VARIABILITY STUDY IN F_2 MATERIALS OF INTERVARIETAL CROSS OF BRINJAL (*Solanum melongena* L.)

BY

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CERTIFICATE

This is to certify that thesis entitled, "VARIABILITY STUDY IN F_2 MATERIALS OF INTERVARIETAL CROSS OF BRINJAL (*Solanum melongena L.*)" submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE IN GENETICS AND PLANT BREEDING, embodies the result of a piece of bonafide research work carried out by **Md. Moniruzzaman**, Registration No. **07-02632** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information, as has been availed of during the course of this investigation has duly been acknowledged.

Dated: June, 2009
Place: Dhaka, Bangladesh

(Dr. Md. Shahidur Rashid Bhuiyan)
Professor
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Dedicated to
my
Beloved Parents

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VARIABILITY STUDY IN F_2 MATERIALS OF INTERVARIETAL CROSS OF BRINJAL (*Solanum melongena* L.)

BY

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ABSTRACT

An experiment was conducted to study genetic variability, character association and path coefficient analysis for yield and its contributing traits in Brinjal genotypes. The experiment was carried out at the Horticulture farm of Shre-E Bangla Agriculture University, Shre-E Bangla Nagar Dhaka-1207. The results indicated that different brinjal genotypes differed significantly regarding all the characters studied. Minimum differences of genotypic and phenotypic variances and coefficient of variation as well as high heritability coupled with high genetic advance and genetic advanced in percent of mean were observed for all the traits of different brinjal genotypes indicated additive gene effects of these traits. Number of fruit per plant and single fruit weight of different brinjal genotypes had a high degree of significant positive association with yield per plant and high positive direct effect indicated that these characters had the major contribution towards the yield per plant. Selection could be made based on these two traits for the improvement of yield of brinjal genotypes. Regarding singal fruit weight and yield per plant, the genotype Line-01× Line-25F_2 performed best. Genotypes Line-01× Line-25F_1, Line-23× Line-24F_2 produced higher yields next to genotype Line-01× Line-25F_2. In respect of days to flowering and days to first harvest Line-23× Line-24F_2 was found as the earliest genotype.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS (Cont'd.)

LIST OF TABLES

LIST OF PLATES

LIST OF APPENDICES

LIST OF ABBREVIATED TERMS

FULL WORD	ABBREVIATION
Agro-Ecological Zone	AEZ
And others	*et al.*
Accessions	ACC
Bangladesh Agricultural Research Institute	BARI
Bangladesh Bureau of Statistics	BBS
Centimeter	cm
Co-efficient of Variation	CV
Etcetera	etc.
Figure	Fig.
Genotype	G
Genetic Advance	GA
Genotypic Co-efficient of Variation	GCV
Genotypic Variance	δ^2_g
Gram	g
Heritability in broad sense	h^2b
Journal	j.
Kilogram	Kg
Meter	m
Mean Sum of Square	MSS
Millimeter	mm
Muriate of Potash	MP
Number	No.
Percent	%
Phenotypic Co-efficient of Variation	PCV
Phenotypic variance	δ^2_p
Randomized Complete Block Design	RCBD
Replication	R
Research	Res.
Sher-e-Bangla Agricultural University	SAU
Standard Error	SE
Square meter	m^2
Triple Super Phosphate	TSP

Chapter I

Introduction

CHAPTER I

INTRODUCTION

Brinjal or Egg plant or Aubergene is the most important and popular crops in Bangladesh. It is one of the major solanaceous crops under the botanical name (*Solanum melongena* L). (2n=24) grown in Bangladesh. The brinjal or egg plant is a crop of uncertain origin .The cultivated brinjal is undoubtedly of Indian origin and has been in cultivation for long time (Thompson and Killy, 1957) Brinjal is a native crop of Indian sub continent. A wide genetic diversity is found here due to the availability of different land races and their wild relatives. Brinjal is not as rich nutritionally as other solanaceous vegetable, but it has a high demand among the consumers due to its diversified uses. Especially in the month of Ramadan we have observed its great demand as baguni. It has medicinal value against diabetics and ailments of liver.

So far, 98 vegetable crops have been reported to be grown in Bangladesh. Considering the extent of production and utilization 19 major and 20 minor indigenous vegetables (IVs) were identified in Bangladesh. Major IVs include brinjal, hyacinth bean, bitter gourd, pointed gourd, ribbed gourd, snake gourd, sponge gourd, wax gourd, teasle gourd, cucumber, Indian spinach etc and are mainly grown in the summer season. Minor IVs include water cress, winged bean, sword bean, ivory gourd, chenopodium, tak palong, water lily, leaf amaranth etc and are cultivated on a small scale. Among IVs, brinjal, hyacinth, bean, teasle gourd have diversified variabilities and brinjal, hyacinth bean, bitter gourd, ridge gourd have got maximum attention for their development. Emphasis has been given for the resistance breeding and integrated pest management of these crops. Plant Genetic Resource Centre (PGRC) of Bangladesh Agricultural Research Institute (BARI) has got short and long term storage facilities where IVs are evaluated and conserved. Even though IVs are highly nutritious and are protective foods against various ailments including cancer, little attention was given for their improvement and many of them are at the risk of extinction. Therefore, attempt should be made for the development of IVs through survey, collection, evaluation, conservation and establishment of network on regional basis.

In Bangladesh, brinjal ranks top in respect of area and population among the vegetables. According to recent statistics, the area under summer brