothmann and Rylski (1983) reported that basal fruits were the heaviest and its presence affected the development of other fruits produced further. According to Patil and More (1983), fruit size was linked with fruit shape.

Plant exploration wing, NBPGR, New Delhi collected 183 accessions and landraces of brinjal. Wide variation was observed for fruit circumference ranging from 3 to 70 cm and for fruit weight, ranging from 5 to 2500g (Verma, 1993).

In a comparative study of six varieties of brinjal, 'Talla' was found to be highest yielding (Siddique and Hussain, 1971). Sweep and Koopmans (1972) evaluated five cultivated varieties of eggplants of which 'Mammouth' and 'Jersey King' gave the highest yields.

In an evaluation of 10 cultivated varieties by Bujdoso and Vedeki (1973), the varieties 'Pana Corbolui', 'Universal 6' and 'Mission Bell F_1' were highest yielders.

The performance of 17 cultivated varieties and selections of eggplant was assessed for two years by Bhutani *et al.* (1977). The highest marketable yield per plant was obtained from 'Shankar Vijay' followed by 'H-4' and 'Pusa Purple Long'. The variety 'Pusa Purple Long' produced the heaviest fruits (450g) and highest yield per plant (3600g) in an evaluation trial conducted by Rao *et al.* (1980). Elmolova (1982) reported that new eggplant variety 'Avrora' had a potential yield of 700–750 hkg/ha.

In a hothouse trial of 'Madonna', 'Adona', 'Dobrix' and 'Berinda' aubergine cultivars, 'Berinda' gave the highest total yield of 17.1 kg/m^2 (Bakker and Jansen, 1985).

Awasthi and Dixit (1986) evaluated 11 round fruited and three long fruited varieties of which marketable yield was highest in 'NDB_2'. In another evaluation of germplasm to screen out high yielding variety, 'Neelum' produced significantly highest yield of 12.59 t/ha (Hussain *et al.*, 1992).

Aubert and Pochard (1981) recommended that brinjal fruits could not be stored for more than two weeks at 8^0C. Storage studies in eggplant varieties conducted by Aluko and Ogbadu (1986) revealed that the variety 'Round Green' was the best for storage. In another study by Singh *et al.* (1989) using six aubergine cultivars, the variety 'P-8' showed least physiological weight loss and 'Pusa Purple Long' the most.

2.1.2 Resistance to biotic stresses

In most of the tropical countries including India, eggplant is attacked by a number of insect pests and diseases during various stages of crop growth. The extent of losses caused by these pests depends on season, variety, soil and other factors (Dhamdhere *et al.*, 1995; Roy and Pande, 1995).

According to Leppik (1970), the gene centres of cultivated plants and wild progenitors were the main source of resistance to insect pests and diseases. Many wild species of *Solanum* have shown high degree of resistance besides immune reactions to several diseases and insects (Kale *et al.*, 1986). Mukhopadhyay and Mandal (1994) described cultivars 'Shyama Dhepa', 'Kalo Dhepa', 'Improved Muktakeshi', 'Banaras Long Purple' and 'BB-1' as having multiple resistance against all the important insect pests.

2.1.2.1 Shoot and fruit borer

Shoot and fruit borer (*Leucinodes orbonalis* Guen.) is a serious pest of brinjal all over the country causing a yield loss up to 70 per cent (Lall, 1964).

Panda *et al.* (1971) evaluated 19 brinjal varieties for resistance to shoot and fruit borer (*L. orbonalis*) and found that varieties like 'Thorn Pendy', 'Black Pendy', 'H-165' and 'H-407' were highly resistant. In another field evaluation of 69 cultivars and six *Solanum* spp. conducted by Lal *et al.* (1976) showed resistance in *S. sisymbrifolium, S. integrifolium, S. xanthocarpum, S. incanum, S. khàsianum* and in cultivated types like 'SM-202', 'SM-145', 'S-497', 'S-519', 'S-520', 'S-521' and 'Solan-11'. Relative tolerance was found in 'Pusa Kranti', 'H-4' and 'A-61' and 'Arka Kusumkar' (Subbratnam and Butani, 1981). Tejarathu *et al.* (1991) found *S. gilo* as resistant to borer and crossable with *S. melongena.*

Of 13 aubergine cultivars studied by Baksha and Ali (1982), none was found resistant to *L. orbonalis.* Moderate tolerance to shoot infestation was noted in 'Baromashi', 'Jhumki', 'Indian' and 'Bogra Special' and to fruit infestation was noted in 'Noyankajal', 'Singnatu', 'Japani', 'Jhumki', 'Indian' and 'Baromashi'. Tolerance to both shoot and fruit infestation was highest in 'Jhumki', 'Indian' and 'Baromashi'.

Kabir *et al.* (1984) evaluated 12 brinjal varieties of which the variety 'Singnath' had the lowest infestation whereas, Duodo (1986) reported that fruits of 'Black Beauty' and 'Florida Market' were significantly least infested.

Long narrow fruits had less infestation (Ahmad *et al.*, 1985). Mishra *et al.* (1988) also observed shoot and fruit borer resistance in long fruited variety 'Katrain–4'. Tightly arranged seeds in mesocarp

and thick fruit skin were identified as possible mechanism of resistance. However, two long fruited varieties namely 'S-5' and 'PPL' despite thick fruit skin, hard pulp and tightly arranged seeds showed high susceptibility. Similarly, susceptibility increased as the days to first bloom were more (Dhankar, 1988).

Singh and Chadha (1991) reported that the resistance in 'SM-17-4', 'PBr-129-5' and 'Punjab Barsati' against *L. orbonalis* could be attributed to a large number of small sized fruits per plant along with late and longer fruiting period.

Shoot thickness, leaf area and preflowering period have some correlation with the shoot infestation (Grewal and Singh, 1992). However, Patil and Ajri (1993) reported a negative correlation of number of seeds per fruit, yield per plant and fruit skin thickness with fruit infestation.

Path analysis conducted by Kumar and Ram (1998) revealed that diameter, weight and volume of the fruit could be used as the indirect negative selection criteria for improving resistance to shoot and fruit borer.

2.1.2.2 Bacterial wilt

Bacterial wilt disease on solanaceous crops caused by *Pseudomonas solanacearum* E.F.Smith is more common in tropical and subtropical countries (Bhide, 1948).

Das and Chattopadhyay (1955) reported that a strain of bacterium *P. solanacearum* var *asiatium* (Smith) Stapp. caused severe wilt disease

of brinjal in India. The decay of roots in infected plants appeared to be due to the wall hydrolysing enzymes, *viz.* cellulases and pectinases as reported by Kelman and Cowling (1965).

Vijayagopal and Sethumadhavan (1973) reported that wilt resistant character of *S. melongena* var. *insanum* was closely associated with the small fruit size.

Studies on the bacterial wilt by Gowda *et al.*(1974) revealed a sudden wilting during the flowering stage in susceptible varieties of brinjal. They have also reported that a local cultivar 'Gulla' and *S. torvum* were resistant.

Gopimony and George (1979) reported that percentage of wilt in improved varieties like 'Arka Kusumkar' and 'Banaras Giant' was as high as 100 per cent, where as in local varieties this varied from six to 20 per cent.

The prickly line 'SM 6-1' with long purple fruits obtained as a result of pure line and single plant selection was found to be immune to wilt (Sheela *et al.*, 1984).

Jessykutty and Peter (1986) evaluated four resistant eggplant lines for yield and percentage of wilted plants. They found that yield was highest in 'SM 56' (1193.07g) and lowest in 'SM 74' (590.18g). But percentage of wilted plants was lowest in 'SM 74' (20 per cent).

Single seed descent (SSD) selection was reported as the most effective one in raising the level of resistance to bacterial wilt in eggplant (Sankar *et al.*, 1987).

Sadashiva *et al.* (1993) observed that varieties 'IHR 180' and 'IHR 181' survived even after 125 days of planting without any incidence of bacterial wilt. 'Rampur Local', a resistant variety yielded 1.65 kg/plant followed by 'West Coast Green Round' (1.37 kg/plant) in an evaluation trial (Sadashiva *et al.*, 1994).

Pathania *et al.* (1996) reported that 'Arka Neelkanth' and 'Arka Keshav' were 100 per cent resistant where as varieties like 'Pant Rituraj', 'Pant Samrat', 'Pusa Purple Long' were 100 per cent susceptible.

Screening of 95 accessions of brinjal resulted in eight wilt resistant accessions *viz.* 'Arka Nidhi', 'Arka Keshav', 'Arka Neelkanth', 'BB-1', 'BB-44', 'BB-49', 'EP-143' and 'Surya'. (Ponnuswamy, 1997)

2.1.2.3 Phomopsis blight

Phomopsis blight is one of the major limiting factors of eggplant production. It was first reported in India by Uppal *et al.* (1935). According to Palo (1938) most commercial eggplant varieties are very susceptible to this disease. Ramanujam (1966) reported that the disease was confined to *S. melongena* only. *Phomopsis vexans*, the causal organism of fruit rot of eggplant remained viable for about 14 months in soil debris (Panwar *et al.*, 1970).

Phomopsis blight of eggplant could be controlled in the field, only by the use of resistant varieties (Howard and Dessosiers, 1941).

Decker (1951) bred and released two eggplant varieties 'Florida Market' and 'Florida Beauty' resistant to phomopsis blight whereas, Pawar

and Patel (1957) reported that out of 24 varieties of brinjal tested, none was found to be resistant.

Kalda *et al.* (1976) reported that *S. xanthocarpum*, *S. indicum*, *S. gilo S. khasianum* and *S. nigrum* were highly resistant against phomopsis blight. But *S. incanum*, *S. integrifolium*, *S. melongena* var *insanum* were found to be susceptible.

Resistance to phomopsis blight in eggplant was recessive and governed by polygenes (Kalda *et al.*, 1977). All wild varieties of brinjal were resistant and the varieties like 'Arka Kusumkar', 'Aurangabad Local' and 'Bengali Long' were moderately resistant (Datar and Ashtaputre , 1988) .

2.1.2.4 Little leaf

Little leaf disease in eggplant was first reported by Thomas and Krishnaswami (1939) from Coimbatore. The symptoms include chlorosis, vein clearing, stimulation of normally dormant bud, malformation, stunting, virescence of flowers, sterility and an abnormally erect, upright growth habit (Maramorosch *et al.*, 1968). Mycoplasmal nature of the disease was reported by Varma *et al.* (1969).

In the diseased plant a reduction occurred for insoluble and total nitrogen, protein, phenol and ascorbic acid content. The significant reduction in growth was during only in the early stages. The number, size and weight of fruits were reduced and seed production was negligible compared to healthy plants (Joshi *et al.*,1979 ; Joshi and Bose, 1983). Datar

(1985) reported a reduced root development in different aubergine cultivars due to the incidence of little leaf disease and the extent of reduction varied with the cultivar.

Anjaneyulu and Ramakrishnan (1968) reported that out of 173 cultivars of brinjal tested, none was found to be resistant to little leaf disease. In a field evaluation by Mote *et al.* (1976) varieties *viz.* 'Aushey', 'Pure White-Bunchy', 'Pusa Kranti', 'Black Beauty', 'Six Seer', '10 x 16', 'American Black Beauty', 'Long White'and 'Long Green Mysore' were observed to be less susceptible to the disease.

Another field screening of thirty nine cultivated varieties and strains of eggplant for resistance to little leaf disease revealed that cultivated variety, 'Brinjal Round' showed most tolerance followed by 'S 433-5' and 'Surati' (Verma and Dubey, 1976).

In a field evaluation of four *Solanum* spp., 57 *S. melongena* varieties and 31 F1 hybrids over two seasons for little leaf resistance, 15 varieties, seven F1 hybrids and four *Solanum* spp. proved resistant or moderately resistant (Datar and Ashtaputre, 1984).

Keshwal and Khare (1986) found varieties 'Pusa Purple Cluster', 'Pusa Purple Round' and 'Round Local' were more tolerant to the disease. They also reported that continous cropping of the same cultivar increased disease incidence.

Doshi *et al.* (1998) observed positive correlation of little leaf disease with anthocyanine content.

2.2 Genetic Variability and Correlation Studies

The improvement of any crop depends to a great extent upon the magnitude of genetic variability existing in the germplasm. Also, a knowledge of correlation between yield and its component characters is essential for a rational improvement in yield.

India being the centre of diversity for brinjal (Ganabus, 1964), provided a large amount of variation for its genetic improvement. Three main botanical varieties have been reported under the species *melongena* (Choudhury, 1976). The round or egg shaped cultivars were grouped under var. *esculentum*. The long slender types were included under var. *serpentinum* and the dwarf brinjal plants were under var. *depressum*. A wild form with many small fruits sometimes called as var. *insanum* was found on the Bengal plains of India (Martin and Rhodes, 1979).

According to Johnson *et al.* (1955), the traits having high estimates of heritability coupled with high genetic advance could be useful in establishing a close relationship between genotype and phenotype in brinjal.

High heritability accompanied by high genetic advance was observed for fruits per plant, seedweight per fruit and rind thickness. Yield per plant had high significant positive correlation with number of fruits per plant, but showed negative correlation with fruit weight and girth of fruit. Positive

correlation was found among the characteristics *viz.*, fruit weight, seed weight and girth of fruits (Hiremath and Rao, 1974).

Yield per plant showed significant positive correlation with weight and size per fruit and negative correlation with days to bloom. Path analysis revealed that number of fruits per plant and weight of fruit exhibited positive direct effect on yield. Size of the fruit showed low negative direct effect. Days to bloom had negative direct effect on yield (Vijay *et al.*, 1978).

Correlation studies in eggplant by Singh and Khanna (1978) indicated significant positive association between plant spread and number of branches and between fruit number and yield. Chadha and Paul (1984) observed high genetic coefficient of variation and genetic advance for number of fruits per plant. A positive correlation was also observed between yield and number of fruits per plant.

Dharmegowda *et al.* (1979) reported a narrow sense of heritability of 63.48 per cent and 67.48 per cent for number of fruits per plant and number of seeds per fruit respectively. Dixit *et al.* (1984) obtained high heritability (> 50 per cent) for all characters except plant height and yield per plant. Low heritability for yield per plant was also reported by Nualsri *et al.* (1986).

Mak and Vijayarungam (1980) studied the variability and interrelationships of some characters in 27 varieties of brinjal. Yield per plant was positively correlated with the number of fruits per plant, mean fruit weight, mean fruit length, number of primary branches and number of seeds per fruit. Plant

spread and number of fruits per plant showed significant positive correlation with yield as well as high genetic advance (Gautham and Srinivas, 1992).

Path analysis indicated that fruits per plant and fruit length : circumference ratio had the maximum direct effect on yield combined with high GCV and heritability values (Sinha, 1983).

Genetic variability studies in 27 brinjal varieties conducted by Gopimony*et al.* (1984) revealed that yield has highest phenotypic coefficient of variation (98.85 per cent). Genotypic coefficient of variation was maximum for single fruit weight (98.2 per cent) which also has highest heritability (99.12 per cent) and genetic advance (201.38 per cent).

Vadivel and Bapu (1990) reported that fruit yield showed higher co-heritability with number of fruits per plant and number of branches. Results on path analysis for yield components suggested the importance in order of number of fruits per plant, number of branches per plant, plant height and fruit weight on fruit yield.

Rai *et al.*, (1998) observed high estimate of heritability (0.935) along with genetic advance (68.48 per cent of mean) for fruit weight. However, number of primary branches, longitudinal and equatorial fruit lengths, leaf length, leaf breadth recorded low heritability and low genetic advance.

MATERIALS AND METHODS

3. MATERIALS AND METHODS

The present study entitled "Collection and characterization of landraces of brinjal (*Solanum melongena* L.) in Kerala" was carried out at the Department of Olericulture, College of Agriculture, Vellayani during the year 1997 – 99.

3.1 Survey and collection of landraces

A survey was carried out in the different brinjal growing tracts of Kerala for collecting landraces. Effective collection was made with the help of the extension personnel, Department of Agriculture, from various traditional brinjal growing areas. In each district, office of the Principal Agricultural Officer was treated as units and the office of the Assistant Director of Agriculture as subunits. The survey was conducted during January to April 1997. Seed samples of various landraces were collected after the field visit. The details of the accessions with their sources are presented in Table 3.1

3.2 Experimental site and planting

Seeds of 50 accessions of various landraces collected through the survey were evaluated in the experimental field of the Instructional Farm, College of Agriculture, Vellayani. It is situated at 8.5^0 N latitude, 76.9^0 E longitude at an altitude of 29 m above MSL. The soil of the experimental site was lateritic red loam belonging to Vellayani series.

The experiment was laid out in randomised block design with two replications. The seedlings were raised in earthenpots filled with potting mixture of soil, sand and

Table 3.1 List of landraces of brinjal used for the study and their details

Sl. No.	Accession No.	Species	Source	Special features
1	S 1	*Solanum melongena* L.	Neyyattinkara, Thiruvananthapuram	Light green coloured fruits with pointed tips.
2	S 2	"	Neyyattinkara, Thiruvananthapuram	Dark green fruits.
3	S 3	"	Neyyattinkara, Thiruvananthapuram	Spines on fruit calyx.
4	S 5	"	Pongummodu, Thiruvananthapuram	Oblong fruits
5	S 6	"	Palapoor, Thiruvananthapuram	Round fruits
6	S 8	"	Nedumangad, Thiruvananthapuram	Purple fruits
7	S 9	"	Palode, Thiruvananthapuram	Greenish white round fruits
8	S 10	"	Nedumangad, Thiruvananthapuram	Plant with light green leaves.
9	S 12	"	Athichanallore, Kollam	Long fruits
10	S 13	"	Athichanallore, Kollam	Spines on fruit calyx.
11	S 14	"	Pathanapuram, Kollam	Purple oblong fruits
12	S 15	"	Kundara, Kollam	Narrow long fruits
13	S 16	"	Perinad, Kollam	Purple fruits
14	S 17	"	Odanavattom, Kollam	Long fruits
15	S 18	"	Kilikollur, Kollam	Purple oblong fruits
16	S 19	"	Vallikeezhu, Kollam	Milk white fruits.
17	S 20	"	Punaloor, Kollam	Round fruits
18	S 21	"	Vallikeezhu, Kollam	Spiny plant.

(Contd...)

19	S 22	"	Thiruvakkal, Alappuzha	Large oblong fruits
20	S 23	"	Cherthala, Alappuzha	Highly branched plant
21	S 24	"	Poochakal, Alappuzha	Large number of small purple fruits, purplish green leaves.
22	S 25	"	Thathampally, Alappuzha	Very long fruits.
23	S 26	*Solanum melongena* L.	Thamarapally, Alappuzha	Oblong fruits
24	S 28	"	Thamarakulam, Alappuzha	Spines are seen all over the plant body.
25	S 29	"	Thamarakulam, Alappuzha	Long fruits
26	S 30	*S. macranthum* Dun.	Konni, Pathanamthitta	Bushy habit with highly lobed long leaves. Mainly cultivated for ornamental purpose, not found wild.
27	S 31	*S. melongena* L.	Adoor, Pathanamthitta	Round fruits
28	S 32	"	Adoor, Pathanamthitta	Long fruits
29	S 33	"	Adoor, Pathanamthitta	Spines on fruit calyx.
30	S 34	"	Poonjar, Kottayam	Long fruits
31	S 35	"	Poonjar, Kottayam	Narrow long fruits
32	S 36	"	Eara, Kottayam	Violet flowers
33	S 37	"	Manarkadu, Kottayam	Green mottled fruits
34	S 39	*S. melongena* var. *insanum* Prain	Vandiperiyar, Idukki	Velutha chunda, a wild type with spines and produce large number of small fruits.

(Contd...)

35	S 42	*S. melongena* L.	Thodupuzha, Idukki	Very large fruits.
36	S 43	"	Angamali, Ernakulam	Milky white oblong fruits
37	S 45	"	Muvattupuzha, Ernakulam	Round fruits
38	S 46	"	Irinjalakuda, Thrissur	Long fruits
39	S 47	"	Irinjalakuda, Thrissur	Long fruits
40	S 52	"	Nilambur, Malappuram	Oblong fruits
41	S 53	"	Walayar, Palakkad	Purplish black fruits
42	S 54	"	Pudussery, Palakkad	Round fruits
43	S 55	"	Ozhur, Malappuram	Large number of white long fruits
44	S 58	"	Ambalawayal, Wynad	Long purple fruits, touching the soil surface
45	S 59	*S. xanthocarpum* Schrad and Wendl.	Ambalawayal, Wynad	Wild type with spines, highly lobed dark green leaves.
46	S 60	*S. melongena* L.	Ambalawayal, Wynad	Spines on the plant.
47	S 61	"	Bathery, Wynad	Round fruits
48	S 63	"	Thalacherry, Kannur	Dark purple fruits
49	S 65	"	Azhikode, Kannur	Round fruits
50	S 66	"	Alakkode, Kasargode	Striped purple fruits

cattle manure in the proportion 1:1:1. They were transplanted to the mainfield 40 days after sowing, adopting a spacing of 75 x 60cm. Five plants were maintained per plot (microplot) in a row. The crop received timely management practices as per the Package of Practices Recommendations of the Kerala Agricultural University (KAU, 1996).

3.3 Characterization of landraces

3.3.1 Observations recorded

All the biometrical observations were recorded from three plants in the middle of the row and mean was taken for further analysis.

3.3.1.1 Growth characters

3.3.1.1.1 Plant height

Plant height was recorded from the ground level to the topmost budleaf of the plants at the time of flowering and presented in cm.

3.3.1.1.2 Stem girth

Girth of the main stem at 15 cm from the soil surface was taken using a twine. The mean girth was worked out and expressed in cm.

3.3.1.1.3 Height at branching

Plant height from the ground level to the axil of the first branch was taken. The average was worked out and expressed in cm.

3.3.1.1.4 Branches per plant

The total number of branches in each of the three observational plant was counted at full vegetative growth (60 days after transplanting).

3.3.1.1.5 Canopy spread

Observations were recorded on the 60th day after transplanting when the plant attained full growth. Measurements were taken in the direction where there was maximum spread of plant and expressed in cm.

3.3.1.1.6 Dry weight

The whole plant was uprooted after the last harvest and dried in a hot air oven, weighed and expressed in g.

3.3.1.2 Leaf characters

3.3.1.2.1 Leaf area index

Five leaves were selected from each observational plant randomly and area of each leaf was measured using leaf area meter. Mean was calculated and multiplied with total number of leaves on the plants to get total leaf area. Then, leaf area index was calculated using the formula

$$LAI = \frac{\text{Total leaf area of the plant}}{\text{Ground area occupied (spacing)}}$$

(Watson, 1952)

3.3.1.2.2 Leaf thickness

Leaf thickness in the middle portion was measured using stage and occular micrometer. Leaf sections from the randomly selected leaves of the plants were used for recording thickness. Mean was computed and expressed in μ (*microns*).

3.3.1.2.3 Leaf petiole length

Length of petiole of five leaves was measured at random in each plant and their mean was expressed in cm.

3.3.1.2.4 Stomatal distribution

Five leaves from each accession were selected at random. Lower epidermis was peeled and observed under light microscope (40x) using the stain acetocarmine. Stomata per microscopic field was counted and mean was computed.

3.3.1.2.5 Vascular bundle distribution

Five leaves from each accession were selected at random. Vascular bundles or veins were counted by observing leaf sections having one cm length from middle portion of leaf under light microscope (10x) using the stain acetocarmine.

3.3.1.3 Flowering parameters

3.3.1.3.1 Days to first flower

The date on which the first flower opened in each observational plant was recorded. The days taken from transplanting to the opening of the first flower were computed to give days to first flower.

3.3.1.3.2 Branch and node of first flower

Branch and node of first flower production was noted counting from the ground level.

3.3.1.3.3 Height of first flowering node

Height from ground level to the node of first flower production was measured and mean was expressed in cm.

3.3.1.3.4 Long styled and medium styled flowers

Number of long and medium styled flowers were counted starting from the commencement of flowering till its completion and expressed as percentage of total number of flowers.

$$\text{Percentage of long and medium styled flowers} = \frac{\text{Number of long and medium styled flowers}}{\text{Total number of flowers}} \times 100$$

3.3.1.4 Fruit set and yield characters

3.3.1.4.1 Fruit set

Total number of fruits was counted in each plant and percentage set was calculated as the number of fruits over the total number of flowers.

3.3.1.4.2 Days to first harvest

The number of days taken from transplanting to the first harvest was computed for each plant.

3.3.1.4.3 Fruits per plant

The total of all the fruits obtained from each plant was counted and mean was taken.

3.3.1.4.4 Total weight of fruits per plant (Yield)

The weight of fruits obtained in each harvest in each plant was added up till the last harvest and expressed in g.

3.3.1.4.5 Harvest Index

Harvest Index was calculated using the formula

$$HI = \frac{\text{Economic yield}}{\text{Total biomass}}$$

Weight of fruits in each harvest was added to get economic yield. Total biomass was computed by adding economic yield with the weight of whole plant after uprooting.

3.3.1.5 Fruit and quality characters

3.3.1.5.1 Fruit measurements

Five fruits of each accession were selected at random from the bulk of fruits harvested at a time. Length, breadth and weight were recorded from this, mean calculated and expressed in cm. Fruit weight was expressed in g.

3.3.1.5.2 Colour and shape of fruits

Colour and shape of fruits in each accession was noted using the descriptor provided by IBPGR (1990).

3.3.1.5.3 Seed weight

One well ripened fruit from each plant was selected at random. The seed mass was extracted carefully and kept them under fermentation for 36 hours. It was washed, cleaned and dried under shade for three days. Seed weight was recorded using an electronic balance and expressed in g.

3.3.1.5.4 Keeping quality

The harvested fruits were kept under ordinary room conditions to study its shelf life and number of days, up to which the fruits remained fresh for consumption without loss of colour and firmness were recorded.

3.3.1.5.5 Organoleptic quality

The organoleptic quality and acceptability trials were done using a scoring method proposed by Jijiamma (1989). The following major quality attributes were included in the score.

1. Appearance /colour
2. Doneness
3. Bitterness
4. Odour
5. Taste

Each of the above mentioned quality was assessed by a five point rating scale ranging from 1 to 5 as furnished in Table 3.2.

Table 3.2 Score card for the organoleptic evaluation of brinjal

Quality attributes	Subdivisions of attributes	Score
Appearance / colour	Natural colour	5
	Colour fairly preserved	4
	Slightly discoloured	3
	Moderately discoloured	2
	Highly discoloured	1
Doneness	Highly acceptable	5
	Fairly acceptable	4
	Moderately acceptable	3
	Slightly acceptable	2
	Least acceptable	1
Bitterness	No bitterness	5
	Slight bitterness	4
	Moderate bitterness	3
	High bitterness	2
	Very high bitterness	1
Odour	Highly acceptable	5
	Fairly acceptable	4
	Moderately acceptable	3
	Slightly acceptable	2
	Least acceptable	1
Taste	Highly acceptable	5
	Fairly acceptable	4
	Moderately acceptable	3
	Slightly acceptable	2
	Least acceptable	1

The fruits were washed thoroughly in water and cut into pieces. 100g of cut fruits were boiled with 50 ml of water and one gram of salt for ten minutes. The prepared sample was used for organoleptic quality scoring.

The panel members were selected from a group of healthy adults in the age group of 25–45. They were requested to taste one sample and score it. Each quality was assessed by the panel members after tasting the same sample several times if needed.

3.3.1.6 Reaction towards pests and diseases

The incidence of various pests and diseases was recorded under natural field and 'hot spot' conditions. No insecticides / fungicides were applied in the plant during the course of the experimentation.

3.3.1.6.1 Incidence of shoot and fruit borer

Characterization of shoot and fruit borer incidence was done as suggested by Tewari and Krishnamoorthy (1985).

The incidence of *Leucinodes orbonalis* Guen. on shoots was assessed in terms of the percentage of infested shoots out of the total number of shoots available in each plot. Incidence on fruits was assessed by calculating percentage of infested fruits over healthy fruits at different pickings and pooled data was subjected for statistical analysis. Pest rating was done as per the following scale :

Percentage of fruit infestation		Rating
0	:	Immune (Immune)
1 - 10	:	Highly resitant (HR)
11 - 20	:	Moderately resistant (MR)
21 - 30	:	Tolerant (T)
31 - 40	:	Susceptible (S)
> 40	:	Highly susceptible (HS) (Mishra *et al.*, 1988)

3.3.1.6.2 Bacterial wilt

Reaction to the incidence of bacterial wilt was studied adopting spot planting technique as suggested by Narayanankutty (1986). In this technique, a wilt susceptible variety Arka Shirish obtained from IIHR Bangalore was planted along with the line under test. The wilting of the susceptible line indicated presence of virulent inoculum in the soil.

Wilt incidence was confirmed by bacterial ooze test. The disease rating was done as per the following scale suggested by Mew and Ho (1976).

Percentage of wilted plants		Rating
< 20 % wilting	:	Resistant (R)
20 - 40 % wilting	:	Moderately resistant (MR)
41 - 60 % wilting	:	Moderately susceptible (MS)
> 60 % wilting	:	Susceptible (S)

3.3.1.6.3 Phomopsis blight

Categorization of the entries in terms of reaction towards the phomopsis disease was done based on the score suggested by Kalda *et al.* (1976). The plant populations were screened for disease incidence on leaves and fruits seperately.

The following visual disease rating was adopted.

On leaves

0 : No visual symptoms on the leaves.

1 : Lower leaves showing symptoms of the disease.

2 : About 60% of total foilage showing disease symptoms

3 : More than 60% of total foilage showing disease symptoms.

For the purpose of calculating percentages of plants showing resistance, the rating 0 and 1 was considered as resistant and 2 and 3 as susceptible.

On fruits

Incidence on fruits was recorded adopting the following formula.

$$\text{Incidence on fruits} = \frac{\text{Number of fruits infested}}{\text{Total number of fruits}} \times 100$$

Disease rating was done as per the following scale :

Percentage of fruit infestation		Rating
0	:	Immune (Immune)
1 - 10	:	Highly resitant (HR)
11 - 20	:	Moderately resistant (MR)
21 - 30	:	Tolerant (T)
31 - 40	:	Susceptible (S)
> 40	:	Highly susceptible (HS)

3.3.1.6.4 Scoring for little leaf

Number of diseased plants were recorded during the crop period. Mean percentage of disease incidence was worked out on the basis of diseased plants to total plants. On the basis of the percentage of disease incidence, following categories were made as suggested by Mote *et al.* (1976).

Percentage of infested plants		Rating
0	:	Immune
1 - 10	:	Resistant
11 - 20	:	Moderately resistant
21 - 50	:	Susceptible
> 51	:	Highly susceptible

3.3.1.7 Weather parameters

Following weather parameters during the course of investigation were recorded and furnished in Appendix I.

3.3.1.7.1 Maximum and minimum temperature

3.3.1.7.2 Rainfall

3.3.1.7.3 Relative humidity

3.3.2 Genetic cataloguing

The landraces were described morphologically using descriptors of IBPGR (1990) for eggplant (Table 3.3). The identity of the wild species was confirmed with the help of herbarium in consultation with the taxonomist TBGRI, Palode.

Table 3.3 Descriptors for eggplant (IBPGR, 1990)

1. Plant data – Vegetative			
A. Plant growth habit			
	3	Upright	
	5	Intermediate	
	7	Prostrate	
1.2 Plant height		At flowering stage	
	1	Very short	(< 20 cm)
	3	Short	(~ 30 cm)
	5	Intermediate	(~ 60 cm)
	7	Tall	(~ 100 cm)
	9	Very tall	(> 150 cm)
1.3 Plant breadth	At flowering stage		
	1	Very narrow	(< 30 cm)
	3	Narrow	(~ 40 cm)
	5	Intermediate	(~ 60 cm)
	7	Broad	(~ 90 cm)
	9	Very broad	(> 150 cm)
1.4 Plant branching	Number of primary branches per plant		
	1	Very weak	(~ 2)
	3	Weak	(~ 5)
	5	Intermediate	(~ 10)
	7	Strong	(~ 20)
	9	Very strong	(> 30)

Contd..

1.5 Leaf blade length			
	3	Short	(~ 10 cm)
	5	Intermediate	(~ 20 cm)
	7	Long	(~ 30 cm)
1.6 Leaf blade width	The maximum width		
	3	Narrow	(~ 5 cm)
	5	Intermediate	(~ 10 cm)
	7	Wide	(~ 15 cm)
1.7 Leaf blade lobing			
	1	Very weak	
	3	Weak	
	5	Intermediate	
	7	Strong	
	9	Very strong	
1.8 Leaf blade colour	Upper surface		
	1	Light green	
	3	Green	
	5	Dark green	
	7	Greenish violet	
	9	Violet	

Contd..

1.9 Leaf prickles	Number of leaf prickles on upper surface of the leaf		
	0	None	0
	1	Very few	(1 – 2)
	3	Few	(3 – 5)
	5	Intermediate	(6 – 10)
	7	Many	(11 – 20)
	9	Very many	(> 20)
1.10 Petiole length			
	0	None	
	1	Very short	(< 5 mm)
	3	Short	(~ 10 mm)
	5	Intermediate	(~ 30 mm)
	7	Long	(~ 50 mm)
	9	Very long	(> 100 mm)
1.11 Petiole colour	Upper surface		
	1	Green	
	3	Greenish violet	
	5	Violet	
	7	Dark violet	
	9	Dark brown	

Contd..

2. Inflorescence and fruit data

2.1 Corolla colour	1	Greenish white	
	3	White	
	5	Pale violet	
	7	Light violet	
	9	Bluish violet	
2.2 Fruit length		From base of calyx to tip of fruit	
	1	Very short	(< 1 cm)
	3	Short	(~ 2 cm)
	5	Intermediate	(~ 5 cm)
	7	Long	(~ 10 cm)
	9	Very long	(> 20 cm)
2.3 Fruit breadth		Diameter of broadest part	
	1	Very small	(< 1 cm)
	3	Small	(~ 2 cm)
	5	Intermediate	(~ 3 cm)
	7	Large	(~ 5 cm)
	9	Very large	(> 10 cm)
2.4 Fruit length / breadth ratio (Fruit shape)	1	Broader than long	
	3	As long as broad	
	5	Slightly longer than broad	
	7	Twice as long as broad	
	8	Three times as long as broad	
	9	Several times as long as broad	

Contd..

2.5 Fruit curvature

1	None (fruit straight)
3	Slightly curved
5	Curved
7	Snake shaped
8	Sickle shaped
9	U shaped

2.6 Fruit colour at commercial ripeness

1	Green
2	Milk white
3	Deep yellow
4	Fire red
5	Scarlet red
6	Lilac grey
7	Purple
8	Purple black
9	Black
10	Light green

2.7 Fruit colour distribution at commercial ripeness

1	Uniform
3	Mottled
5	Netted
7	Striped

Contd..

2.8 Fruit calyx prickles		Average number of prickles / calyx	
	0	None	
	1	Very few	(< 3)
	3	Few	(~ 5)
	5	Intermediate	(~ 10)
	7	Many	(~ 20)
	9	Very many	(> 30)
2.9 Fruit yield per plant			
	1	Very low	(< 250 g)
	3	Low	(~ 500 g)
	5	Intermediate	(~ 1000 g)
	7	High	(~ 2500 g)
	9	Very high	(> 5000 g)

3.3.3 Statistical Analysis

Data recorded from experimental plants were statistically analysed. Analysis of variance and covariance were done :

a) to test the significant difference among the genotypes and

b) to estimate variance components and other genetic parameters like correlation coefficients, heritability, genetic advance etc.

Table 3.4 : Analysis of Variance / Covariance

Source	df	Observed mean square XX	Expected mean square XX	Observed mean sum of products XY	Expected mean sum of products XY	Observed mean square YY	Expected mean square YY
Block	(r-1)	B_{xx}		B_{xy}		B_{yy}	
Genotype	(v-1)	G_{xx}	$\sigma^2_{ex} + r\sigma^2_{gx}$	G_{xy}	$\sigma^2_{exy} + r\sigma^2_{gxy}$	G_{yy}	$\sigma^2_{ex} + r\sigma^2_{gx}$
Error	(v-1) (r-1)	E_{xx}	σ^2_{ex}	E_{xy}	σ^2_{exy}	E_{yy}	σ^2_{ex}
Total	(rv-1)	T_{xx}		T_{xy}		T_{yy}	

From the above table other genetic parameters were estimated as follows :

3.3.3.1 Variance

		X		Y
Environmental variance (σ^2_e)	$\sigma^2_{ex} = E_{xx}$		$\sigma^2_{ey} = E_{yy}$	
Genotypic variance (σ^2_g)	$\sigma^2_{gx} = \frac{G_{xx} - E_{xx}}{\gamma}$		$\sigma^2_{gy} = \frac{G_{yy} - E_{yy}}{\gamma}$	
Phenotypic variance (σ^2_p)	$\sigma^2_{px} = \sigma^2_{gx} + \sigma^2_{ex}$		$\sigma^2_{py} = \sigma^2_{gy} + \sigma^2_{ey}$	

3.3.3.2 Coefficient of variation

Phenotypic and genotypic coefficients of variation (PCV and GCV) were estimated as

$$GCV = \frac{\sigma_{gx}}{\overline{x}} \times 100$$

$$PCV = \frac{\sigma_{px}}{\overline{x}} \times 100$$

where,

σ_{gx} - genotypic standard deviation

σ_{px} - phenotypic standard deviation

$\overline{x}$ - mean of the character under study

3.3.3.3 Heritability (Broad sense)

$$H^2 = \frac{\sigma^2_{gx}}{\sigma^2_{px}} \times 100$$

where, H^2 is the heritability (Jain, 1982) expressed in percentage.

3.3.3.4 Genetic advance as percentage of mean

$$GA = \frac{kH^2\sigma_p}{\overline{x}} \times 100$$

where k is the standard selection differential.

k = 2.06 at 5% selection intensity (Miller et al., 1958)

3.3.3.5 Correlation

Genotypic correlation coefficient (γ_{gxy}) $= \frac{\sigma_{gxy}}{\sigma_{gx} \times \sigma_{gy}}$

$$\text{Phenotypic correlation coefficient } (\gamma_{pxy}) = \frac{\sigma_{pxy}}{\sigma_{px} \times \sigma_{py}}$$

$$\text{Environmental correlation coefficient } (\gamma_{exy}) = \frac{\sigma_{exy}}{\sigma_{ex} \times \sigma_{ey}}$$

3.3.3.6 Path analysis

The path coefficients were worked out by the method suggested by Wright (1921) using the characters which showed high correlation with yield.

The simultaneous equations which give the estimates of path coefficients are as follows.

$$\begin{vmatrix} r_{1y} \\ r_{2y} \\ r_{iy} \\ r_{ky} \end{vmatrix} = \begin{vmatrix} 1 & r_{12} & r_{13} \text{-------} r_{1j} \text{-------} & r_{1k} \\ & 1 & r_{23} \text{----------} & r_{2k} \\ & & r_{ij} \text{----------} & r_{ik} \\ & & & 1 \end{vmatrix} \times \begin{vmatrix} P_1 \\ P_2 \\ P_i \\ P_k \end{vmatrix}$$

where, r_{ij} is the genotypic correlation between x_i and x_j ; i, j = 1,2, ...k;

r_{iy} is the genotypic correlation between x_i and y and P_i is the path coefficient of x_i.

The residual factor (R) which measures the contribution of other factors not defined in the causal scheme was estimated by the formula.

$$R = \sqrt{(1 - \sum_{i=1}^{k} P_i r_{iy})}$$

Indirect effect of different characters on yield is obtained as $P_i r_{ij}$ for the i^{th} character via j^{th} character.

3.3.3.6 Selection index

The selection index developed by Smith (1937) using discriminant function of Fisher (1936) was used to discriminate the genotypes based on 10 characters. The selection index was described by the function

$I = b_1 x_1 + b_2 x_2 + \ldots\ldots\ldots b_k x_k$ and the merit of a plant is described by the funciton.

$H = a_1 G_1 + a_2 G_2 + \ldots\ldots\ldots\ldots a_k G_k$

Where, $x_1, x_2 \ldots\ldots x_k$ are the phenotypic values and $G_1, G_2 \ldots\ldots G_k$ are the genotypic values of the plant with respect to characters, $x_1, x_2 \ldots\ldots x_k$ and H is the genetic worth of the plant.

It is assumed that the economic weight assigned to each character is equal to unity, i.e., $a_1, a_2 \ldots\ldots a_k = 1$. The b coefficients were determined such that the correlation between H and I is maximum.

RESULTS

4. RESULTS

The experimental data collected on morphological characters, yield and other yield attributing characters were statistically analysed and the results are presented under the following heads :

4.1 Characterization of the landraces

4.2 Genetic cataloguing

4.3 Variability studies

4.4 Heritability and genetic advance

4.5 Correlation studies

4.6 Path analysis

4.7 Selection index

4.1 Characterization of the landraces

The mean data on morphology and yield attributes were subjected to analysis of variance for testing the significance of the difference among accessions. The results (Appendix II) revealed that genotypes exhibited significant difference for all the characters except branch and node of first flower production and stomatal distribution.

4.1.1 Growth characters

The mean performance of each of the fifty accessions for various

growth characters is furnished in Table 4.1. Plant height varied from 24.00 in S 59 to 58.90 cm in S 33. S 35 (51.90 cm) and S 60 (51.83 cm) were found on par with S 33. S 42, S 55, S 33, S 19, S 12, S 25, S 23 and S 28 were superior in terms of stem girth (5.36, 5.25, 5.10, 5.05, 4.94, 4.85, 4.85 and 4.85 cm respectively). S 9, S 59, S 2, S 20 and S 30 recorded low stem girth (2.61, 2.70, 2.85, 3.01 and 3.13 cm respectively). For the character of height at branching, the range was 4.50 cm to 12.55 cm in S 59 and S 37 respectively. S 33 (12.50 cm) and S 35 (11.25 cm) were on par with S 37. Highest value for branches per plant was recorded by S 39 (36.05) followed by S 55 (28.50). Lowest mean was for S 54 (10.12). The mean value for canopy spread ranged from 34.50 cm for S 59 to 99.84 cm for S 39. S 33 (91.67 cm) was on par with S 39. S 15, S 14, S 18, S 29, S 46 and S 33 recorded high values for dry weight (985, 980, 973, 967.5, 965 and 962.5 g respectively). Lowest dry weight (257.5 g) was recorded by S 59.

4.1.2 Leaf characters

Details on various landraces in terms of the leaf characters are presented in Table 4.2 and Plate 4.1. S 55, S 15, S 32, S 14 and S 23 were superior in leaf area index (0.840, 0.830, 0.830, 0.825 and 0.805) lowest value of 0.120 was recorded by S 59. Leaf thickness was highest (279.91 μ) for S 25 followed by S 46 (248. 32 μ). Petiole length ranged from 1.75 cm in S 20 to 8.75 cm in S 43 which was followed by S 59 (7.15 cm). Maximum stomata per unit area (6.3) was observed in S 5, S 10, S 12, S 14, S 37, S 46, S 52 and S 65, lowest count of six was noted in S 39, S 25, S 55 and S 15. Vascular

Table 4.1 Growth characters of the landraces of brinjal

Sl. No.	Accession	Plant height (cm)	Stem girth (cm)	Height at branching (cm)	Branches per plant	Canopy spread (cm)	Dry weight (g)
1	S 1	47.58	4.78	10.04	27.25	74.17	800.00
2	S 2	33.42	2.85	7.35	17.00	72.34	453.00
3	S 3	38.62	3.98	8.30	15.83	68.00	470.00
4	S 5	37.50	4.38	8.79	18.95	45.50	732.50
5	S 6	36.55	3.57	7.95	16.84	38.84	418.00
6	S 8	47.00	3.35	9.95	24.84	71.00	802.50
7	S 9	33.33	2.61	7.35	25.00	74.17	690.00
8	S 10	39.78	3.20	8.35	25.59	71.33	920.00
9	S 12	46.50	4.94	10.25	14.50	73.67	794.50
10	S 13	44.00	3.99	8.35	19.64	64.00	916.00
11	S 14	38.74	3.85	8.70	22.00	75.34	980.00
12	S 15	49.17	4.72	9.80	27.00	85.50	985.00
13	S 16	38.07	3.96	8.40	17.25	39.50	665.00
14	S 17	47.50	4.39	9.10	16.34	66.59	755.00
15	S 18	37.57	3.84	8.30	21.45	69.34	973.00
16	S 19	32.88	5.05	7.15	19.67	77.85	800.00
17	S 20	34.00	3.01	7.40	15.60	39.34	420.00
18	S 21	32.72	4.77	7.25	19.50	74.54	811.00
19	S 22	40.02	4.82	7.85	23.50	71.50	815.00
20	S 23	47.70	4.85	10.05	26.92	77.50	955.00
21	S 24	38.17	4.2.00	8.43	13.17	54.67	527.50
22	S 25	46.00	4.85	10.00	15.50	71.84	800.00
23	S 26	37.88	3.50	8.20	17.15	78.00	795.00
24	S 28	37.47	4.85	8.50	14.50	50.50	780.00
25	S 29	43.62	4.20	9.20	17.90	75.34	967.50

(Contd.....)

Sl. No.	Accession	Plant height (cm)	Stem girth (cm)	Height at branching (cm)	Branches per plant	Canopy spread (cm)	Dry weight (g)
26	S 30	27.17	3.13	6.70	23.67	64.00	861.00
27	S 31	35.53	4.64	8.10	12.34	36.50	700.00
28	S 32	47.00	4.69	10.15	25.00	80.00	931.00
29	S 33	58.90	5.10	12.50	26.10	91.67	962.50
30	S 34	47.60	4.55	10.30	16.00	79.00	612.50
31	S 35	51.90	3.97	11.25	15.50	86.00	600.00
32	S 36	47.50	4.20	9.90	21.75	67.50	730.00
33	S 37	44.00	4.58	12.55	21.90	53.00	920.00
34	S 39	34.05	3.78	7.65	36.05	99.84	905.00
35	S 42	39.55	5.36	8.70	12.34	88.00	805.00
36	S 43	38.50	4.75	8.50	18.95	72.00	900.00
37	S 45	42.00	4.35	9.70	11.60	37.00	676.50
38	S 46	46.33	4.47	9.05	17.00	80.50	965.00
39	S 47	37.82	4.39	8.35	22.50	72.00	800.00
40	S 52	39.67	4.55	8.70	22.00	66.00	795.00
41	S 53	43.28	4.22	8.64	17.00	65.00	875.00
42	S 54	34.22	4.55	8.37	10.12	44.00	400.00
43	S 55	49.00	5.25	8.80	28.50	84.00	839.00
44	S 58	35.22	4.00	7.04	18.37	60.50	655.00
45	S 59	24.00	2.70	4.50	13.50	34.50	257.50
46	S 60	51.83	4.69	10.4	13.67	72.50	860.00
47	S 61	36.75	4.10	7.27	12.83	62.50	710.00
48	S 63	43.50	4.02	9.70	19.15	58.50	685.00
49	S 65	39.90	3.90	8.00	19.50	58.69	680.00
50	S 66	41.95	4.12	8.42	20.68	53.34	730.00
	C.D.	8.25	0.516	1.52	4.94	11.72	28.19
	Mean	40.86	4.21	8.76	19.38	66.54	757.61

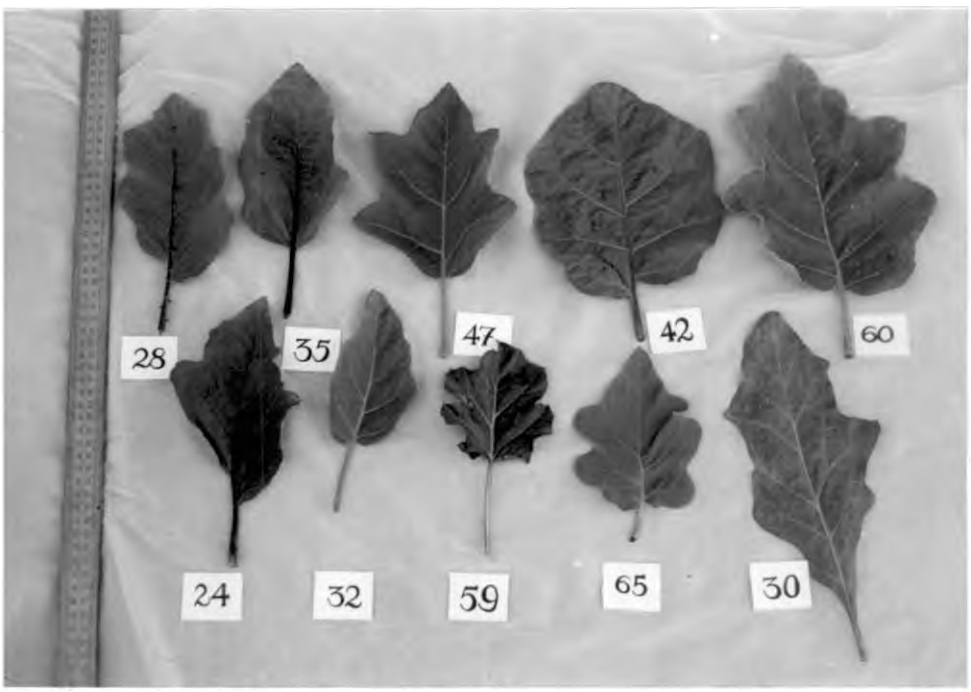
Table 4.2 Leaf characters of the landraces of brinjal

Sl. No.	Accession	LAI	Leaf thickness (μ)	Petiole length (cm)	Stomatal distribution	V.B. distribution
1	S 1	0.655	186.55	1.85	6.1	32.5
2	S 2	0.330	159.53	3.35	6.2	32.5
3	S 3	0.482	170.00	4.50	6.2	30.5
4	S 5	0.475	200.15	3.50	6.3	36.0
5	S 6	0.380	164.00	2.75	6.2	28.5
6	S 8	0.635	194.10	3.20	6.2	39.5
7	S 9	0.635	162.54	2.37	6.1	36.5
8	S 10	0.653	230.25	3.60	6.3	33.0
9	S 12	0.620	236.29	2.35	6.3	40.0
10	S 13	0.540	224.24	2.50	6.2	42.0
11	S 14	0.825	195.65	5.05	6.3	41.0
12	S 15	0.830	243.79	3.25	6.0	45.0
13	S 16	0.415	225.75	4.85	6.2	46.0
14	S 17	0.630	231.77	3.25	6.2	40.0
15	S 18	0.705	198.66	4.05	6.2	40.5
16	S 19	0.635	242.29	4.65	6.2	24.0
17	S 20	0.320	158.03	1.75	6.2	27.0
18	S 21	0.640	210.70	5.95	6.2	25.5
19	S 22	0.650	223.86	4.00	6.2	35.5
20	S 23	0.805	218.23	2.85	6.1	47.0
21	S 24	0.380	221.24	2.75	6.2	49.5
22	S 25	0.665	279.91	6.70	6.0	42.5
23	S 26	0.510	207.69	3.18	6.1	35.5
24	S 28	0.520	243.81	4.20	6.2	29.5
25	S 29	0.680	229.85	6.00	6.2	42.0

(Contd.....)

Sl. No.	Accession	LAI	Leaf thickness (μ)	Petiole length (cm)	Stomatal distribution	V.B. distribution
26	S 30	0.450	229.86	1.95	6.1	38.0
27	S 31	0.460	209.19	2.55	6.1	27.0
28	S 32	0.830	198.66	2.95	6.1	49.5
29	S 33	0.735	162.50	3.35	6.1	41.5
30	S 34	0.620	236.29	6.40	6.2	43.5
31	S 35	0.640	234.78	3.25	6.1	37.0
32	S 36	0.610	185.07	4.35	6.2	36.5
33	S 37	0.620	222.35	3.65	6.3	30.0
34	S 39	0.380	164.00	3.10	6.0	34.5
35	S 42	0.640	180.00	5.70	6.2	30.5
36	S 43	0.660	198.66	8.75	6.2	42.5
37	S 45	0.460	153.52	2.50	6.1	27.5
38	S 46	0.665	248.32	6.45	6.3	43.5
39	S 47	0.690	230.27	3.89	6.2	34.5
40	S 52	0.600	241.90	3.30	6.3	35.0
41	S 53	0.525	174.59	2.40	6.2	37.5
42	S 54	0.380	155.02	2.90	6.1	29.5
43	S 55	0.840	242.30	2.50	6.0	50.5
44	S 58	0.560	210.70	3.05	6.2	23.5
45	S 59	0.120	164.05	7.15	6.1	33.5
46	S 60	0.690	185.12	6.65	6.2	37.0
47	S 61	0.415	159.51	2.75	6.2	27.5
48	S 63	0.530	177.59	3.75	6.2	30.5
49	S 65	0.520	213.71	2.50	6.3	35.5
50	S 66	0.520	216.71	2.90	6.1	36.0
	C.D	0.053	26.35	1.15	0.36	3.72
	Mean	0.575	205.07	3.82	6.17	36.27

Plate 4.1 Variability in landraces of brinjal for leaf characters


28
35
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30

bundles or veins per unit area of leaves ranged between 23.5 and 50.5 in S 58 and S 55. S 24 (49.5), S 32 (49.5) and S 23 (47.0) were on par with S 55.

4.1.3 Flowering characters

Characterization of the landraces in terms of the flowering is presented in Table 4.3. The days to bloom ranged between 37.5 (S 58) and 75.50 (S 19). S 24 (Plate 4.2) was on par with S 58. S 43 (71.00), S 21 (69.00), S 60 (68.67) and S 37 (68.50) were on par with S 19. For branch of first flower production, maximum value was obtained in S 60 (4.17) whereas S 43, S 24, S 15 and S 58 produced first flower on the first branch itself. Maximum value of 12.50 was recorded by S 15 for node of first flower production and S 58 recorded minimum value (2.84). Height of first flowering node ranged from 15.50 cm in S 59 to 44.50 cm in S 60. S 35 (42.75 cm), S 1 (40.67 cm) and S 36 (39.50 cm) were on par with S 60. S 10, S 24, S 58, S 60, S 59, S 47, S 3 and S 8 were superior in production of long and medium styled flowers (65.08, 64.04, 62.65, 62.50, 62.00, 61.00, 60.00, 59.50 per cent respectively).

4.1.4 Fruit set and yield characters

Per cent fruit set ranged from 27 to 56.50 for S 28 and S 24 respectively (Table 4.4). S 39 (53.00 per cent), S 47 (53.00 per cent), S 59 (51.00 per cent) and S 1 (51.00 per cent) were on par with S 24. S 43 took maximum days to harvest (101.00) whereas S 14 took minimum days (52.50). For fruits per plant, highest value of 43.5 was recorded by S 39. S 60 (5.00), S 42 (6.50) and S 43 (7.00) had less fruits. S 33, S 47 and S 23 were superior in terms of the yield (1495, 1365 and 1361 g respectively). Lowest yield

Table 4.3 Flowering characters of the landraces of brinjal

Sl. No.	Accession	Days to first flowering	Branch of first flower	Node of first flower	Height of first flowering node (cm)	Long and medium styled flowers (%)
1	S 1	43.50	3.00	9.17	40.67	55.00 (47.86)
2	S 2	38.00	2.17	4.50	25.00	42.50 (40.66)
3	S 3	48.50	3.17	4.50	30.00	60.00 (50.75)
4	S 5	48.00	2.17	5.50	22.00	51.50 (45.84)
5	S 6	43.00	2.00	5.50	26.50	51.50 (45.84)
6	S 8	42.00	2.50	8.50	35.50	59.50 (50.46)
7	S 9	51.50	2.50	6.00	23.00	38.47 (38.32)
8	S 10	46.00	2.00	7.50	23.00	65.08 (53.76)
9	S 12	53.70	1.50	9.50	27.00	42.49 (40.66)
10	S 13	45.00	3.84	9.50	32.00	42.49 (40.66)
11	S 14	39.67	3.50	9.00	33.50	52.50 (46.42)
12	S 15	42.00	1.00	12.50	37.50	45.00 (42.11)
13	S 16	61.67	3.17	5.50	31.50	40.00 (39.20)
14	S 17	60.50	3.00	6.00	36.00	37.48 (37.74)
15	S 18	50.00	3.67	8.50	33.50	47.50 (43.55)
16	S 19	75.50	2.17	5.50	25.00	46.50 (42.97)
17	S 20	41.84	2.00	4.50	24.00	43.50 (41.25)
18	S 21	69.00	2.33	3.50	25.00	46.90 (43.26)
19	S 22	46.50	3.00	9.00	28.00	37.00 (37.45)
20	S 23	43.00	2.00	8.50	37.00	45.00 (42.11)
21	S 24	38.50	1.00	3.50	25.14	64.04 (53.14)
22	S 25	57.17	3.00	6.50	37.50	43.00 (40.96)
23	S 26	50.50	1.50	8.50	26.84	43.98 (41.53)
24	S 28	66.00	2.00	5.17	27.00	33.94 (35.62)
25	S 29	51.50	2.50	6.00	31.00	37.48 (37.74)

(Contd.....)

Sl. No.	Accession	Days to first flowering	Branch of first flower	Node of first flower	Height of first flowering node	Long and medium styled flowers (%)
26	S 30	65.50	2.50	3.50	17.00	50.00 (44.98)
27	S 31	50.50	2.00	5.50	23.00	41.48 (40.08)
28	S 32	44.67	1.84	8.50	37.50	44.50 (41.83)
29	S 33	47.50	3.00	8.00	36.67	51.00 (45.55)
30	S 34	48.50	2.50	10.50	38.00	44.97 (42.09)
31	S 35	51.50	3.00	6.50	42.75	37.00 (37.45)
32	S 36	45.00	3.00	9.50	39.50	54.01 (47.28)
33	S 37	68.50	2.50	9.50	29.00	49.49 (44.70)
34	S 39	55.00	3.00	6.00	22.00	55.52 (48.150)
35	S 42	56.33	1.17	4.50	17.67	49.00 (44.40)
36	S 43	71.00	1.00	3.50	27.00	46.00 (42.68)
37	S 45	49.50	2.50	7.00	29.50	41.48 (40.08)
38	S 46	48.00	2.50	6.50	36.50	37.48 (37.74)
39	S 47	44.50	2.17	6.00	24.00	61.00 (51.33)
40	S 52	43.00	3.00	9.00	28.00	37.00 (37.45)
41	S 53	45.50	2.00	5.00	30.50	54.00 (47.57)
42	S 54	45.00	2.00	5.50	25.50	51.50 (45.84)
43	S 55	43.50	1.84	9.00	33.50	45.00 (42.11)
44	S 58	37.50	1.00	2.84	19.00	62.65 (52.31)
45	S 59	40.50	1.34	3.00	15.50	62.00 (51.92)
46	S 60	68.67	4.17	9.50	44.50	62.50 (52.22)
47	S 61	48.50	2.50	5.50	21.50	47.50 (43.55)
48	S 63	42.50	2.50	6.00	29.00	50.00 (44.98)
49	S 65	41.50	3.00	7.50	30.00	48.50 (44.12)
50	S 66	43.50	2.50	5.50	30.00	48.00 (43.84)
	C.D.	9.30	2.03	5.57	5.99	4.51
	Mean	49.95	2.38	6.71	29.40	43.88

(Transformed data given in parenthesis)

Plate 4.2 Landrace of brinjal (S 24) showing early flowering

Table 4.4 Fruit set and yield characters of the landraces of brinjal

Sl. No.	Accession	Fruit set (%)	Days to first harvest	Fruits per plant	Yield (g)	HI
1	S 1	51.00 (45.56)	68.00	15.50	1123.75	0.285
2	S 2	38.50 (38.34)	58.67	7.50	431.25	0.240
3	S 3	46.50 (42.98)	68.50	9.50	522.50	0.265
4	S 5	42.00 (40.37)	68.00	10.50	862.50	0.305
5	S 6	40.50 (39.51)	63.67	10.50	446.25	0.245
6	S 8	47.00 (43.26)	62.50	14.34	1110.50	0.305
7	S 9	29.96 (33.17)	73.34	18.17	681.20	0.260
8	S 10	50.00 (44.98)	71.50	21.50	1128.75	0.290
9	S 12	37.49 (37.74)	74.00	11.00	902.50	0.255
10	S 13	35.48 (36.54)	65.00	20.50	1076.25	0.280
11	S 14	49.50 (44.7)	52.50	19.00	1092.50	0.235
12	S 15	39.50 (38.92)	63.67	21.00	1260.00	0.275
13	S 16	27.98 (31.92)	91.50	11.50	661.00	0.215
14	S 17	34.46 (35.93)	72.00	9.00	810.00	0.245
15	S 18	43.00 (40.96)	65.00	18.50	1110.00	0.235
16	S 19	43.00 (40.96)	96.00	7.50	750.00	0.235
17	S 20	39.00 (38.62)	62.67	14.00	630.00	0.245
18	S 21	42.50 (40.67)	99.00	7.50	731.25	0.235
19	S 22	33.00 (35.05)	71.00	15.00	1350.00	0.300
20	S 23	39.50 (38.92)	63.50	22.50	1361.00	0.270
21	S 24	56.50 (48.2)	57.50	31.00	779.10	0.325
22	S 25	37.00 (37.45)	68.00	11.00	1237.50	0.295
23	S 26	42.00 (40.37)	75.17	10.50	971.25	0.300
24	S 28	27.00 (31.29)	96.00	7.50	562.50	0.200
25	S 29	33.94 (35.62)	66.50	9.00	945.00	0.270

(Contd.....)

Sl. No.	Accession	Fruit set (%)	Days to first harvest	Fruits per plant	Yield (g)	HI
26	S 30	43.50 (41.25)	87.00	14.50	688.75	0.205
27	S 31	35.95 (36.83)	71.67	11.50	625.00	0.255
28	S 32	39.00 (38.63)	66.50	20.50	1230.00	0.280
29	S 33	48.00 (43.84)	69.00	23.00	1495.00	0.280
30	S 34	34.97 (36.24)	78.50	8.50	765.00	0.265
31	S 35	41.00 (39.8)	71.00	21.00	1050.00	0.250
32	S 36	47.50 (43.55)	68.50	15.50	1085.00	0.285
33	S 37	42.50 (40.67)	98.50	8.50	637.50	0.210
34	S 39	53.00 (46.7)	76.00	43.50	761.25	0.255
35	S 42	46.00 (42.69)	82.34	6.50	1040.00	0.305
36	S 43	35.97 (36.84)	101.00	7.00	665.00	0.215
37	S 45	40.00 (39.21)	61.50	11.00	715.00	0.255
38	S 46	31.93 (34.40)	77.00	9.50	878.75	0.270
39	S 47	53.00 (46.70)	64.50	21.00	1365.00	0.310
40	S 52	33.00 (35.05)	65.50	12.50	1125.00	0.300
41	S 53	47.00 (43.26)	68.50	17.00	1020.00	0.285
42	S 54	40.50 (39.51)	66.00	10.00	475.00	0.225
43	S 55	39.50 (38.92)	64.67	20.50	1275.00	0.285
44	S 58	50.00 (44.98)	53.00	11.50	862.50	0.305
45	S 59	51.00 (45.56)	53.50	26.50	238.50	0.230
46	S 60	40.98 (39.79)	100.00	5.00	522.50	0.230
47	S 61	37.99 (38.04)	69.50	14.50	616.25	0.250
48	S 63	42.49 (40.66)	65.00	14.00	735.00	0.250
49	S 65	40.50 (39.51)	62.50	14.00	770.00	0.255
50	S 66	39.99 (39.21)	65.00	13.50	776.00	0.255
	C.D.	3.57	10.76	2.12	142.69	0.012
	Mean	39.88	71.59	14.68	879.08	0.262

(Transformed data given in parenthesis)

(238.5 g) was recorded by S 59. Maximum harvest index (0.325) was in S 24 followed by S 47 (0.310) whereas minimum harvest index (0.200) was noted in S 28.

4.1.5 Fruit and quality characters

Longest fruits (25.70 cm) were produced by S 25 (Table 4.5, Plate 4.3) followed by S 34 (24.40 cm). S 59 produced shortest fruits (2.25 cm) (Plate 4.4). Average fruit breadth ranged from 2.70 cm to 10.55 cm in S 17 and S 42 respectively (Plate 4.5). S 42 was followed by S 60 (8.70 cm) which was on par with S 43 (8.06 cm). Highest mean value for fruit weight (160.00 g) was recorded by S 42 followed by S 25 (112.50 g). Lowest value (9.00 g) was recorded by S 59. Maximum seed weight (11.50 g) was obtained in S 42 followed by S 21 (7.80 g), S 60 (7.80 g) and S 29 (7.60 g). S 59 (1.00 g), S 39 (2.00 g) and S 24 (2.30 g) had lower seed yield. Keeping quality ranged between three to eight days. S 10, S 12, S 9, S 30, S 39, S 17, S 25, S 35 and S 46 had good keeping quality (8, 8, 7.5, 7.5, 7.5, 7, 7, 7 and 7 days respectively). S 24, S 47, S 52, S 42, S 19, S 58 and S 22 obtained high scores (18.55, 18.45, 18.15, 17.95, 17.8, 17.8 and 17.75 respectively) for organoleptic quality. Lowest score of seven was obtained for S 30 and S 59.

4.1.6 Characterisation in terms of the reaction towards various biotic stress

Reaction of the landraces to various pests and diseases and their corresponding ratings are presented in Table 4.6 and 4.7.

Table 4.5 Fruit and quality characters of the landraces of brinjal

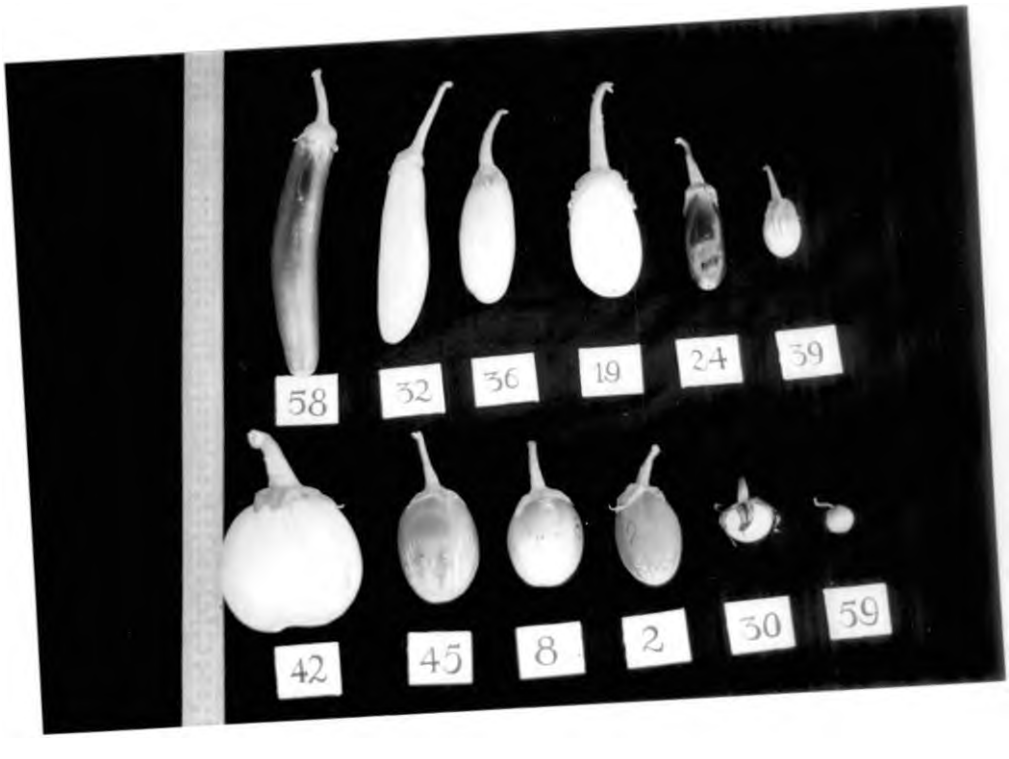
Sl. No.	Accession	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Seed weight (g)	Keeping quality (days)	Organoleptic quality
1	S 1	15.35	3.90	72.50	5.35	6.50	16.75
2	S 2	8.00	5.60	57.50	4.55	3.50	11.50
3	S 3	6.60	4.70	55.00	4.35	5.00	13.55
4	S 5	9.35	4.95	92.50	7.25	3.50	16.60
5	S 6	5.75	4.85	42.50	3.15	5.00	13.70
6	S 8	8.35	5.24	77.50	5.70	6.50	17.15
7	S 9	5.85	5.22	37.50	2.55	7.50	12.65
8	S 10	7.90	5.13	52.50	4.05	8.00	15.60
9	S 12	16.25	3.80	77.50	5.15	8.00	12.00
10	S 13	16.70	3.42	52.50	3.70	3.50	16.95
11	S 14	7.55	4.95	57.50	4.60	5.00	12.75
12	S 15	16.85	2.98	60.00	4.80	6.00	16.40
13	S 16	9.73	4.75	57.50	4.60	6.00	10.40
14	S 17	18.75	2.70	90.00	6.30	7.00	13.00
15	S 18	7.15	4.70	60.00	4.80	4.50	12.90
16	S 19	12.75	7.38	100.00	7.00	3.00	17.80
17	S 20	5.95	4.82	45.00	3.60	5.00	13.15
18	S 21	12.30	7.70	97.50	7.80	3.50	17.75
19	S 22	10.21	4.65	90.00	7.20	6.50	16.40
20	S 23	15.70	2.90	60.50	4.20	6.50	16.25
21	S 24	8.75	3.30	25.00	2.30	4.50	18.55
22	S 25	25.70	3.74	112.50	6.50	7.00	12.90
23	S 26	8.80	5.18	92.50	6.50	4.00	16.90
24	S 28	10.71	6.60	75.00	5.30	5.50	11.65
25	S 29	20.38	2.91	105.00	7.30	6.50	12.40

(Contd.....)

Sl. No.	Accession	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Seed weight (g)	Keeping quality (days)	Organoleptic quality
26	S 30	5.35	6.10	47.50	3.30	7.50	7.00
27	S 31	5.90	4.99	50.00	3.50	5.00	15.90
28	S 32	14.94	2.70	60.00	4.80	6.00	16.00
29	S 33	19.80	3.65	65.00	5.40	5.50	15.75
30	S 34	24.40	3.05	90.00	6.30	6.50	12.80
31	S 35	12.25	2.93	50.00	3.50	7.00	15.65
32	S 36	14.80	3.65	70.00	5.30	6.00	16.00
33	S 37	12.75	3.92	75.00	6.00	4.00	12.00
34	S 39	5.72	3.90	17.50	2.00	7.50	10.50
35	S 42	9.45	10.55	160.00	11.50	6.00	17.95
36	S 43	14.05	8.06	95.00	6.65	3.50	16.20
37	S 45	5.75	4.90	65.00	4.50	5.50	12.90
38	S 46	21.50	2.80	92.50	6.50	7.00	12.75
39	S 47	14.05	4.05	65.00	4.50	6.00	18.45
40	S 52	8.60	4.45	90.00	7.20	6.50	18.15
41	S 53	7.05	6.10	60.00	4.20	6.50	16.85
42	S 54	9.25	5.30	47.50	3.30	4.50	13.60
43	S 55	16.57	2.94	75.00	5.30	5.50	15.90
44	S 58	17.70	2.90	75.00	5.20	5.00	17.80
45	S 59	2.25	3.00	9.00	1.00	6.00	7.00
46	S 60	7.87	8.70	105.00	7.60	5.50	14.75
47	S 61	7.25	5.25	42.50	2.95	6.00	13.55
48	S 63	6.64	5.45	52.50	3.65	4.50	14.00
49	S 65	8.25	4.50	55.00	3.75	5.50	13.55
50	S 66	7.71	5.20	57.50	3.75	5.50	13.85
	C.D.	1.18	0.70	42.67	1.44	1.05	0.80
	Mean	11.42	4.70	68.34	5.00	5.63	14.49

Plate 4.3 Landrace of brinjal (S 25) with longest fruit

Plate 4.4 Variaility in landraces of brinjal for fruit characters


58
32
36
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2
30
59

Plate 4.5 Landrace of brinjal (S 42) with broadest fruit

Table 4.6 Response of different landraces of brinjal for borer and bacterial wilt incidence

Sl. No.	Acc-ession	Percentage borer incidence		Rating of borer incidence (Fruits)	Bacterial wilt		Rating of bacterial wilt incidence
		On shoots	On fruits		Plants wilted (%)	Days to wilt	
1	S 1	11.95 (20.22)	9.49 (17.94)	HR	0 (0)	0	R
2	S 2	6.75 (15.05)	16.29 (23.8)	MR	0 (0)	0	R
3	S 3	9.80 (18.23)	18.19 (25.24)	MR	0 (0)	0	R
4	S 5	8.2 0(16.63)	28.50 (32.25)	T	0 (0)	0	R
5	S 6	7.85 (16.26)	29.55 (32.92)	T	40 (39.22)	57.5	MR
6	S 8	6.95 (15.28)	43.00 (40.96)	HS	0 (0)	0	R
7	S 9	12.50 (20.69)	32.25 (34.59)	S	0 (0)	0	R
8	S 10	8.75 (17.20)	24.50 (29.66)	T	0 (0)	0	R
9	S 12	15.70 (23.33)	13.46 (21.52)	MR	0 (0)	0	R
10	S 13	17.74 (24.90)	9.49 (17.94)	HR	0 (0)	0	R
11	S 14	20.45 (26.88)	52.00 (46.13)	HS	0 (0)	0	R
12	S 15	14.55 (22.41)	12.24 (20.47)	MR	0 (0)	0	R
13	S 16	9.90 (18.33)	32.80 (34.92)	S	0 (0)	0	R
14	S 17	17.50 (24.71)	13.89 (21.87)	MR	60 (50.75)	52.5	MS
15	S 18	20.00 (26.55)	51.85 (46.04)	HS	0 (0)	0	R
16	S 19	18.50 (25.46)	38.20 (38.16)	S	50 (44.98)	67.5	MS
17	S 20	7.49 (15.88)	26.95 (31.26)	T	40 (39.22)	63.5	MR
18	S 21	18.40 (25.39)	36.95 (37.42)	S	40 (39.22)	61.5	MR
19	S 22	10.49 (18.89)	39.00 (38.63)	S	0 (0)	0	R
20	S 23	9.49 (17.94)	11.50 (19.8)	MR	0 (0)	0	R
21	S 24	6.49 (14.75)	15.50 (23.17)	MR	0 (0)	0	R
22	S 25	7.49 (15.88)	17.50 (24.72)	MR	0 (0)	0	R
23	S 26	9.49 (17.93)	28.50 (32.25)	T	0 (0)	0	R
24	S 28	9.49 (17.93)	9.49 (17.94)	HR	0 (0)	0	R
25	S 29	11.50 (19.81)	15.99 (23.56)	MR	29.5 (32.89)	64	MR
26	S 30	12.50 (20.69)	6.86 (15.18)	HR	50 (44.98)	64	MS
27	S 31	7.75 (16.15)	31.50 (34.13)	S	50 (44.98)	61	MS
28	S 32	8.49 (16.94)	12.00 (20.26)	MR	0 (0)	0	R
29	S 33	14.24 (22.17)	12.8 (20.95)	MR	0 (0)	0	R
30	S 34	9.49 (17.94)	16.00 (23.57)	MR	5.28 (13.28)	32.5	R
31	S 35	14.49 (22.37)	9.98 (18.4)	HR	50 (44.98)	68.5	MS
32	S 36	11.80 (20.08)	9.44 (17.9)	HR	0 (0)	0	R

(Contd...)

33	S 37	16.99 (24.33)	9.49 (17.94)	HR	5.28 (13.28)	35	R
34	S 39	13.85 (21.84)	6.80 (15.11)	HR	0 (0)	0	R
35	S 42	8.49 (16.94)	33.49 (35.35)	S	0 (0)	0	R
36	S 43	12.50 (20.69)	31.50 (34.13)	S	0 (0)	0	R
37	S 45	9.49 (17.94)	17.40 (24.64)	MR	0 (0)	0	R
38	S 46	7.49 (15.88)	18.50 (25.46)	MR	20 (26.55)	66.5	MR
39	S 47	12.50 (20.69)	12.65 (20.82)	T	0 (0)	0	R
40	S 52	10.50 (18.89)	38.00 (38.04)	S	0 (0)	0	R
41	S 53	14.50 (22.37)	12.98 (21.11)	MR	0 (0)	0	R
42	S 54	7.40 (15.77)	27.44 (31.58)	T	50 (44.98)	58.5	MS
43	S 55	14.50 (22.37)	12.80 (20.95)	MR	0 (0)	0	R
44	S 58	6.40 (14.65)	28.99 (32.57)	T	50 (44.98)	55.5	MS
45	S 59	0 (0)	0 (0)	I	0 (0)	0	R
46	S 60	14.50 (22.37)	28.50 (32.25)	T	20 (26.55)	75.5	MR
47	S 61	6.49 (14.75)	26.5 (30.97)	T	40 (39.22)	51.5	MR
48	S 63	6.65 (14.94)	25.99 (30.64)	T	20 (26.55)	53	MR
49	S 65	6.10 (14.29)	24.5 (29.65)	T	40 (39.22)	44.5	MR
50	S 66	6.80 (15.11)	24.85 (29.89)	T	0 (0)	0	R
C.D.		0.98	1.8		9.87	19.93	
MEAN		18.94	27.09		13.12	20.65	

(Transformed data in parenthesis)

I - Immune
HR - Highly Resistant
MR - Moderately Resistant
T - Tolerant
S - Susceptible
HS - Highly Susceptible

Table 4.7 Response of different landraces of brinjal for phomopsis blight and little leaf

Sl. No	Acc-ession	Percentage phomopsis incidence		Rating Of phomopsis incidence (Fruits)	Little leaf incidence	Rating of little leaf incidence
		On plants (%)	On fruits (%)		Plants infested (%)	
1	S 1	0	6.97 (15.30)	HR	0(0)	I
2	S 2	70.50 (57.08)	18.50 (25.46)	MR	0(0)	I
3	S 3	29.50 (32.89)	18.99 (25.82)	MR	0(0)	I
4	S 5	29.50 (32.89)	20.00 (26.55)	MR	0(0)	I
5	S 6	50.00 (44.98)	17.43 (24.67)	MR	0(0)	I
6	S 8	20.00 (26.55)	14.50 (22.37)	MR	0(0)	I
7	S 9	80.00 (63.41)	40.50 (39.51)	HS	0(0)	I
8	S 10	29.50 (32.89)	28.00 (31.94)	T	29.50 (32.89)	S
9	S 12	20.00 (26.55)	12.39 (20.60)	MR	0(0)	I
10	S 13	29.50 (32.89)	8.97 (17.43)	HR	0(0)	I
11	S 14	29.50 (32.89)	36.49 (37.15)	S	0(0)	I
12	S 15	5.28 (13.28)	8.49 (16.94)	HR	0(0)	I
13	S 16	40.00 (39.22)	20.00 (26.55)	MR	0(0)	I
14	S 17	20.00 (26.55)	10.00 (18.43)	HR	0(0)	I
15	S 18	29.50 (32.89)	35.00 (36.26)	S	0(0)	I
16	S 19	80.00 (63.41)	39.49 (38.92)	S	0(0)	I
17	S 20	70.50 (57.08)	15.00 (22.78)	MR	0(0)	I
18	S 21	80.00 (63.41)	39.50 (38.92)	S	0 (0)	I
19	S 22	50.00 (44.98)	26.49 (30.96)	T	0 (0)	I
20	S 23	0 (0)	8.50 (16.94)	HR	0 (0)	I
21	S 24	20 (26.55)	15.50 (23.17)	MR	0 (0)	I
22	S 25	0 (0)	12.39 (20.60)	MR	0 (0)	I
23	S 26	29.5 (32.89)	22.45 (28.27)	T	0 (0)	I
24	S 28	5.28 (13.28)	25.00 (29.99)	T	0 (0)	I
25	S 29	5.28 (13.28)	10.98 (19.34)	MR	0 (0)	I
26	S 30	40.00 (39.22)	0 (0)	I	0 (0)	I
27	S 31	29.50 (32.89)	18.00 (25.09)	MR	0 (0)	I
28	S 32	0 (0)	8.00 (16.42)	HR	0 (0)	I
29	S 33	0 (0)	8.97 (17.43)	HR	0 (0)	I
30	S 34	0 (0)	10.00 (18.43)	HR	0 (0)	I
31	S 35	0 (0)	10.00 (18.43)	HR	0 (0)	I
32	S 36	5.28 (13.28)	7.00 (15.34)	HR	0 (0)	I

(Contd...)

33	S 37	0 (0)	28.99 (32.57)	T	0 (0)	I
34	S 39	29.50 (32.89)	9.98 (18.41)	HR	0 (0)	I
35	S 42	29.50 (32.89)	61.55 (51.66)	HS	0 (0)	I
36	S 43	29.50 (32.89)	20.00 (26.55)	MR	0 (0)	I
37	S 45	20.00 (26.55)	10.00 (18.43)	HR	0 (0)	I
38	S 46	20.00 (26.55)	8.49 (16.94)	HR	0 (0)	I
39	S 47	29.50 (32.89)	17.43 (24.67)	MR	0 (0)	I
40	S 52	29.50 (32.89)	24.50 (29.66)	T	0 (0)	I
41	S 53	29.50 (32.89)	10.00 (18.43)	HR	0 (0)	I
42	S 54	29.50 (32.89)	15.00 (22.78)	MR	0 (0)	I
43	S 55	5.28 (13.28)	8.00 (16.42)	HR	0 (0)	I
44	S 58	80.00 (63.41)	29.00 (32.57)	T	0 (0)	I
45	S 59	0 (0)	0 (0)	I	0 (0)	I
46	S 60	0 (0)	10.00 (18.43)	HR	0 (0)	I
47	S 61	70.50 (57.08)	16.47 (23.94)	MR	0 (0)	I
48	S 63	20.00 (26.55)	12.93 (21.07)	MR	0 (0)	I
49	S 65	20.00 (26.55)	10.98 (19.34)	MR	0 (0)	I
50	S 66	20.00 (26.55)	10.98 (19.34)	MR	0 (0)	I
C.D.		4.93	2.61		2.54	
MEAN		27.84	23.54		0.657	

(Transformed data in parenthesis)

I - Immune
HR - Highly Resistant
MR - Moderately Resistant
T - Tolerant
S - Susceptible
HS - Highly Susceptible

4.1.6.1 Shoot and fruit borer

Shoot borer infestation was maximum in S 14 (20.45 per cent) which was on par with S 18 (20.00 per cent). No infestation was noted in S 59. Similarly, S 14 (52.00 per cent) was most affected by fruit borer too. Fruits of S 59 was free from borer attack also. High level of resistance was noted in S 1, S 13, S 28, S 30, S 35, S 36, S 37 and S 39 (Table 4.6).

4.1.6.2 Bacterial wilt

S 6, S 17, S 19, S 20, S 21, S 29, S 30, S 31, S 34, S 35, S 37, S 46, S 54, S 58, S 60, S 61, S 63 and S 65 showed wilting. Among this wilt susceptible accessions, S 60 took maximum days (75.5) and S 34 took minimum days (32.5) for showing the initial symptoms of wilt (Table 4.6).

4.1.6.3 Phomopsis blight

Susceptibility to phomopsis blight on leaves was highest in S 9 (80.00 per cent). Phomopsis fruit rot was maximum for S 42 (61.55 per cent). S 1, S 13, S 15, S 17, S 23, S 32, S 33, S 34, S 35, S 36, S 39, S 45, S 46, S 53, S 55 and S 60 were found to be highly resistant. No rotting was recorded in S 30 and S 59 (Table 4.7).

4.1.6.4 Little leaf

Susceptible reaction for little leaf incidence was noted only in S 10 in which 29.5 per cent of plants were infested. Others were completely free of little leaf incidence during the crop period (Table 4.7).

Resistance against more than one disease and / or pest was noted in some of the landraces in the present collection (Table 4.8). S 1, S 13, S 36, S 39 and S 59 had resistance against all the biotic stresses under study *viz.*, shoot and fruit borer, bacterial wilt, phomopsis blight and little leaf disease.

4.2 Genetic cataloguing

The landraces were described morphologically and a data base was developed using the simplified descriptor developed by the IBPGR, Rome. The accessions were scored for twenty agro morphological characters on an appropriate scale ranging from 0-10 (Table 4.9). The distribution of the landraces is ploted in the Fig. 4.1.

Out of the landraces, collected for the study, three species were identified as *Solanum macranthum* Dun. (S 30), *Solanum melongena* var. *insanum* Prain (S 39) and *Solanum xanthocarpum* Schrad and Wendl. (S 59) (Plates 4.6. to 4.9).

All the accessions had either upright or intermediate growth habit except S 39, which has a prostrate growth habit. Plant height showed considerable variation among the genotypes with a range of 30 - 60 cm.

Regarding plant breadth, the present collection included very narrow (2), narrow (7), intermediate (30) and broad (11) types. All landraces showed weak and intermediate branching except S 15, S 23, S 32, S 33, S 39 and S 55 which had a strong branching.

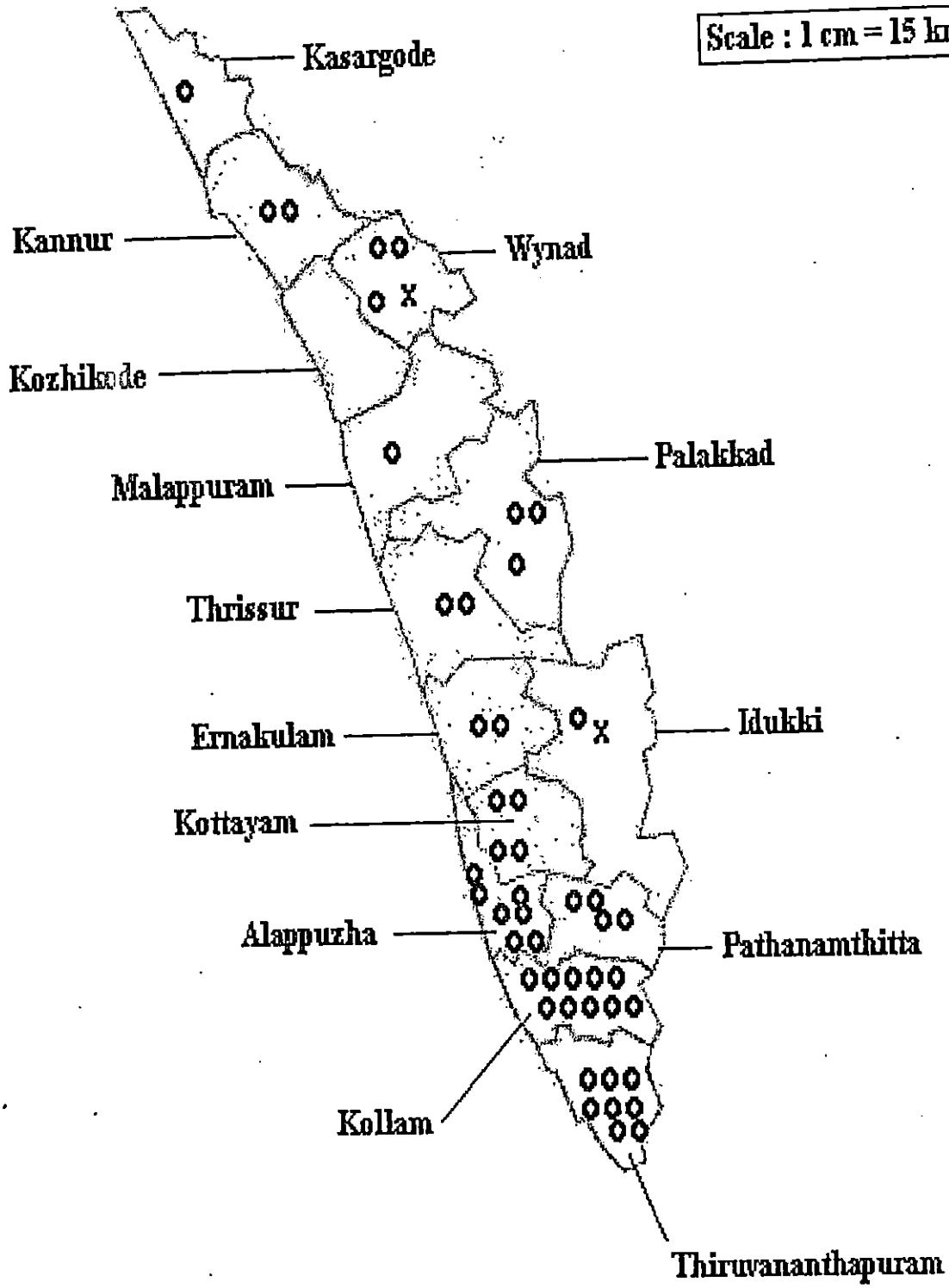
Considerable variation among the genotypes was noted for leaf

Table 4.8 Landraces of brinjal found with multiple resistance against biotic stresses

Sl. No.	Accession	Resistance located against
1	S 1	FB, BW, PB, LL
2	S 2	BW, LL
3	S 3	BW, LL
4	S 5	BW, LL
5	S 8	BW, LL
6	S 9	BW, LL
7	S 12	BW, LL
8	S 13	SFB, BW, PB, LL
9	S 14	BW, LL
10	S 15	BW, PB, LL
11	S 16	BW, LL
12	S 17	PB, LL
13	S 18	BW, LL
14	S 22	BW, LL
15	S 23	BW, PB, LL
16	S 24	BW, LL
17	S 25	BW, LL
18	S 26	BW, LL
19	S 28	SFB, BW, LL
20	S 30	SFB, PB, LL
21	S 32	BW, PB, LL
22	S 33	BW, PB, LL
23	S 34	BW, PB, LL
24	S 35	SFB, PB, LL
25	S 36	SFB, BW, PB, LL
26	S 39	SFB, BW, PB, LL
27	S 42	BW, LL
28	S 43	BW, LL
29	S 45	BW, PB, LL
30	S 46	PB, LL
31	S 47	BW, LL
32	S 52	BW, LL
33	S 53	BW, PB, LL
34	S 55	BW, PB, LL
35	S 59	SFB, BW, PB, LL
36	S 60	PB, LL
37	S 66	BW, LL

SFB - Shoot and Fruit borer
PB - Phomopsis blight
BW - Bacterial wilt
LL - Little leaf

Fig. 4.1 Map of Kerala showing the distribution of landraces of brinjal



o - Cultivated types

x - Wild species

Table 4.9 Genetic cataloguing of landraces of brinjal distributed in Kerala

Sl No	Descriptor	S1	S2	S3	S5	S6	S8	S9	S10	S12	S13	S14	S15	S16
1	Growth habit	3	3	5	5	5	3	5	5	3	3	3	3	5
2	Plant height	5	3	3	3	3	5	3	3	5	5	3	5	3
3	Plant breadth	5	5	5	3	3	5	5	5	5	5	5	7	3
4	Plant branching	5	3	3	3	3	5	5	3	5	5	5	7	3
5	Leaf blade length	3	3	3	3	3	3	3	3	3	3	3	3	3
6	Leaf blade width	5	5	5	5	5	5	5	5	5	5	5	5	5
7	Leaf blade lobing	3	5	5	5	3	3	5	5	5	5	1	5	5
8	Leaf blade color	3	5	5	5	3	5	3	1	5	3	5	3	3
9	Leaf prickles	0	1	3	0	0	0	0	0	1	7	0	0	3
10	Petiole length	3	5	7	5	5	5	5	5	5	5	7	5	7
11	Petiole colour	3	3	3	3	1	3	1	3	5	1	3	1	3
12	Corolla colour	7	5	7	7	5	5	3	7	7	3	7	3	7
13	Fruit length	7	7	5	7	5	7	5	7	7	7	7	7	7
14	Fruit breadth	5	7	7	5	7	7	7	7	5	5	7	3	7
15	Fruit l/b ratio	5	5	5	7	5	5	3	5	9	9	5	9	7
16	Fruit curvature	1	1	1	1	1	1	1	1	3	3	1	1	1
17	Fruit colour	10	1	8	6	6	8	10	7	6	10	7	10	7
18	Fruit colour distribution	1	3	1	3	3	1	1	7	1	1	1	1	1
19	Calyx prickles	0	3	3	0	0	0	0	0	0	5	0	0	3
20	Yield	5	3	3	5	3	5	3	5	5	5	5	5	3

(Contd .....)

Sl No	Descriptor	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S28	S29	S30
1	Growth habit	3	3	5	5	5	3	3	3	3	5	3	3	5
2	Plant height	5	3	3	3	3	3	5	3	5	3	3	3	3
3	Plant breadth	5	5	5	3	5	5	7	3	5	5	5	7	5
4	Plant branching	5	5	3	3	3	5	7	3	3	3	3	3	3
5	Leaf blade length	3	3	5	3	5	3	3	3	5	3	3	3	7
6	Leaf blade width	5	5	7	5	7	5	5	5	5	5	5	5	5
7	Leaf blade lobing	3	1	5	3	5	3	5	3	3	5	3	3	5
8	Leaf blade color	5	5	3	3	3	3	3	7	5	3	5	5	3
9	Leaf prickles	3	0	1	0	1	0	0	0	1	1	7	1	0
10	Petiole length	5	7	7	3	7	7	5	5	7	5	7	7	3
11	Petiole colour	3	3	1	3	1	1	1	7	5	3	5	5	1
12	Corolla colour	7	7	3	5	3	3	3	7	5	7	5	3	3
13	Fruit length	9	7	7	5	7	7	7	7	9	7	7	9	5
14	Fruit breadth	3	7	9	7	9	7	3	5	5	7	7	5	7
15	Fruit l/b ratio	9	5	5	5	5	7	9	7	9	5	5	9	1
16	Fruit curvature	3	1	1	1	1	1	1	1	3	1	1	3	1
17	Fruit colour	6	7	2	6	2	10	10	7	6	6	8	6	6
18	Fruit color distributon	1	1	1	3	1	1	3	1	1	3	1	1	3
19	Calyx prickles	0	0	1	0	1	0	0	0	3	0	9	3	0
20	Yield	5	5	5	3	3	5	5	5	5	5	3	5	3

(Contd .....)

Sl. No	Descriptor	S31	S32	S33	S34	S35	S36	S37	S39	S42	S43	S45	S46	S47
1	Growth habit	5	3	3	3	3	3	3	7	5	5	3	3	3
2	Plant height	3	5	5	5	5	5	3	3	3	3	3	5	3
3	Plant breadth	1	7	7	7	7	5	5	7	7	5	1	7	5
4	Plant branching	3	7	7	5	3	5	3	7	3	3	5	3	5
5	Leaf blade length	3	3	3	3	3	3	5	3	7	5	3	5	3
6	Leaf blade width	5	5	5	5	5	5	7	3	7	7	5	5	5
7	Leaf blade lobing	5	3	5	3	3	3	5	3	3	3	3	3	5
8	Leaf blade color	3	3	3	5	5	3	3	3	3	3	3	5	3
9	Leaf prickles	0	0	3	3	3	0	1	3	0	0	0	1	0
10	Petiole length	5	5	5	7	5	7	5	5	7	7	5	7	5
11	Petiole colour	3	1	1	5	5	1	1	1	3	1	1	5	1
12	Corolla colour	5	5	3	5	5	7	5	3	5	3	5	5	3
13	Fruit length	5	7	9	9	7	7	7	5	7	7	5	9	7
14	Fruit breadth	7	5	5	5	5	5	5	5	9	7	7	5	7
15	Fruit l/b ratio	5	9	9	9	9	9	8	5	1	7	5	9	9
16	Fruit curvature	1	1	1	3	3	1	1	1	1	1	1	3	1
17	Fruit colour	6	10	10	6	6	10	1	1	10	10	10	6	10
18	Fruit color distributon	3	1	1	1	1	1	3	7	1	1	3	1	1
19	Calyx prickles	0	0	1	1	0	0	3	5	0	1	3	3	0
20	Yield	3	5	5	5	5	5	3	5	5	3	3	5	5

(Contd .....)

Sl. No	Descriptor	S52	S53	S54	S55	S58	S59	S60	S61	S63	S65	S66
1	Growth habit	3	3	5	3	5	5	3	5	5	5	5
2	Plant height	3	3	3	5	3	3	5	3	3	3	3
3	Plant breadth	5	5	3	7	5	3	5	5	5	5	5
4	Plant branching	5	5	3	7	3	3	3	5	3	3	3
5	Leaf blade length	5	3	3	3	3	3	5	3	3	3	3
6	Leaf blade width	5	5	5	5	5	5	7	5	5	5	5
7	Leaf blade lobing	3	5	5	5	5	7	3	5	5	5	5
8	Leaf blade color	3	3	3	3	1	5	3	3	3	3	3
9	Leaf prickles	0	0	0	0	0	3	3	0	0	0	0
10	Petiole length	5	5	5	5	5	7	7	5	5	5	5
11	Petiole colour	1	5	5	1	5	7	1	3	5	3	3
12	Corolla colour	3	5	5	3	7	3	3	5	7	7	7
13	Fruit length	7	5	7	7	7	3	7	5	5	7	5
14	Fruit breadth	7	7	7	5	5	5	7	7	7	7	7
15	Fruit l/b ratio	7	5	5	9	9	1	1	5	5	5	5
16	Fruit curvature	1	1	1	1	1	1	1	1	1	1	1
17	Fruit colour	10	8	6	10	8	2	10	6	8	7	7
18	Fruit color distributon	1	5	3	1	1	1	1	3	1	7	7
19	Calyx prickles	0	0	0	0	0	3	1	0	0	0	0
20	Yield	5	5	3	5	5	1	3	3	3	5	5

Plate 4.6 ***Solanum macranthum*** **Dun. (S 30)**

Plate 4.7 ***S. macranthum*** **at fruiting stage**

Plate 4.8 ***S. melongena*** **var.** ***insanum*** **Prain (S 39)**

Plate 4.9 ***S. xanthocarpum*** **Schrad and Wendl. (S 59)**

characters like leaf length, leaf width and leaf shape. All landraces except S 30, S 42 had leaves with 'short' or 'intermediate' length. Regarding leaf width, only S 39 belonged to narrow leaf category. Broad leaves were seen in S 19, S 21, S 42, S 37, S 43 and S 60. All landraces had weak or intermediate lobing except S 14 and S 18 (very weak) and S 59 (strong).

All the landraces had green or dark green leaves except S 10, S 58 (light green) and S 24 (greenish violet leaves). In total, 20 accessions in the present collection had spines on the leaf surface. S 13 and S 28 had many spines on the leaves. Petiole length ranged between 10-50 mm in all landraces. Petiole colour also showed variation from green to dark violet.

Landraces varied in corolla colour also. Collection included types with white flowers (18), pale violet flowers (16) and light violet flowers (16).

All the described fruit lengths were present in the collection except very short (< 1cm) fruits. Regarding the fruit breadth, collection included types with small, intermediate, large and very large fruits.

Fruits length / breadth ratio ranged from 'broader than long', to 'several times as long as broad'. All the categories were present in the germplasm. No curvature for fruits was observed in majority of the landraces whereas in S 12, S 13, S 17, S 25, S 29, S 34, S 35 and S 46 fruits were slightly curved.

Fruit colour showed wide variation. It included light green (16), green (4), milk white (3), lilac grey (15), purple (8) and purple black (4) categories. Fruit colour distribution also had high variation. Thirty three accessions had

uniform fruit colour. However, 12 genotypes were grouped in mottled category. The description also revealed that 18 landraces had spines on calyx. S 28 had many prickles on calyx. Most of the landraces were in the yield range of 500 - 1000 g.

4.3 Variability studies

The phenotypic variance, genotypic variance and coefficient of variation for the biometric characters are presented in Table 4.10. Maximum value for GCV was observed for fruits per plant (48.00 per cent) followed by fruit length (47.26 per cent), petiole length (39.49 per cent), seed weight (35.20 per cent), fruit breadth (34.90 per cent), yield (32.07 per cent) and fruit weight (31.59 per cent). Lowest GCV was noted for harvest index (8.50 per cent). The highest PCV was observed for fruits per plant (48.59 per cent) followed by fruit length (47.50 per cent), fruit weight (44.32 per cent), petiole length (42.21 per cent), seed weight (38.01), fruit breadth (35.69 per cent) and yield (33.07 per cent). Lowest PCV was also for harvest index (8.77 per cent) (Fig. 4.2). Difference between GCV and PCV was maximum for fruit weight.

4.4 Heritability and genetic advance

The estimates of heritability and genetic advance are presented in Table 4.10. High values of heritability were recorded for fruit length (98.83 per cent), leaf area index (96.85 per cent), dry weight (96.34 per cent), fruits per plant (97.82 per cent), organoleptic quality (97.87 per cent), harvest index (96.41 per cent), fruit breadth (95.64 per cent) and yield (94.04 per cent). Majority of the characters had high heritability as per the classification of

Table 4.10 Estimates of genetic parameters for growth, flowering and yield in brinjal landraces

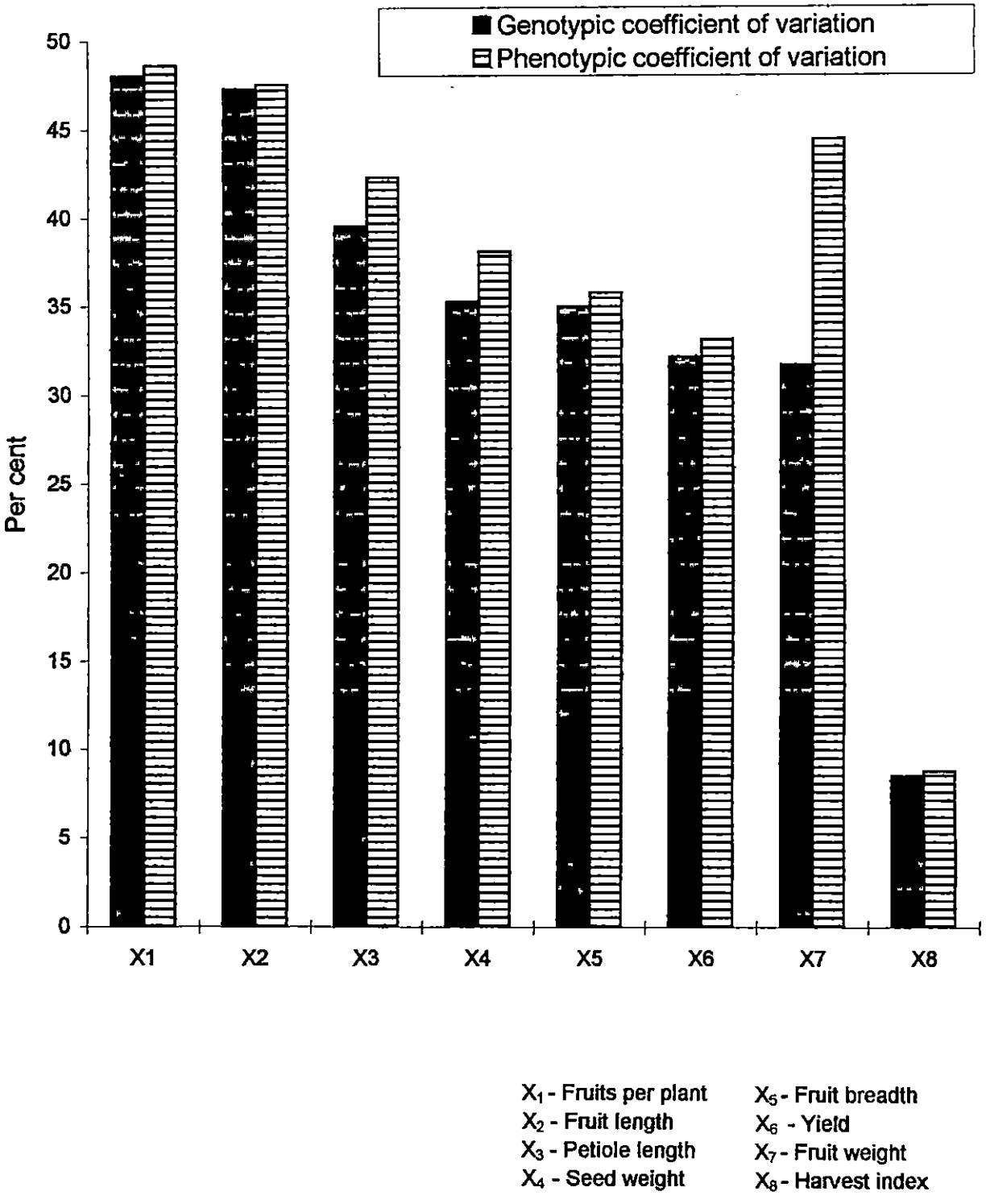
Sl No	Characters	$\sigma^2 g$	$\sigma^2 e$	$\sigma^2 p$	PCV (%)	GCV (%)	H (%)	GA	GA as % of mean
1	Plant height	35.84	16.87	52.71	17.77	14.66	68.00	10.17	24.9
2	Stem girth	0.40	0.07	0.47	16.32	15.13	85.98	1.21	28.8
3	Height at branching	1.72	0.57	2.30	17.30	14.90	75.10	2.34	27.71
4	Branches per plant	24.48	6.04	30.52	28.52	25.54	80.21	9.13	47.13
5	Canopy spread	222.12	33.99	256.12	24.05	22.40	86.73	28.59	42.97
6	Dry weight	28702.58	196.65	29899.23	22.84	22.77	96.34	353.86	46.74
7	LAI	0.02	0.0007	0.02	26.71	26.15	96.85	0.30	51.72
8	Leaf thickness	895.00	171.83	1066.83	15.92	14.59	83.80	56.44	27.52
9	Petiole length	2.28	0.33	2.60	42.21	39.49	87.49	2.91	76.10
10	Vascular bundle distribution	45.25	3.43	48.68	19.24	18.55	92.96	13.36	36.83
11	Days to first flower	80.41	21.41	101.82	20.20	17.95	78.97	16.42	32.87
12	Height of first flowe-ring node	42.26	8.88	51.14	24.32	22.11	82.63	12.17	41.39
13	Long and medium styled flowers	40.59	5.04	45.63	15.40	14.52	79.69	14.00	31.91
14	Fruit set	13.65	3.16	16.81	10.28	9.26	81.28	11.60	29.08

(Contd ...)

15	Days to harvest	141.15	28.66	169.81	18.20	16.6	83.12	22.31	31.17
16	Fruits per plant	49.77	1.11	50.88	48.59	48.00	97.82	14.37	97.80
17	Yield	79467.22	5039.67	84506.89	33.07	32.07	94.04	563.13	64.06
18	Fruit length	29.13	0.35	29.48	47.50	47.26	98.83	11.05	96.76
19	Fruit breadth	2.69	0.12	2.81	35.69	34.90	95.64	3.30	70.20
20	Fruit weight	466.59	450.69	917.38	44.32	31.59	50.87	31.73	46.43
21	Harvest Index	0.00049	0.00003	0.00052	8.77	8.50	96.41	0.06	23.46
22	Seed weight	3.10	0.52	3.61	38.01	35.20	85.73	3.36	67.00
23	Keeping quality	1.47	0.27	1.75	23.48	21.56	84.34	2.30	40.67
24	Organoleptic quality	7.22	0.16	7.38	18.74	18.54	97.87	5.47	37.75

$ó^2g$ - Genotypic variance
$ó^2e$ - Environmental variance
$ó^2p$ - Phenotypic variance
PCV - Phenotypic coefficient of variation
GCV - Genotypic coefficient of variation
H - Heritability
GA - Genetic advance

Fig. 4.2 Coefficients of variation for various characters in landraces of brinjal



heritability estimates proposed by Robinson (1966).

Expected genetic advance as per cent of mean was maximum for fruits per plant (97.80) followed by fruit length (96.76), petiole length (76.10), fruit breadth (70.20), seed weight (67.00), yield (64.06), leaf area index (51.72), branches per plant (47.13), dry weight (46.74) and fruit weight (46.43). These traits also possessed high heritability values except fruit weight which had only a moderate heritability (Fig. 4.3).

4.5 Correlation studies

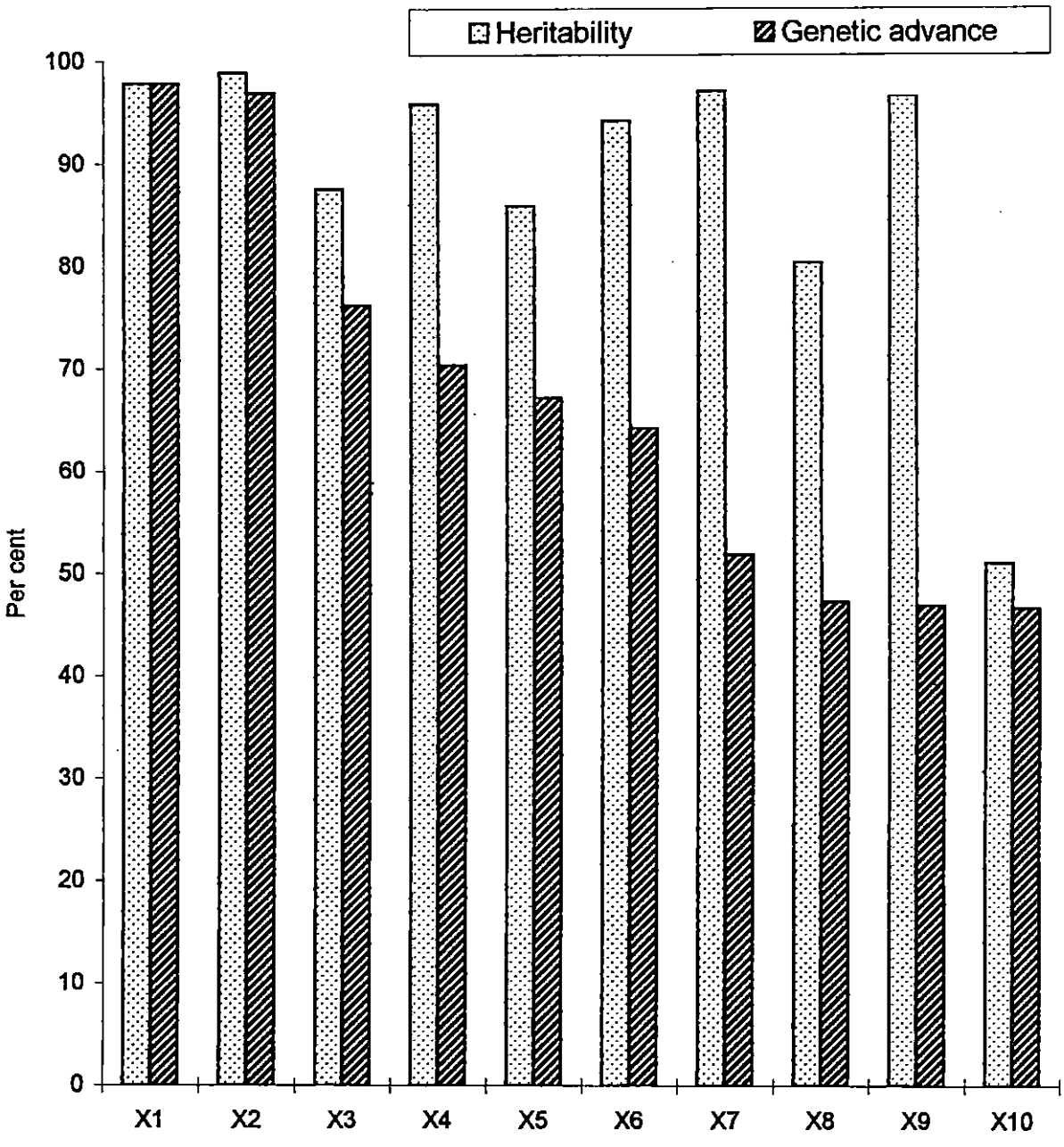
The phenotypic, genotypic and environmental correlation among the characters were worked out and presented in Tables 4.11, 4.12 and 4.13.

4.5.1 Phenotypic correlation coefficients

Total yield per plant was positively and significantly correlated with plant height (0.544), canopy spread (0.572), dry weight (0.646), leaf area index (0.734), fruits per plant (0.524), fruit length (0.478), harvest index (0.63) and organoleptic quality (0.522). Also a positive association with yield was noted for branches per plant (0.325), leaf thickness (0.376), vascular bundles (0.456) and stem girth (0.394). However a negative association was found for characters like days to bloom (-0.344) and fruit breadth (-0.309) with yield.

The leaf area index showed a positive correlation with plant height (0.602), stem girth (0.528), canopy spread (0.643), dry weight (0.761), fruit length (0.567) and fruit weight (0.425). Stem girth was positively associated

Fig. 4.3 Heritability and genetic advance for various characters in landraces of brinjal



X_1 - Fruits per plant
X_2 - Fruit length
X_3 - Petiole length
X_4 - Fruit breadth
X_5 - Seed weight
X_6 - Yield
X_7 - Leaf area index
X_8 - Branches per plant
X_9 - Dry weight
X_{10} - Fruit weight

1. Plant height
2. Stem girth
3. Height at branching
4. Branches per plant
5. Canopy spread
6. Dry weight
7. Leaf area index
8. Leaf thickness
9. Petiole length
10. Vascular bundles
11. Days to flower
12. Height of first flowering node
13. Long and medium styled flowers
14. Fruit set
15. Days to harvest
16. Fruits per plant
17. Yield
18. Fruit length
19. Fruit breadth
20. Fruit weight
21. Harvest index
22. Seed yield
23. Keeping quality
24. Organoleptic quality
25. Shoot borer incidence
26. Fruit borer incidence
27. Bacterial wilt incidence
28. Days to wilt
29. Phomopsis incidence on leaves
30. Phomopsis incidence on fruits
31. Little leaf incidence

Table 4.11 Phenotypic correlation matrix of various characters in the landraces of brinjal

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	1.000																														
2	0.521	1.000																													
3	0.848	0.297	1.000																												
4	0.215	0.018	0.178	1.000																											
5	0.433	0.297	0.345	0.552	1.000																										
6	0.413	0.413	0.400	0.516	0.575	1.000																									
7	0.602	0.528	0.032	0.452	0.643	0.761	1.000																								
8	0.266	0.384	0.227	0.126	0.242	0.402	0.445	1.000																							
9	-0.008	0.179	-0.007	-0.201	0.162	0.083	0.124	0.181	1.000																						
10	0.135	0.152	0.312	0.285	0.343	0.390	0.448	0.368	0.111	1.000																					
11	-0.078	0.270	0.053	-0.127	0.059	0.266	0.097	0.232	0.363	-0.124	1.000																				
12	0.807	0.358	0.704	0.177	0.343	0.331	0.112	0.250	0.089	0.487	-0.023	1.000																			
13	-0.120	-0.200	-0.102	0.115	-0.048	-0.148	-0.148	-0.295	0.011	-0.143	-0.197	-0.159	1.000																		
14	-0.080	-0.135	-0.022	0.218	0.138	-0.059	-0.083	-0.297	-0.097	-0.142	-0.275	-0.146	0.856	1.000																	
15	-0.020	0.298	0.103	-0.074	0.095	0.273	0.114	0.206	0.363	-0.105	0.920	0.011	-0.158	-0.292	1.000																
16	0.002	-0.213	-0.070	0.531	0.244	0.102	-0.040	-0.111	-0.291	0.323	-0.375	-0.040	0.320	0.495	-0.402	1.000															
17	0.544	0.394	0.444	0.325	0.572	0.646	0.734	0.376	-0.314	0.456	-0.344	0.411	-0.033	0.167	-0.234	0.524	1.000														
18	0.569	0.536	0.476	0.112	0.441	0.387	0.567	0.569	0.275	0.429	0.084	0.496	-0.262	-0.213	0.073	-0.155	0.478	1.000													
19	-0.277	0.094	-0.196	-0.245	-0.029	0.020	-0.087	-0.234	0.263	-0.415	0.483	-0.299	0.086	-0.020	0.534	-0.450	-0.309	-0.416	1.000												
20	0.238	0.497	0.213	-0.148	0.265	0.329	0.425	0.330	0.380	0.028	0.331	0.174	-0.275	-0.279	0.340	-0.598	0.180	0.432	0.390	1.000											
21	0.273	0.143	0.132	0.182	0.284	0.131	0.238	0.133	-0.179	0.207	-0.064	0.072	0.246	0.341	-0.473	0.270	0.630	0.257	-0.273	0.158	1.000										
22	0.273	0.002	0.278	-0.077	0.333	0.387	0.467	0.309	0.420	0.008	0.156	0.175	-0.238	-0.226	0.394	-0.592	0.257	0.409	0.433	0.931	0.197	1.000									
23	0.190	-0.095	0.101	0.213	0.257	0.171	0.168	0.169	-0.122	0.265	-0.082	0.148	-0.074	-0.071	-0.114	0.286	0.269	0.142	-0.293	-0.065	0.162	-0.129	1.000								
24	0.394	-0.434	0.216	0.094	0.261	0.244	0.422	0.134	-0.104	-0.004	-0.143	0.172	0.135	0.209	-0.058	-0.027	0.522	0.209	0.123	0.316	0.258	0.182	-0.267	1.000							
25	0.240	0.282	0.276	0.304	0.027	0.283	0.044	0.212	0.009	0.147	0.429	0.308	-0.163	-0.013	0.348	0.018	0.313	0.214	0.080	0.167	-0.215	0.233	-0.089	0.139	1.000						
26	-0.204	-0.035	-0.181	-0.088	-0.072	0.077	0.144	-0.076	0.136	-0.209	0.059	-0.108	-0.038	-0.117	0.058	-0.326	0.002	-0.284	0.463	0.255	-0.004	0.216	-0.289	0.271	0.138	1.000					
27	-0.165	-0.046	-0.180	-0.320	-0.208	-0.262	-0.195	0.026	-0.130	-0.128	0.212	-0.130	-0.118	-0.115	0.111	-0.287	-0.359	-0.013	0.048	-0.027	-0.327	-0.071	-0.076	-0.082	0.010	0.096	1.000				
28	-0.070	-0.017	-0.070	-0.340	-0.155	-0.177	-0.131	0.033	0.059	-0.368	0.267	-0.019	-0.104	-0.157	0.239	-0.361	-0.398	-0.034	0.109	0.087	-0.369	0.039	-0.087	-0.115	0.004	0.163	0.882	1.000			
29	-0.578	-0.325	-0.603	0.097	-0.151	-0.237	-0.292	-0.253	-0.162	-0.103	0.097	-0.043	-0.022	-0.063	0.078	-0.182	-0.301	-0.330	0.347	-0.048	-0.090	-0.039	-0.266	0.090	0.028	0.478	0.333	0.232	1.000		
30	-0.300	0.087	-0.170	-0.086	0.104	0.106	0.157	-0.030	0.174	-0.376	0.261	-0.363	-0.044	-0.015	0.267	-0.285	-0.003	-0.186	0.063	0.350	0.025	0.046	-0.264	0.294	0.239	0.660	-0.019	-0.055	0.503	1.000	
31	-0.020	-0.202	-0.036	0.069	0.043	0.128	0.069	0.085	-0.011	-0.076	-0.069	-0.130	0.249	0.159	0.128	0.128	0.114	-0.089	0.037	-0.052	0.123	-0.049	0.247	0.049	-0.071	0.025	-0.089	-0.096	0.001	0.122	1.000

Table 4.12 Genotypic correlation matrix of various characters in the landraces of brinjal

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	1.000																														
2	0.513	1.000																													
3	0.922	0.310	1.000																												
4	0.159	-0.071	0.094	1.000																											
5	0.476	0.280	0.298	0.538	1.000																										
6	0.499	0.442	0.450	0.573	0.613	1.000																									
7	0.720	0.562	0.116	0.465	0.680	0.777	1.000																								
8	0.230	0.388	0.156	0.214	0.214	0.437	0.470	1.000																							
9	-0.013	0.220	-0.046	-0.275	0.145	0.092	0.132	0.195	1.000																						
10	0.158	0.174	0.391	0.343	0.405	0.406	0.471	0.419	0.135	1.000																					
11	-0.081	0.374	0.123	0.090	0.147	0.303	0.130	0.232	0.472	-0.176	1.000																				
12	0.901	0.335	0.751	0.156	0.375	0.357	0.118	0.252	0.122	0.441	-0.023	1.000																			
13	-0.150	-0.218	-0.157	0.108	-0.048	-0.176	0.186	-0.368	0.038	-0.135	-0.275	-0.208	1.000																		
14	-0.100	-0.145	-0.095	0.242	0.149	-0.076	-0.099	-0.340	-0.138	-0.127	-0.320	-0.191	0.863	1.000																	
15	-0.014	0.384	0.184	-0.040	0.169	0.300	0.141	0.258	0.461	-0.145	0.940	0.014	-0.251	-0.369	1.000																
16	-0.006	-0.241	-0.096	0.592	0.256	-0.097	-0.042	-0.125	-0.314	0.351	-0.425	-0.048	0.317	0.510	-0.445	1.000															
17	0.653	0.420	0.479	0.305	0.599	0.660	0.765	0.412	-0.158	0.510	-0.361	0.454	-0.120	0.113	-0.256	0.570	1.000														
18	0.656	0.562	0.532	0.102	0.464	0.392	0.571	0.608	0.293	0.446	0.103	0.333	-0.290	-0.235	0.085	-0.155	0.500	1.000													
19	-0.349	0.104	-0.235	-0.286	-0.027	0.025	-0.094	-0.287	0.291	-0.442	0.558	-0.339	0.107	-0.013	0.106	-0.554	-0.304	-0.434	1.000												
20	0.449	0.751	0.454	-0.191	0.453	0.488	0.582	0.468	0.490	-0.021	0.575	0.428	-0.245	-0.239	0.566	-0.744	0.444	0.577	0.448	1.000											
21	0.338	0.158	0.137	0.210	0.305	0.130	0.250	0.148	-0.198	0.239	-0.174	0.072	0.235	0.335	-0.522	0.259	0.628	0.266	-0.271	0.301	1.000										
22	0.331	0.120	0.337	-0.108	0.379	0.428	0.499	0.332	0.486	-0.008	0.178	0.196	-0.218	-0.202	0.499	-0.612	0.340	0.429	0.423	1.061	0.238	1.000									
23	0.329	-0.071	0.188	0.295	0.318	0.187	0.187	0.242	-0.113	0.297	-0.145	0.177	0.067	-0.051	-0.137	0.313	0.310	0.159	-0.325	-0.100	0.186	-0.132	1.000								
24	0.356	0.474	0.238	0.119	0.282	0.247	0.444	0.150	-0.113	-0.008	-0.172	0.178	0.167	0.239	-0.067	-0.209	0.544	0.214	0.133	0.469	0.301	0.232	-0.296	1.000							
25	0.294	0.313	0.329	0.339	0.064	0.389	0.058	0.243	-0.006	0.152	0.468	0.343	-0.185	0.013	0.019	0.019	0.324	0.218	0.091	0.264	-0.218	0.267	-0.098	0.141	1.000						
26	-0.253	-0.037	-0.211	-0.099	-0.075	0.078	0.145	-0.095	0.154	0.221	0.061	-0.124	-0.042	-0.125	0.060	-0.328	0.010	-0.290	0.462	0.320	0.002	0.228	-0.314	0.277	0.141	1.000					
27	-0.284	-0.068	-0.246	-0.354	-0.235	-0.271	-0.215	0.008	-0.134	-0.152	0.233	-0.184	-0.115	-0.109	0.133	-0.304	-0.384	-0.020	0.040	-0.036	-0.355	0.082	-0.140	-0.086	0.013	0.097	1.000				
28	-0.140	-0.024	-0.081	-0.366	-0.168	-0.179	-0.143	0.027	0.048	-0.414	0.309	-0.030	-0.093	-161	0.268	-0.378	-0.419	0.029	0.093	0.036	-0.387	0.015	-0.115	-0.126	0.025	0.091	0.941	1.000			
29	-0.714	-0.363	-0.685	0.073	-0.129	-0.259	-0.310	-0.277	-0.179	-0.168	0.040	-0.052	-0.069	-0.092	0.029	-0.194	-0.319	-0.350	0.368	-0.101	0.090	-0.043	-0.323	0.088	0.028	0.508	0.377	0.258	1.000		
30	-0.347	0.105	-0.187	-0.085	0.116	0.107	0.166	-0.025	0.175	-0.386	0.289	-0.679	-0.059	-0.019	0.291	0.294	-0.010	-0.187	0.085	0.117	0.019	0.191	-0.301	0.304	0.242	0.673	-0.027	-0.055	0.539	1.000	
31	-0.029	-0.243	-0.051	0.199	0.047	0.144	0.083	0.153	-0.032	-0.061	-0.048	-0.142	0.368	0.230	0.010	0.151	0.140	-0.100	0.038	-0.143	0.139	-0.107	0.298	0.072	-0.083	0.033	-0.104	-0.114	0.029	0.136	1.000

Table 4.13 Error correlation matrix of various characters in the landraces of brinjal

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	1.000																														
2	0.607	1.000																													
3	0.667	0.463	1.000																												
4	0.186	0.158	0.173	1.000																											
5	0.325	0.405	0.576	0.135	1.000																										
6	0.069	0.142	0.287	0.119	0.175	1.000																									
7	0.177	0.235	0.072	0.523	0.308	-0.105	1.000																								
8	0.405	0.363	0.115	0.370	0.408	0.119	0.299	1.000																							
9	0.012	-0.090	0.174	0.184	0.273	-0.093	0.035	0.092	1.000																						
10	-0.164	-0.040	-0.113	0.097	-0.212	0.104	0.016	-0.017	-0.118	1.000																					
11	-0.074	-0.226	-0.182	-0.268	-0.379	-0.070	-0.199	-0.029	-0.179	0.221	1.000																				
12	-0.561	0.488	0.041	0.266	0.167	0.210	0.181	0.241	-0.102	0.114	0.027	1.000																			
13	-0.038	-0.118	0.084	0.143	-0.045	0.241	0.201	0.034	-0.135	-0.229	0.101	0.053	1.000																		
14	-0.023	-0.083	0.254	0.117	0.258	0.258	0.067	0.013	0.127	-0.271	-0.097	0.060	0.331	1.000																	
15	-0.039	-0.177	-0.207	-0.229	-0.324	0.003	-0.167	-0.058	-0.209	0.205	0.040	-0.002	0.252	0.061	1.000																
16	0.079	0.143	0.173	0.106	0.460	0.196	0.053	0.028	-0.007	-0.303	-0.086	0.059	0.197	0.630	-0.012	1.000															
17	0.154	0.174	0.342	0.264	0.444	0.015	0.098	0.111	0.105	-0.311	-0.165	0.101	0.560	0.642	-0.071	0.096	1.000														
18	0.502	0.450	0.330	0.428	0.298	-0.179	0.154	0.351	0.079	0.039	-0.125	0.314	-0.090	-0.067	-0.098	-0.154	-0.151	1.000													
19	0.040	-0.011	0.031	0.062	-0.064	-0.226	0.082	0.276	0.058	0.024	-0.025	0.032	-0.080	-0.093	-0.074	-0.364	-0.388	0.274	1.000												
20	-0.065	0.011	-0.192	-0.087	-0.140	-0.315	0.136	0.089	-0.054	0.228	-0.104	0.045	-0.376	-0.414	-0.099	-0.705	-0.741	0.296	0.528	1.000											
21	-0.007	-0.021	0.165	-0.030	0.086	0.285	-0.113	0.004	0.043	-0.381	-0.116	0.096	0.470	0.538	-0.071	0.159	0.185	-0.157	0.309	-0.396	1.000										
22	0.094	0.168	0.042	0.071	0.042	-0.265	0.193	0.181	-0.011	0.152	-0.194	0.068	-0.339	0.141	-0.176	-0.168	-0.524	0.361	0.103	0.868	-0.265	1.000									
23	-0.265	-0.229	-0.248	-0.173	-0.103	-0.013	-0.017	-0.214	-0.181	0.020	0.196	0.001	-0.110	-0.146	0.005	0.026	-0.080	-0.082	-0.012	0.004	-0.074	-0.108	1.000								
24	0.157	-0.003	0.169	-0.178	0.036	-0.146	-0.396	-0.024	0.018	0.089	0.123	0.197	-0.191	-0.069	0.043	0.058	0.015	-0.066	-0.176	-0.152	-0.008	-0.237	0.022	1.000							
25	-0.005	-0.136	-0.123	0.052	-0.048	0.009	-0.012	-0.192	-0.088	0.039	0.277	-0.038	0.023	-0.034	0.253	-0.019	0.052	-0.107	-0.325	-0.228	-0.101	-0.261	0.004	0.033	1.000						
26	0.069	-0.018	0.030	0.002	-0.057	0.087	0.143	0.303	-0.247	0.152	0.108	0.099	-0.021	-0.116	0.091	-0.285	-0.368	0.281	0.684	0.435	-0.326	0.381	-0.065	-0.146	-0.159	1.000					
27	0.359	0.130	0.160	-0.132	0.011	-0.186	0.103	0.160	-0.096	-0.157	0.100	0.241	-0.144	-0.168	-0.042	0.007	-0.040	0.188	0.176	-0.014	0.120	0.015	0.133	-0.016	-0.071	0.142	1.000				
28	0.203	0.029	-0.020	-0.213	-0.319	0.350	-0.004	0.070	0.143	0.158	0.057	0.049	-0.172	-0.138	0.061	-0.177	-0.193	0.164	0.336	0.267	-0.174	0.199	0.097	0.055	-0.452	0.029	0.350	1.000			
29	-0.131	-0.074	-0.265	-0.202	-0.303	-0.112	-0.105	-0.239	-0.046	0.114	0.398	0.089	0.231	0.099	0.370	-0.044	-0.131	-0.114	0.136	0.077	-0.103	-0.012	0.085	0.157	0.049	0.106	-0.049	0.030	1.000		
30	-0.200	-0.174	-0.141	-0.159	-0.055	0.233	-0.167	-0.128	0.214	-0.205	0.105	-0.358	0.023	0.034	0.066	0.098	0.161	-0.148	-0.084	-0.142	0.233	-0.065	0.168	-0.166	0.101	-0.185	0.147	-0.082	0.052	1.000	
31	0.006	-0.002	0.017	-0.056	0.021	-0.010	-0.049	-0.224	0.089	-0.200	-0.154	-0.075	-0.224	-0.138	-0.102	-0.077	-0.063	-0.012	0.037	0.125	0.014	0.232	0.012	-0.227	0.057	-0.097	-0.007	-0.000	-0.149	0.037	1.000

with fruit length (0.536) and fruit weight (0.497). Canopy spread had significant positive correlation with dry weight (0.575) and branches per plant (0.552). Dry weight was associated with branches per plant (0.516).

Fruits per plant had high positive correlation with branches per plant (0.531) and percentage fruit set (0.495) whereas, it had negative correlation with fruit breadth (-0.450), days to harvest (-0.402) and fruit weight (-0.598).

Fruit breadth was positively correlated to fruit weight (0.390) and seed yield (0.433). Fruit breadth recorded a negative correlation with fruit length (-0.416) which had a positive association with fruit weight (0.432) and seed yield (0.409). Seed yield showed a very high positive correlation with fruit weight (0.931).

Days to flowering exhibited a very high correlation with days to harvest (0.920). Days to harvest had positive association with fruit breadth (0.534) and fruit weight (0.340) whereas, it had significant negative association with harvest index (-0.473).

Shoot borer infestation had a positive association with days to bloom (0.429). Fruits per plant and fruit breadth recorded negative and positive correlations (-0.326, 0.463) respectively with fruit borer attack.

Phomopsis fruit rot had a negative correlation (-0.363) with height of first flowering node. Similarly, phomopsis infection on leaves had a high negative correlation (-0.603) with height at branching. Both height at branching (0.848) and height of first flowering node (0.807) had very high

positive association with plant height. Phomopsis infestation on leaves and fruits showed a positive correlation (0.503). Between fruit borer incidence and phomopsis rot disease also a positive association (0.660) was seen.

4.5.2 Genotypic correlation coefficients

Genotypic correlation coefficients were in general higher than phenotypic correlation coefficient for the characters under study.

High positive correlation was obtained between yield and plant height (0.653), canopy spread (0.599), dry weight (0.660), leaf area index (0.765), vascular bundles (0.510), fruits per plant (0.570), fruit length (0.500), harvest index (0.628) and organoleptic qualities (0.544). Positive association was also noted for characers *viz.*, branches per plant (0.305), fruit weight (0.444) leaf thickness (0.412), stem girth (0.420) with yield. Characters like days to bloom (-0.361) and fruit breadth (-0.304) had a negative correlation with yield.

Leaf area index had a positive association with plant height (0.720), stem girth (0.562), canopy spread (0.680), dry weight (0.777), fruit length (0.571) and fruit weight (0.582). Stem girth showed positive correlation with fruit length (0.562) and fruit weight (0.751). Canopy spread showed significant positive correlation with dry weight (0.613) and number of branches (0.538).

Branches per plant exhibited a significant positive correlation with dry weight (0.573) and fruits per plant (0.592). Fruits per plant showed positive association with fruit set (0.510) and negative correlation with characters like

fruit breadth (-0.554) days to harvest (-0.445) and fruit weight (-0.744).

Fruit breadth had a positive correlation to fruit weight (0.448) and seed yield (0.423) and a significant negative correlation with fruit length (-0.434). Fruit weight and seed yield showed a very high correlation of 1.062.

Highly significant association was also noted between days to flowering and days to harvest (0.940). Days to bloom had shown a positive correlation with shoot borer attack (0.468). Fruits per plant showed negative association (-0.328) whereas fruit breadth showed positive association (0.462) with fruit borer attack.

Height at branching showed a high negative association (-0.685) with phomopsis blight on leaves. Height of first flowering node had a negative correlation (-0.679) with phomopsis fruit rot. Both height at branching and height of first flowering node had significant positive association with plant height (0.922, 0.901).

Phomopsis blight on leaves and fruit rot was highly correlated (0.539). Also, fruit borer infestation showed a significant association with phomopsis fruit rot (0.673).

4.5.3 Error correlation coefficient

Most of the error correlation coefficients were very low. However, error correlations between yield and fruit weight (-0.741), fruit weight and fruit number (-0.705) and fruit weight and seed yield (0.868) were very high.

4.6 Path coefficient analysis

Plant height, branches per plant, fruits per plant, fruit weight, days to flower, stem girth, fruit length, harvest index, fruit breadth and fruit set were selected in the present study for path coefficient analysis. The results were furnished in Table 4.14 and Fig 4.4.

The direct effect of plant height on yield was significant and positive (0.6148) and the total correlation was 0.653. The positive and negative indirect effects through other traits got nullified.

Total correlation of number of branches with yield was 0.305, whereas its direct effect on yield was 0.2036.

Fruits per plant exerted a positive direct effect on yield (0.3442). The indirect effects through plant height (0.0979) and harvest index (0.1647) also contributed to the total correlation (0.570).

The direct effect of fruit weight on yield was negative (-0.4493), eventhough its correlation with yield was positive (0.444). Fruit weight had an indirect effect through stem girth (0.4226) and plant height (0.2761).

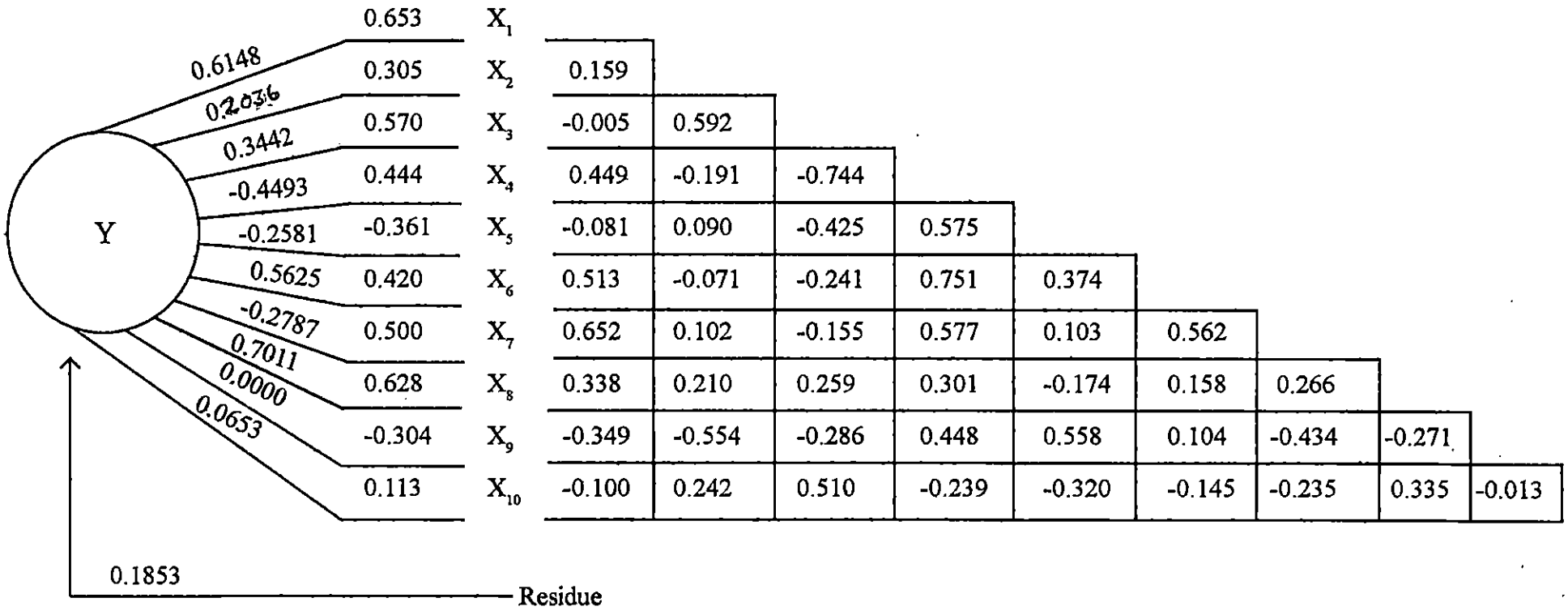
Days to flower had negative direct effect on yield (-0.361) and its total correlation was also negative (-0.2581). Harvest index had a negative indirect effect (-0.4049) through days to bloom.

The direct effect of stem girth on yield was 0.5625 and the total

Table 4.14 Direct and indirect effects of the component characters on the yield in landraces of brinjal

Sl. No.	Characters	Plant height	Branches per plant	Fruits per plant	Fruit weight	Days to flower	Stem girth	Fruit length	Harvest index	Fruit breadth	Fruit set	Total
1.	Plant height	0.6148	-0.0000	0.0548	-0.2018	-0.0192	0.1200	-0.1828	0.2366	-0.0000	0.0310	0.653
2.	Branches per plant	-0.0039	0.2036	0.0000	0.3344	-0.1009	-0.1357	0.0432	0.1816	-0.0590	-0.1582	0.305
3.	Fruits per plant	0.0979	0.0000	0.3442	0.0857	0.0215	-0.0398	-0.0285	0.1647	-0.0000	-0.0751	0.570
4.	Fruit weight	0.2761	-0.0000	-0.0656	-0.4493	0.1366	0.4226	-0.1608	0.2107	0.0000	0.0740	0.444
5.	Days to flower	-0.0497	-0.0000	0.0311	0.2377	-0.2581	-0.0286	0.2106	-0.4049	0.0000	-0.0992	-0.361
6.	Stem girth	0.1311	-0.0000	-0.0244	-0.3376	0.0890	0.5625	-0.1565	0.1110	0.0000	0.0451	0.420
7.	Fruit length	0.4033	-0.0000	0.0352	-0.2593	0.0244	0.3159	-0.2787	0.1868	-0.0000	0.0727	0.500
8.	Harvest index	0.2075	0.0000	0.0808	-0.1351	-0.1373	0.0891	-0.0742	0.7011	0.0000	-0.1039	0.628
9.	Fruit breadth	-0.2147	-0.2187	-0.0974	-0.2012	0.1326	0.0586	0.1209	0.1110	0.0000	0.0041	-0.304
10.	Fruit set	-0.0615	0.0000	0.0834	0.1072	0.0760	-0.1818	-0.2101	0.2349	-0.0000	0.0653	0.113

Fig. 4.4 Path diagram showing direct effects and interrelationships in landraces of brinjal



X_1	0.653								
X_2	0.305	0.159							
X_3	0.570	-0.005	0.592						
X_4	0.444	0.449	-0.191	-0.744					
X_5	-0.361	-0.081	0.090	-0.425	0.575				
X_6	0.420	0.513	-0.071	-0.241	0.751	0.374			
X_7	0.500	0.652	0.102	-0.155	0.577	0.103	0.562		
X_8	0.628	0.338	0.210	0.259	0.301	-0.174	0.158	0.266	
X_9	-0.304	-0.349	-0.554	-0.286	0.448	0.558	0.104	-0.434	-0.271
X_{10}	0.113	-0.100	0.242	0.510	-0.239	-0.320	-0.145	-0.235	0.335

X_1 Plant height
X_2 Branches per plant
X_3 Fruits per plant
X_4 Fruit weight
X_5 Days to flower
X_6 Stem girth
X_7 Fruit length
X_8 Harvest index
X_9 Fruit breadth
X_{10} Fruit set

correlation was 0.420. It had a negative indirect effect especially through fruit weight (-0.3376).

Fruit length exhibited positive correlation (0.4033) with yield, but on partitioning, it was observed that the direct effect on yield was negative (-0.2787). However, it had a positive indirect effect through plant height (0.4033) and stem girth (0.3159).

The direct effect of harvest index on yield was high and positive (0.7001) with a total correlation of 0.628. The positive and negative indirect effects through other traits got nullified.

It was noted that fruit breadth, which exhibited negative correlation with yield (-0.304) had a nil direct effect on yield.

Fruit set had negligible positive direct effect on yield (0.0653) and its total correlation was 0.113. It exerted a positive direct effect (0.2349) through harvest index.

The residual effect was low (0.1853).

4.7 Selection index

Discriminant function technique was adopted for the construction of selection index for yield using fruit yield per plant (X7) and the component characters *viz.*, plant height (X_1), days to flower (X_2), fruit length (X_3), fruit breadth (X_4), branches per plant (X_5), fruit weight (X_6), fruits per plant (X_8) stem girth (X_9) and harvest index (X_{10}). These component characters showed

relatively stronger association with yield and could form a valuable selection index for yield in this crop.

The selection index, worked out in the present study is given below.

$$I = -0.611\ X_1 + 0.4383\ X_2 + -1.6727\ X_3 + -12.0933\ X_4 + 0.0376\ X_5 + 3.2944\ X_6 + 0.9228\ X_7 + 6.0051\ X_8 + 0.8153\ X_9 + 428.68\ X_{10}$$

The index value for each landrace was determined and they were ranked accordingly (Table 4.15). Ten landraces *viz.*, S 33 (2999.23), S 22 (2913.33), S 23 (2776.48), S 47 (2730.57), S 25 (2712.95), S 55 (2675.73), S 15 (2558.50), S 42 (2514.35), S 32 (2510.92) and S 52 (2473.08) recorded top index values.

Table 4.15 Selection indices for the landraces of brinjal

Sl. No.	Accession No.	Selection Index	Rank
1	S 1	2273.88	15
2	S 2	872.04	49
3	S 3	1048.92	46
4	S 5	1926.21	24
5	S 6	958.41	48
6	S 8	2349.88	13
7	S 9	1398.14	40
8	S 10	2414.83	11
9	S 12	1911.52	25
10	S 13	2155.60	19
11	S 14	2335.15	14
12	S 15	2558.50	7
13	S 16	1464.32	38
14	S 17	1928.98	23
15	S 18	2406.37	12
16	S 19	1849.76	27
17	S 20	1353.26	42
18	S 21	1768.66	28
19	S 22	2913.33	2
20	S 23	2776.48	3
21	S 24	1528.27	34
22	S 25	2712.95	5
23	S 26	2128.24	20
24	S 28	1245.87	45
25	S 29	2203.42	17

(Contd.....)

Sl. No.	Accession No.	Selection Index	Rank
26	S 30	1469.86	37
27	S 31	1373.19	41
28	S 32	2510.92	9
29	S 33	2999.23	1
30	S 34	1714.52	29
31	S 35	2213.10	16
32	S 36	2200.33	18
33	S 37	1429.08	39
34	S 39	1651.48	31
35	S 42	2514.35	8
36	S 43	1560.45	33
37	S 45	1502.18	36
38	S 46	1993.95	22
39	S 47	2730.57	4
40	S 52	2473.08	10
41	S 53	2015.29	21
42	S 54	1046.54	47
43	S 55	2675.73	6
44	S 58	1899.61	26
45	S 59	464.47	50
46	S 60	1329.13	43
47	S 61	1300.39	44
48	S 63	1525.48	35
49	S 65	1653.03	30
50	S 66	1599.92	32

DISCUSSION

5.DISCUSSION

Brinjal or eggplant is one of the most popular vegetables in India. Developing genotypes having high yield coupled with resistance to major pests and diseases always deserves priority among the brinjal breeders. Evaluation of germplasm to assess the existing variability is the prerequisite in this context. The extent of variability is of immense value to the breeder for designing the breeding procedure. The role of the landraces adapted in various geographical areas is also accepted by the breeders. The present study was hence, taken up to collect and characterize brinjal landraces of Kerala for yield and resistance against major biotic stresses. Also, an attempt was made to estimate genetic parameters, correlation, direct and indirect effects of different yield components and to construct a selection index so as to identify superior genotypes. The results are discussed hereunder :

5.1 Characterization of the landraces

In the present investigation, significant differences were recorded among the landraces of brinjal, for all the characters except stomatal distribution and branch and node of first flower production. The results suggested the importance of selecting brinjal landraces based on the characters *viz.*, plant height, stem girth, height at branching, branches per plant, canopy spread, dry weight, leaf area index, leaf thickness, petiole length, vascular bundle distribution, days to flowering, height of first flowering node, long and medium styled flowers, fruit set, days to harvest, fruits per plant, yield, fruit length, fruit breadth, fruit weight, harvest index, seed yield, keeping quality, organoleptic quality and incidence of shoot and

fruit borer, bacterial wilt, phomopsis blight and little leaf in formulating a systematic breeding programme.

The number of stomates present in the epidermis of leaves depend upon the environmental conditions under which the leaf has developed (Meyer and Anderson, 1952). As the experiment was conducted in one location, no significant difference was observed in the present study as far as the stomatal count is concerned. Similar results was also reported by Daunay (1986) in brinjal varieties.

Yield is the most important character of a crop which varies with genotypes and species. In the present study, landraces *viz.*, S 33 from Adoor (Pathanamthitta) and S 47 from Irinjalakuda (Thrissur) were superior in yield. Plant height, fruits per plant and stem girth were more in these accessions. They had high organoleptic quality also. Lowest yield was recorded by S 59, a wild *Solanum* obtained from Ambalawayal (Wyanad). Similar differential response of yield and yield attributes in local varieties of brinjal was reported by Hiremath and Rao (1974), Chadha and Paul (1984), Vadivel and Bapu (1989), Hussain *et al.* (1992), Olufolaji and Makinde (1994) and Rajput *et al.* (1996).

Resistant varieties havelong been acknowledged as the most effective means of controlling pest and diseases. They have a significant role in the integrated pest management practice adopted in most of the vegetables grown in the humid tropical ecosystems of Kerala. Genotypic differences noticed in the present study indicated scope for the selection of plants with resistance against pest and disease incidence in brinjal.

Shoot and fruit borer, *Leucinodes orbonalis* Guen. is a major constraint in the production of eggplant. Though, there is no appreciable loss of yield in terms of the weight, the fruits damaged are unfit for consumption and this results in a total loss. Repeated application of insecticides for the control of this pest pose toxic residues in the fruits where several pickings are done. Therefore, it will be very useful if some variety is found with resistance or even tolerance to this pest.

Screening experiments have indicated highly differential response of germplasm to the attack of this pest (Mishra *et al.*, 1988 ; Singh and Chadha, 1991 ; Grewal and Singh, 1992). In the present investigation also, borer infestation ranged from 0 to 26.88 per cent and 0 to 46.13 per cent on shoot and fruit respectively. However cultivated landraces *viz.*, S 1 (Neyyattinkara, Thiruvananthapuram), S 13 (Athichanallore, Kollam), S 28 (Thamarakulam, Alappuzha), S 35 (Poonjar, Kottayam), S 36 (Eara, Kottayam) and S 37 (Manarkadu, Kottayam) showed high resistance against fruit borer. This could be very well utilised in the intervarietal crossing programme in brinjal for combining high yield and borer resistance. Among the resistant lines, S1, S 13, S 35 and S 36 possessing good yield and yield attributes deserve special attention.

The accession, S 59 (*S. xanthocarpum*) from Ambalawayal (Wynad) was free of shoot and fruit borer in the present investigation. This is in confirmity with the earlier findings of Lal *et al.* (1976). *S. melongena* var. *insanum* (S 39) obtained from Vandiperiyar (Idukki) and *S. macranthum* (S 30) from Konni (Pathanamthitta) also recorded very low infestation. This might be due to the presence of resistant genes in these as reported by Kale *et al.* (1986).

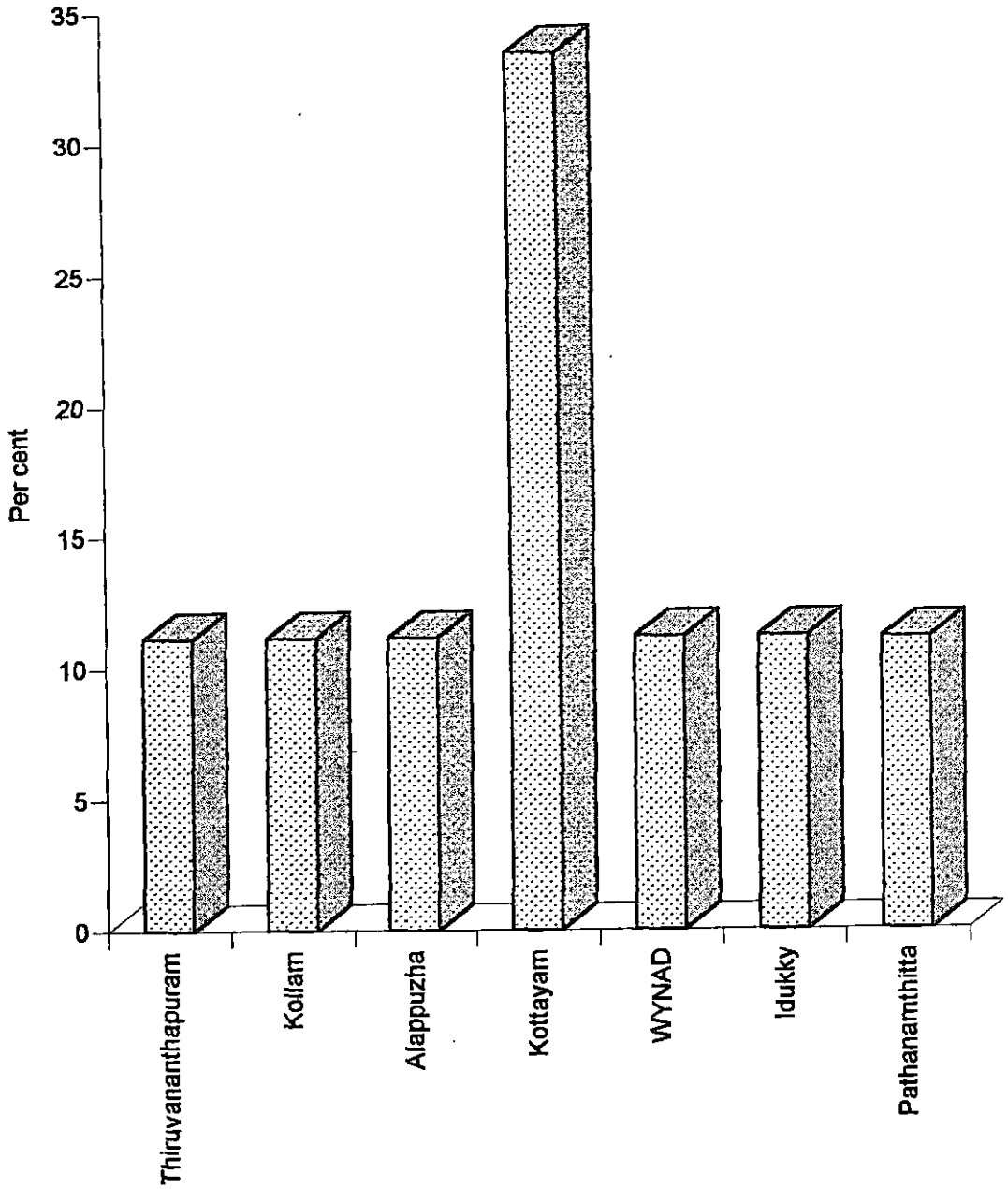
The borer resistance found in these wild or semi-wild species opens a new avenue in the borer resistance breeding through interspecific hybridization as reported in Cucurbita (Whitaker and Bemis, 1976) and in Cucumis (Rajamony and More, 1995).

In the present collection more shoot and fruit borer resistant landraces were obtained from Kottayam district (Fig. 5.1). Analysis on the differential response of brinjal varieties to the shoot and fruit borer incidence and the location specificity in the distribution of varieties are worthwhile in this context. It is reported that long fruited varieties of brinjal are less preferred by shoot and fruit borer (Mishra *et al.*, 1988). Moreover, the district Kottayam comes in the central Travancore region were the preference for long fruited varieties is more (Rajamony, 1999). These factors could be taken as the reason for the distribution of more landraces in Kottayam district with respect to shoot and fruit borer resistance.

Bacterial wilt caused by *Ralstonia solanacearum* Yabuuchi has become a major bottle neck in successful cultivation of brinjal in Kerala. Since the bacterium is soil borne, its chemical control through soil treatment is both cumbersome and uneconomical (Madalageri *et al.*, 1983).

In this context, breeding varieties for bacterial wilt resistance combined with high yield and acceptable quality becomes the need of the hour. In the present attempt to characterize various landraces for bacterial wilt resistance, the collections showed a wide variation (0-50 per cent) in their response to this disease. Such differential response of varieties for bacterial wilt incidence was

Fig. 5.1 Distribution of the source of resistance to fruit borer in brinjal landraces of Kerala



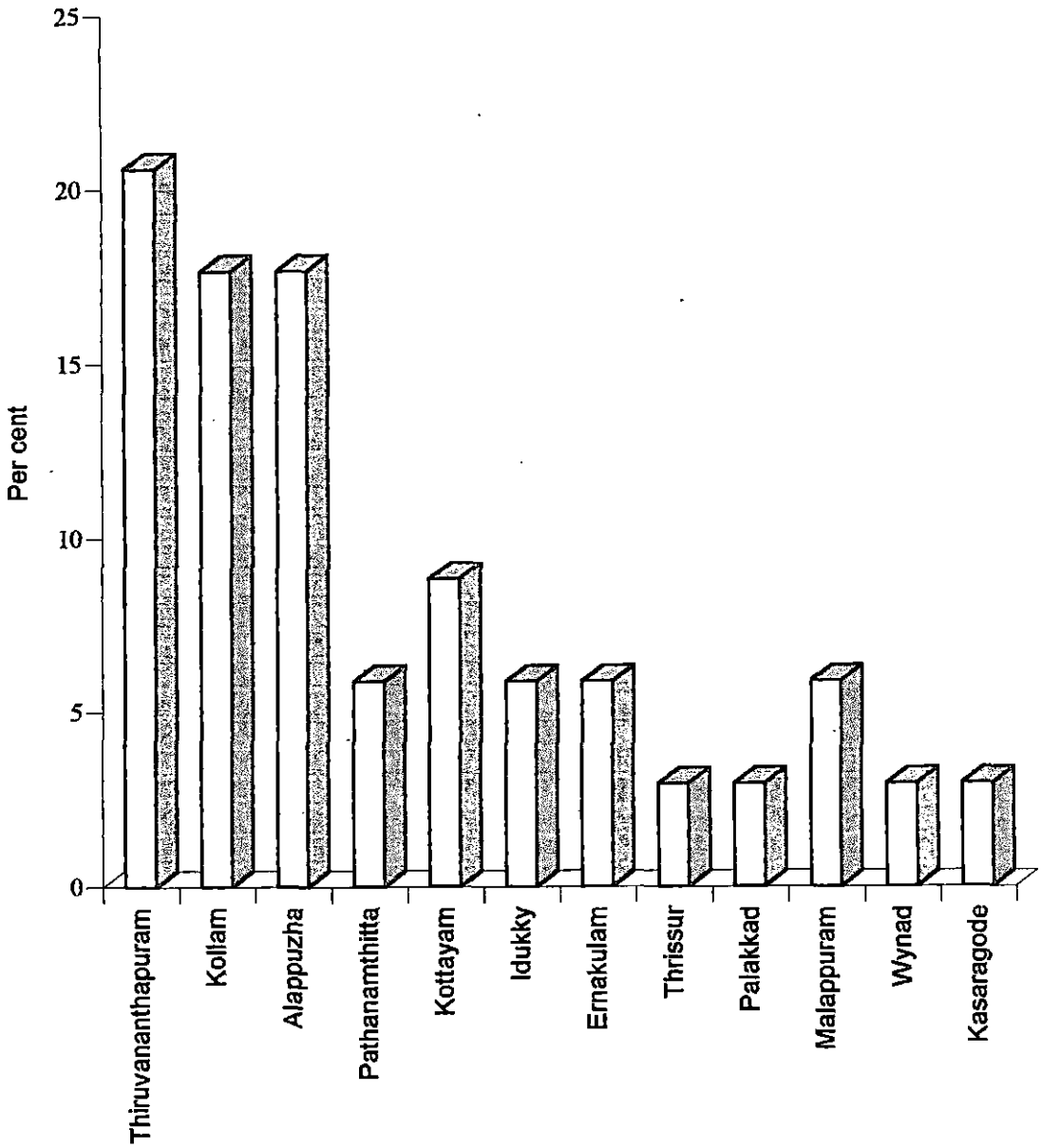
reported by Gopimony and George (1979), Jessykutty and Peter (1986), Sadasiva *et al.* (1994), Pathania *et al.* (1996) and Ponnuswamy (1997). Among the wilt resistant lines of the present study, S 47 from Irinjalakuda (Thrissur), S 55 from Ozhur (Malappuram), S 32 and S 33 from Adoor (Pathanamthitta), S 22 from Thiruvakkal (Alappuzha), S 23 from Cherthala (Alappuzha) and S 15 from Kundara (Kollam) were superior in yield , yield attributing characters and organoleptic qualities. These lines could be recommended as an adhoc step to grow in the disease prone areas after multilocational testings.

S. melongena var. *insanum* was reported as resistant to bacterial wilt (Gopimony and George, 1979). In the present study also S 39 belonging to *S. melongena* var. *insanum* from Vandiperiyar (Idukki) was free of wilting which can be very well utilised in interspecific hybridisation in resistance breeding programme. In most of the susceptible accessions, wilting started during flowering stage (50 - 60 days). This is in confirmity with the findings of Gowda *et al.* (1974) and Mew and Ho (1976). So it can be suggested that flowering stage is the critical one so as to categorize the population into resistant and susceptible groups.

Based on the study it can be inferred that bacterial wilt resistant landraces of brinjal were distributed more in the southern districts (Fig. 5.2). This might be due to the 'hot spot' situation coupled with the genetic wealth of the crop in this region.

Phomopsis blight by *Phomopsis vexans* (Sacc. & Syd.) Harter in eggplant has attained serious proportions ever since it was first reported in

Fig. 5.2 Distribution of source of resistance to bacterial wilt in brinjal landraces of Kerala



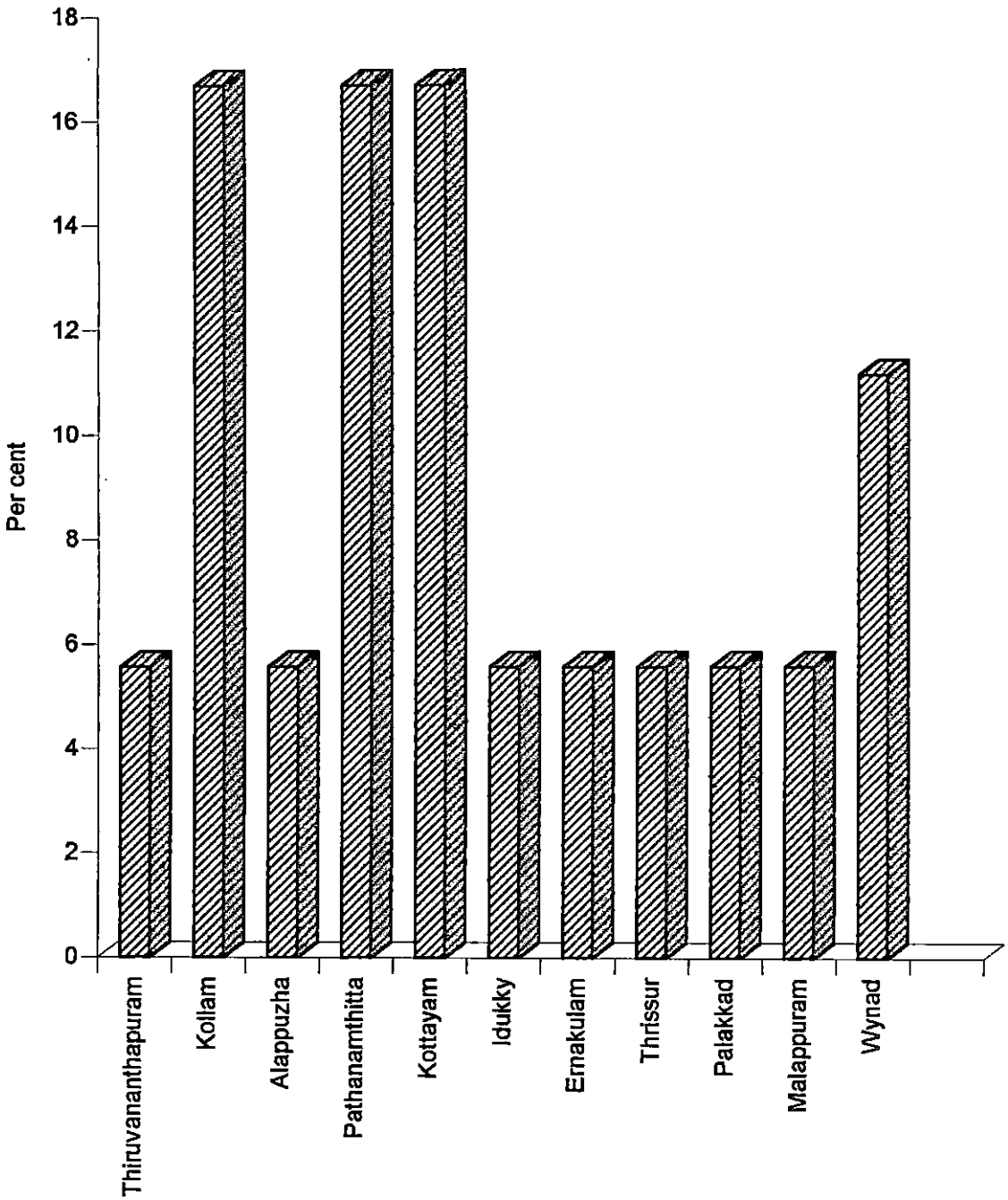
India by Uppal *et al.* (1935). Almost all commercial varieties grown in the country are susceptible to the disease. Howard and Desrosiers (1941) reported two resistant stocks in USA from the material introduced from India. In view of this report, it is considered worthwhile to screen eggplant landraces distributed in different parts of Kerala to locate sources of resistance.

In the present investigation, resistance against phomopsis blight has been located in S1 (Neyyattinkara, Thiruvananthapuram), S 13 (Athichanallore, Kollam), S 15 (Kundara, Kollam), S 17 (Odanavattom, Kollam), S 23 (Cherthala, Alappuzha), S 32 and S 33 (Adoor, Pathanamthitta), S 34 and S 35 (Poonjar, Kottayam), S 36 (Eara, Kottayam), S 39 (Vandiperiyar, Idukki), S 45 (Muvattupuzha, Ernakulam), S 46 (Irinjalakuda, Thrissur), S 53 (Walayar, Palakkad), S 55 (Ozhur, Malappuram) and S 60 (Ambalawayal, Wynad). As the landraces in the present study *viz.*, S 15, S 23, S 32, S 33 and S 55 were superior both in terms of resistance and yield attributing characters, they deserve special attention in the adhoc recommendation.

Ramanujam (1966) reported that phomopsis blight was confined only in *S. melongena*. In the present study also, the infection was seen only in accessions belonging to *S. melongena*. In comparison to the landraces of the *S. melongena*, the level of resistance in the wild and semiwild species *viz.*, *S. macranthum* (S 30) and *S. xanthocarpum* (S 59) was high. Similar high level of resistance was also reported by Kalda *et al.* (1976) in *S. xanthocarpum*.

Phomopsis blight resistant landraces were more seen in Kollam, Pathanamthitta and Kottayam districts (Fig. 5.3). Further studies should be

Fig. 5.3 Distribution of the source of resistance to phomopsis fruit rot in brinjal landraces of Kerala



generated under artificial epiphytotic conditions so as to confirm the resistance.

Application of insecticides and antibiotics has been recommended to control the little leaf disease of brinjal caused by mycoplasma like organisms. However, in view of the hazards and high cost involved in chemical control, it has become imminent to seek built in protection by way of varietal resistance. Mote *et al.* (1976) and Datar and Ashtaputre (1984) reported varietal resistance for little leaf. In the present investigation, all the accessions except S 10 (Nedumangad, Thiruvananthapuram) were found free from little leaf incidence during the crop period. This may be either due to the low population of the disease vector (*Hishimonus phycitis* Distant) during the crop period or due to the resistant genes present in the landraces.

Multiple resistance in brinjal for important pests and diseases was described by Babu *et al.* (1998). In the present study, S 1 collected from Neyyattinkara (Thiruvananthapuram), S 13 from Athichanallore (Kollam), S 36 from Eara (Kottayam), S 39 from Vadiperiyar (Idukki), S 59 from Ambalawayal (Wynad) exhibited resistance against all the biotic stresses under study. Since this includes both cultivated as well as wild species, they could be considered as potential donors of resistant genes. However, the resistance on these landraces should be further confirmed through screening under epiphytotic / epizootic conditions and multilocational / multi seasonal trials.

5.2 Genetic cataloguing

Genetic cataloguing of germplasm based on standard descriptors helps in international exchange of information in a more scientific way. This also

helps in locating some accessions with specific morphological characters which can be used for crop improvement. Attempts to collect and characterize eggplant have been made by scientists like Perrino *et al.* (1992), Olufolaji and Makinde (1994) and Reifschneider *et al.* (1997).

In the present investigation, landraces of brinjal collected from different places of Kerala showed wide range of variations for characters like fruit shape, colour, leaf lobing, spininess, etc. Similar variations in agromorphological characters were reported by Thomas *et al.* (1990), Rai *et al.* (1995) and Sivaraj *et al.* (1998).

The database formulated reflected a highly variable collection which in turn gives a good idea about the wealth of the landraces of eggplant in Kerala. This basic materials would be required as new genes while facing unforeseen challenges of crop breeding in future. If not saved now, this gene pool for important traits may be lost for ever. Hence, further collections and studies are needed to cover new areas and new aspects for evaluation. Present collection of landraces should be characterized further for morphological, biochemical and anatomical basis governing resistance.

5.3 Variability

Information on the nature and magnitude of variability present in a population owing to genetic and non genetic causes is an important pre-requisite of starting any systematic breeding programme. Only the genetic proportion of the total variability contributes to gain under selection. So knowledge of the genetic variation governing the inheritance of quantitative

characters like yield and its components is essential in any of the crop plants (Allard, 1960).

To make valid comparison, an accurate estimate of phenotypic and genotypic variabilities are computed in terms of the corresponding coefficients of variation *viz.*, phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV). The GCV provides a valid basis for comparing and assessing the range of genetic diversity for quantitative characters and PCV measures the extent of total variation.

In the present investigation, for majority of the characters, magnitude of PCV and GCV were closer, suggesting greater contribution of genotype rather than environment. So the selection can be very well based on the phenotypic values. Such a closer PCV and GCV for different characters were earlier reported by Hiremath and Rao (1974) and Rajput *et al.* (1996).

High values of PCV with corresponding high values of GCV for fruits per plant, fruit length, petiole length, seed weight, fruit breadth and yield per plant indicated greater extent of variability that could be ascribed to genotype (Fig. 4.2). Similar results were obtained for fruits per plant, seed weight and yield per plant by Hiremath and Rao (1974), for fruits per plant by Sinha (1983), for fruit length, fruit breadth and yield per plant by Vadivel and Bapu (1989) and for fruits per plant, fruit weight and yield per plant by Rajput *et al.* (1996).

Harvest index recorded lowest GCV indicating limited scope for improvement of this trait due to low magnitude of variability. The difference

between PCV and GCV was maximum for fruit weight revealing the influence of environment on this character (Fig. 4.2).

From the foregoing discussion, it is clear that the characters *viz*., fruits per plant, fruit length, petiole length, seed yield, fruit breadth and yield per plant offer good scope for selection in the present collection of landraces of brinjal.

5.4 Heritability and genetic advance

While selecting for a character, consideration of mere phenotypic variability without estimating the heritable part will not be of much use. Heritability estimates provide an exact and precise information of the influence of environment on various characters. Burton (1952) suggested that GCV along with heritability would provide a picture of the amount of advance to be expected by phenotypic selection.

In the present study, fruit length followed by leaf area index, dry weight, fruits per plant, organoleptic quality, harvest index, fruit breadth and yield recorded high heritability values. This can be attributed to the fact that these characters are least influenced by environmental effects and there could be greater correspondence between phenotypes and breeding value while selecting individuals (Johnson *et al*., 1955). High heritability of fruits per plant, fruit length and yield per plant is in agreement with the findings of Hiremath and Rao (1974) and Tambe *et al*. (1992). High heritability for fruit length and fruits per plant was recorded by Vadivel and Bapu (1989) and for yield, fruit length and fruit breadth by Rajput *et al*. (1996).

Moderate values of heritability were recorded for plant height and fruit weight in the present investigation (Table 4.10). This was in accordance with the findings of Vadivel and Bapu (1989).

High heritability estimates indicate the effectiveness of selection based on good phenotypic performance, but doesn't necessarily mean a high genetic gain for a particular trait. Johnson *et al.* (1955) pointed out that high heritability estimates along with high genetic advance were more useful than the heritability values alone in predicting the resultant effect for selecting the best individual.

Higher values of genetic advance as per cent of mean were recorded in the present study for fruits per plant, fruit length, fruit breadth, seed weight, yield, leaf area index, branches per plant, dry weight and fruit weight. Such a high value of genetic advance as per cent of mean was also recorded by Hiremath and Rao (1974) for fruits per plant, fruit weight, seed weight, fruit length, fruit girth and seed yield.

According to Panse (1957), the characters with high heritability and high genetic advance were controlled by additive gene action and therefore amenable to genetic improvement through selection. In the present study, high values of heritability associated with high genetic advance were observed for fruits per plant, fruit length, petiole length, fruit breadth, seed weight, yield, leaf area index, branches per plant and dry weight (Fig.4.3). High heritability values accompanied by high genetic gain for fruits per plant and seed weight were recorded also by Hiremathe and Rao (1974). Vadivel and Bapu (1989)

and Rajput *et al.* (1996) reported high heritability with high genetic gain for the characters yield and fruits per plant.

5.5 Correlation studies

Yield is a complex character, which is the outcome of a number of genetic factors and the environmental conditions, which are interrelated at various stages of plant growth. Therefore selection made for this character merely on the basis of its phenotypic expression is likely to be misleading. Hence analysis of yield in terms of genotypic, phenotypic and environmental correlation coefficients of component characters leads to the understanding of them so as to form basis of selection. The genotypic correlation between characters provides a reliable measure of genetic association between the characters and helps to differentiate the vital association useful in breeding from the nonvital ones (Falconer, 1981).

Based on the present study it is evident that, in general the genotypic correlations are higher than phenotypic correlation as reported earlier by Johnson (1955) and Gotoh (1956). It indicated the strong inherent association between the various character pairs studied.

In the present investigation, yield per plant showed significant positive association with plant height, branches per plant, canopy spread, dry weight, leaf area index, vascular bundles, leaf thickness, stem girth, fruits per plant, fruit length, fruit weight, harvest index and organoleptic quality. It reveals the importance of predicting yield of brinjal by applying selection on these characters in advance.

High positive association of leaf area index with yield underlines the paramount role of large leaves in augmenting yield. For optimum crop growth and yield, enough leaves must be present in the canopy to intercept more solar radiation. Similar association of leaf area index with yield was reported by Abraham *et al.* (1992) in black gram.

The fruits per plant was identified as one of the main yield contributing factors (Srivastava and Sachan, 1973 ; Singh and Singh, 1979). In the present investigation also, the fruits per plant was seen significantly correlated to yield. This was also in line with the findings of Sinha (1983), Chadha and Paul (1984), Vadivel and Bapu (1988) and Kumar (1995). Therefore by putting selection pressure on fruits per plant, yield can be enhanced.

Vadivel and Bapu (1988), Tambe *et al.* (1992) and Kumar (1995) reported significant positive correlation of branches per plant and fruit length with yield. The present study confirmed their findings. Plant height showed a high positive correlation with yield, which was in confirmity with the findings of Sinha (1983), Chadha and Paul (1984) and Vadivel and Bapu (1988). Fruit weight was also positively correlated to yield as reported by Vijay *et al.* (1978) and Rajput *et al.* (1996). Gautham and Srinivas (1992) reported a positive correlation of plant spread with yield which was true in the present study also. So it may be suggested that selection in the landraces of brinjal for yield based on the characters *viz.*, branches per plant, fruit length, plant height, fruit weight and canopy spread may prove fruitful.

Harvest index had a significant positive association with yield. Harvest index characterize the conversion of dry matter to the economic part of the plant. The plant with high harvest index is more efficient in transferring drymatter to the harvested part of the plant, thereby giving good yield. Association between yield and harvest index in grain crops was reported by Gardner *et al.* (1985). High and positive association was noted in the present study for dry weight, vascular bundles and leaf thickness with yield. More dry weight, vascular bundles and leaf thickness were the indications of efficient storage of photosynthates which in turn resulted in more yield.

Days to flowering and days to harvest, in the present study recorded a negative association with yield. This was in confirmity with the findings of Vijay *et al.* (1978) and Vadivel and Bapu (1988). Thus, early blooming landraces of brinjal can be regarded as good yielders. Fruit breadth also recorded a negative correlation with yield. Hiremath and Rao (1974) reported similar negative association. It may be assumed that increasing the fruit breadth beyond a certain limit will be at the cost of the yield per plant.

In addition to the selection based on individual yield components, data on interrelationships among the yield components is also necessary, as it gives a more reliable information rather than a knowledge on association between yield and its components.

Leaf area index showed significant positive association with plant height, stem girth, canopy spread, dry weight, fruit length and fruit weight. At the same time, these characters showed positive interrelationships with each

other also. This indicated that selection for these characters will also improve leaf area index and thereby yield. Positive association of leaf area index with plant height was reported in greengram by Manivannan and Nadarajan (1996).

Association of fruits per plant with branches per plant was observed in the present study as reported by Sinha (1983). Fruits per plant also showed a positive association with fruit set as reported by Rajput *et al.* (1996). Thus, it can be inferred that accessions with more branches and fruit set will in turn produce more fruits. Hiremath and Rao (1974) reported a negative correlation for fruits per plant with fruit weight and fruit breadth. In the present investigation also number of fruits recorded a negative association with fruit weight and fruit breadth. It shows that with increase in fruits per plant, there is a simultaneous decrease in fruit weight and breadth. Therefore, we have to make a compromise among fruits per plant, fruit weight and fruit breadth, while selecting for yield. Fruits per plant also had negative association with days to harvest which means, selection for early genotypes will result in more fruits per plant and thereby good yield. This was in accordance with the findings of Chadha and Paul (1984).

The positive significant association of fruit breadth and fruit weight, observed in present investigation indicated that selection for accessions with greater fruit breadth would result in isolating strains with higher fruit weight. This was in confirmity with the findings of Kumar (1995). Increased fruit weight and fruit breadth can lead to more seed production as they are positively correlated in the present study, which was also reported by Hiremath and Rao (1974).

In the present investigation, a significant negative correlation was noted between fruit length and fruit breadth, which was in confirmity with the findings of Kumar (1995). Thus selection for more length and less breadth of fruits can be expected to give good yield. From the high and significant association noted between days to flowering and days to harvest in the present study, it can be inferred that early blooming varieties reach harvesting early and gives more fruits. Association between days to flower and days to harvest was also reported by Chadha and Paul (1984).

Many plant and fruit characters of brinjal regulate the level of tolerance against shoot and fruit borer (Panda *et al.*, 1971). According to Grewal and Singh (1992) preflowering period had significant correlation with shoot borer attack, which was observed in the present study also. The reduced shoot infestation on early flowering accessions could be attributed to the fact that borer shifted to flower and fruits early as compared to the late flowering ones. Again fruit borer showed a negative association with fruits per plant. Thus, accessions with more fruits per plant suffered least from borer damage. This was in confirmity with the findings of Singh and Chadha (1991). Fruit breadth also recorded a positive correlation with fruit borer indicating more successful boring of larva in broad fruits. The borer also gets good protection in fruits with more breadth. This association was also reported by Kumar and Ram (1998). It is therefore concluded that for borer resistance landraces having more fruits with less breadth have to be selected.

Association of plant height with phomopsis infestation is very important, since it is highly correlated in the present study with height at

branching and height of first flowering node. Accessions with low branches and low flowering node suffered more infection. This might be due to the proximity of soil surface which facilitates easy entry of the pathogen, a soil borne fungus (Panwar *et al.*, 1970). The close association of leaf and fruit infection in the present study indicated that common factors are contributing irrespective of the site of infection. So while selecting for phomopsis resistance, plant height should be given prime importance. Again, a significant association was noted between fruit borer infestation and phomopsis fruit rot. This might be due to the fact that the injuries made on the fruit surface by borer provide an easy entry for pathogen. Hence, fruit borer resistant lines can offer some degree of control for phomopsis fruit rot too.

5.6 Path analysis

As the correlation coefficients are insufficient to explain the true relationship for an effective manipulation of the character, path coefficients were worked out. The path analysis furnishes a method of partitioning the correlation coefficients into direct and indirect effects so as to provide the actual contribution of an attribute and its influence through other traits.

In the present study, plant height, fruits per plant, stem girth and harvest index exerted strong and positive direct effect on yield. Positive direct effect of plant height and fruits per plant on yield was in accordance with the findings of Vadivel and Bapu (1990). Direct effect of fruit number on yield per plant was reported by Vijay *et al.* (1978) and Sinha (1983). Fruit weight had a negative direct effect on yield. It's positive association with yield might be

due to the positive indirect effect through stem girth and plant height. Negative direct effect of fruit weight on yield was also reported by Sinha (1983).

Similarly, fruit length exerted a negative direct effect even though its total correlation with yield was positive. It's positive indirect effect through plant height and stem girth could be considered as the cause for this. Vijay *et al.* (1978), Sinha (1983) and Vadivel and Bapu (1990) obtained a negative direct effect for days to bloom. In the present investigation also days to bloom recorded a negative direct effect. Low value for residue indicated that the component characters taken for path analysis well explained the cause and effect system.

It is inferred from the path analysis that early genotypes of various landraces of brinjal with more plant height, number of fruits, stem girth and harvest index should be given importance while selecting for yield. All these characters except harvest index had good GCV coupled with high heritability and genetic advance in the present population of landraces.

5.7 Selection index

Discriminant function analysis developed by Fisher (1936) gives information on the proportionate weightage to be given to a yield component. Thus, selection index was formulated to increase the efficiency of selection by taking into account the important characters contributing to yield. Further, Hazel (1943) suggested that selection based on a suitable index was more efficient than individual selection for the character.

Plant height, days to flower, fruit length, fruit breadth, branches per plant, fruit weight, fruits per plant, stem girth and harvest index together with yield per plant were used for constructing selection index. Based on the selection index values, top ranking landraces namely S 33 from Adoor (Pathanamthitta), S 22 from Thiruvakkal (Alappuzha), S 23 from Cherthala (Alappuzha), S 47 from Irinjalakuda (Thrissur), S 25 from Thathampally (Alappuzha), S 55 from Ozhur (Malappuram), S 15 from Kundara (Kollam), S 42 from Thodupuzha (Ernakulam), S 32 from Adoor (Pathanamthitta) and S 52 from Nilambur (Malappuram) were identified as superior ones in terms of yield and resistance against various biotic stresses (Table 12). These locally adapted landraces of brinjal can be exploited further in future breeding programmes. A 'location specific evaluation' has to be carried out with these brinjal lines in areas where diverse agroclimatic situations and consumer preference exist.

SUMMARY

6. SUMMARY

The present study "collection and characterization of landraces of brinjal (*Solanum melongena* L.) in Kerala" was conducted at the Department of Olericulture, College of Agriculture, Vellayani, during the period 1997-99. The programme envisaged assessing the variability on the landraces of brinjal in Kerala, for morphology, yield, yield attributes and resistance to pest and diseases so as to identify suitable lines for further breeding.

Fifty diverse landraces of brinjal collected from different parts of Kerala were evaluated in a randomised block design with two replications. The salient results of the study are summarised below :

The analysis of variance revealed significant difference among the landraces for all the characters studied except, stomatal distribution and branch and node of first flower. S 33, a landrace from Adoor (Pathanamthitta) was the top yielder.

Resistance against shoot and fruit borer was noted in the landraces, *viz.*, S 1 from Neyyattinkara (Thiruvananthapuram), S 13 from Athichanallore (Kollam), S 28 from Thamarakkulam (Alappuzha), S 35 from Poonjar (Kottayam), S 36 from Eara (Kottayam) and S 37 from Manarkadu (Kottayam). Wild/semi-wild collections like *S. macranthum*, *S. melongena* var. *insanum* and *S. xanthocarpum* showed high level of resistance against the borer.

Landraces *viz.*, S15 from Kundara (Kollam), S 22 from Thiruvakkal (Alappuzha), S 23 from Cherthala (Alappuzha), S 32 and S 33 from Adoor

(Pathanamthitta), S 47 from Irinjalakkuda (Thrissur) and S 55 from Ozhur (Malappuram) were superior in bacterial wilt resistance and yield.

S. macranthum and *S. xanthocarpum* were completely free from phomopsis fruit rot. Landraces like S 1 (Neyyattinkara, Thiruvananthapuram), S 13 (Athichanallore, Kollam), S 15 (Kundara, Kollam), S 17 (Odanavattom, Kollam), S 23 (Cherthala, Alappuzha), S 32 and S 33 (Adoor, Pathanamthitta), S 34 and S 35 (Poonjar, Kottayam), S 36 (Eara, Kottayam), S 39 (Vandiperiyar, Idukki), S 45 (Muvattupuzha, Ernakulam), S 46 (Irinjalakkuda, Thrissur), S 53 (Walayar, Palakkad), S 55 (Ozhur, Malappuram) and S 60 (Ambalawayal, Wynad) were also resistant.

Incidence of little leaf disease was seen only in the landrace S 10 from Nedumangad, Thiruvananthapuram.

Multiple resistance against all the biotic stresses under study was noted in S 1 (Neyyattinkara, Thiruvananthapuram), S 13 (Athichanallore, Kollam), S 36 (Eara, Kottayam), S 39 (Vandiperiyar, Idukki) and S 59 (Ambalawayal, Wynad).

The landraces were described morphologically and a database was developed using the simplified descriptor of IBPGR, Rome.

High PCV coupled with high GCV was recorded for fruits per plant, fruit length, petiole length, seed weight, fruit breadth and yield.

A very high heritability was observed for fruit length, leaf area index, dry weight, fruits per plant, organoleptic quality, harvest index, fruit breadth

and yield. Expected genetic advance as per cent of mean was maximum for fruits per plant followed by fruit length, petiole length, fruit breadth, seed weight, yield, leaf area index, branches per plant, dry weight and fruit weight. All these characters possessed high heritability values except fruit weight.

At genotypic level, yield per plant was positively correlated to plant height, stem girth, branches per plant, canopy spread, dry weight, leaf area index, leaf thickness, vascular bundles, fruits per plant, fruit length, harvest index and organoleptic quality. Days to bloom and fruit breadth had a negative correlation with yield.

Plant height, fruits per plant, stem girth and harvest index recorded high positive correlation coefficient and positive direct effect.

Fruit borer incidence showed positive correlation with fruit breadth. A negative association was noted between fruit borer incidence and fruits per plant. Phompsis blight incidence showed a significant negative correlation with plant height.

A selection index was formulated using ten characters having high correlation with yield. Landraces *viz.*, S 33 from Adoor (Pathanamthitta), S 22 from Thiruvakkal (Alappuzha), S 23 from Cherthala (Alappuzha), S 47 from Irinjalakkuda (Thrissur), S 25 from Thathampally (Alappuzha), S 55 from Ozhur (Malappuram), S 15 from Kundara (Kollam), S 42 from Thodupuzha (Idukki), S 32 from Adoor (Pathanamthitta) and S 52 from Nilambur (Malappuram) were identified as superior ones with yield and field resistance against biotic stresses.

APPENDICES

Appendix E Weather data for the crop period – weekly averages

Period (1997)	Max temperature (°C)	Min temperature (°C)	Relative Humidity (%)	Rainfall (mm)
July 1 – July 7	30.30	23.63	80.21	0.029
8 – 14	30.39	28.41	82.99	2.77
15 – 21	28.83	23.89	85.79	4.00
22 – 28	29.19	23.91	86.07	1.57
29 – Aug 4	29.59	24.84	85.71	0.70
5 – 11	30.07	24.24	83.00	2.77
12 – 18	30.74	24.83	81.93	0.31
19 – 25	29.01	26.80	87.50	16.74
26 – Sep 1	30.19	24.17	82.29	0.04
2 – 8	29.96	24.13	83.14	8.69
9 – 15	29.75	23.97	85.29	13.46
16 – 22	25.97	24.03	88.21	7.54
23 – 29	28.71	23.50	84.90	15.00
30 – Oct 6	29.60	24.16	86.57	0.94
Oct 7 – Oct 13	28.24	23.00	94.29	51.91
14 – 20	30.20	23.70	83.50	5.69
21 – 27	30.54	23.70	81.64	-
28 – Nov 3	30.07	23.04	81.86	2.54
4 – 10	28.77	23.39	89.14	41.57
11 – 17	30.07	23.10	82.71	7.43
18 – 24	30.57	23.07	78.36	-
25 – Dec 1	30.74	23.76	84.36	1.51
2 – 8	30.90	23.43	83.07	16.77
9 – 15	29.20	23.11	87.09	5.54
16 – 22	30.79	23.08	85.00	6.86
23 – 29	31.34	21.14	85.50	0.86

Appendix II Analysis of variance for different characters in 50 accessions of Brinjal (Mean squares are given)

Source	df	Plant height	Girth of stem	Height at branching	branches per plant	Dry weight	Canopy spread	LAI	Leaf thickness
Replication	1	202.2031	4.0078	8.2041	307.7852	40	2916.844	0.0089	1488.5
Genotype	49	88.5532**	0.8730**	4.0202**	55.0033**	59601.8**	478.2469**	0.0444**	1961.827**
Error	49	16.8663	0.0658	0.5717	6.0410	196.6531	33.9885	0.0001	171.8265

Source	df	Leaf petiole length	Stomatal distribution	Vascular bundle distribution	Days to flower	Branch of 1st flowering	Node of 1st flowering	Height of 1st flower node
Replication	1	4.5544	0.0471	3.6093	26.2813	3.3599	0.6416	0.9609
Genotype	49	4.8762**	0.0137	93.9225**	182.2283*	1.1067	9.9	93.3905**
Error	49	0.3255	0.0320	3.4263	21.4114	1.0209	7.6914	8.8849

(Contd.....)

Source	df	Long and medium styled flowers	Fruit set	Days to harvest	Fruits per plant	Yield	Fruit length	Fruit breadth
Replication	1	21.6094	32.1789	68.2813	1.0625	2008	11.1152	0.4484
Genotype	49	43.9633**	30.4528**	310.9643**	100.6531**	163974.1**	58.6037**	5.5036**
Error	49	5.0443	3.1575	28.6626	1.1108	5039.674	0.345	0.1225

Source	df	Fruit weight	HI	Seed weight	Keeping quality	Organoleptic quality	Shoot borer incidence
Replication	1	21.1562	0.0001	0.1226	0.0900	0.1836	3.3164
Genotype	49	1383.866**	0.001**	6.709**	3.2206**	14.5904**	40.1875**
Error	49	450.6907	0.0003	0.5156	0.2737	0.1573	0.2373

Source	df	Fruit borer incidence	Bacterial wilt incidence	Days to wilt	Phomopsis blight incidence on leaves	Phomopsis fruit rot incidence on fruits	Little leaf incidence
Replication	1	0.1016	1.6015	0.0117	961.1953	5.5898	1.6031
Genotype	49	156.9739**	708.2588**	1635.311**	721.6186**	167.7112**	43.2570**
Error	49	0.8002	24.1361	98.2956	48.5188	1.6830	1.6030

** Significant at 1 per cent level

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*Original not seen

COLLECTION AND CHARACTERIZATION OF LANDRACES OF BRINJAL (*Solanum melongena* L.) IN KERALA

By

SHEENA SEBASTIAN

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ABSTRACT

A study was carried out to characterize the landraces of brinjal *Solanum melongena* L. in Kerala at the Department of Olericulture, College of Agriculture, Vellayani. The collections were evaluated for morphology, yield, yield attributes and reactions to various biotic stresses *viz.*, fruit and shoot-borer (*Leucinodes orbonalis* Guen.), bacterial wilt (*Ralstonia solanacearum* Yabuuchi), phomopsis blight (*Phomopsis vexans* (Sacc. & Syd.) Hartar) and little leaf (Mycoplasma). The genetic parameters, correlation and path coefficients were studied and a selection index was formulated to identify superior genotypes.

landraces showed significant difference for all the characters except stomatal distribution and branch and node of flowering. S 33 collected from Adoor (Pathanamthitta) was the top yielder.

S. macranthum Dun., *S. melongena* var. *insanum* and *S. xanthocarpum* were highly resistant against shoot and fruit borer. Landraces, *viz.*, S 1 (Neyyattinkara, Thiruvananthapuram), S 13 (Athichanallore, Kollam), S 28 (Thamarakulam, Alappuzha, S 35 (Poonjar, Kottayam), S 36 (Eara, Kottayam) and (S 37 (Manarkadu, Kottayam) were found with high resistance.

Collections, *viz.*, S 15 from Kundara (Kollam), S 22 from Thiruvakkal (Alappuzha), S 23 from Cherthala (Alappuzha), S 32 and S 33 from Adoor (Pathanamthitta), S 47 from Irinjalakuda (Thrissur) and S 55 from Ozhur

(Malappuram) were resistant to bacterial wilt coupled with high yield and yield attributes.

Resistance to phomopsis blight was noted in wild/semi-wild species, *viz.*, *S. macranthum*, *S. melongena* var. *insanum* and *S. xanthocarpum* and in cultivated types, *viz.*, S 1 (Neyyattinkara, Thiruvananthapuram), S 13 (Kundara, Kollam), S 15 (Athichanallore, Kollam), S 17 (Odanavattom, Kollam), S 23 (Cherthala, Alappuzha), S 32 and S 33 (Adoor, Pathanamthitta), S 34 and S 35 (Poonjar, Kottayam) S 36 (Eara, Kottayam), S 45 (Muvattupuzha, Ernakulam), S 46 (Irinjalakkuda, Thrissur), S 53 (Walayar, Palakkad), S 55 (Ozhur, Malappuram) and S 60 (Ambalawayal, Wynad).

Incidence of little leaf disease was seen only in S 10, a landrace from Nedumangad (Thiruvananthapuram).

Multiple resistance to all the major biotic stresses was noted in *S. melongena* var. *insanum* and *S. xanthocarpum* and in landraces, *viz.*, S 1 (Neyyattinkara, Thiruvananthapuram), S 13 (Athichanallore, Kollam) and S 36 (Eara, Kottayam).

The landraces were described using the simplified descriptor for eggplant provided by the IBPGR, Rome.

GCV and PCV were highest for fruits per plant followed by fruit length, petiole length, seed weight, fruit breadth and yield. High heritability coupled with high genetic advance was noted for fruits per plant, fruit length, petiole length, fruit breadth, seed weight, yield, leaf area index, branches per plant,

dry weight and fruit weight indicating scope for the improvement through selection.

Plant height, stem girth, branches per plant, canopy spread, dry weight, leaf area index, leaf thickness, vascular bundles, fruits per plant, fruit length, fruit weight, harvest index and organoleptic quality had high positive correlations with yield whereas days to flower and fruit breadth had a negative correlation. Path analysis revealed plant height, fruits per plant, stem girth and harvest index as primary contributors to yield.

Fruit borer incidence showed a positive correlation with fruit breadth and a negative correlation with fruits per plant whereas, phomopsis blight incidence showed a significant negative association with plant height.

A selection index was constructed based on the yield per plant and nine yield contributing characters. The landraces S 33 from Adoor (Pathanamthitta), S 22 from Thiruvakkal (Alappuzha), S 23 from Cherthala (Alappuzha), S 47 from Irinjalakkuda (Thrissur), S 25 from Thathampally (Alappuzha), S 55 from Ozhur (Malappuram), S 15 from Kundara (Kollam), S 42 from Thodupuzha (Idukki), S 32 from Adoor (Pathanamthitta) and S 52 from Nilambur (Malappuram) were identified as elite in terms of yield and field resistance against various biotic stresses.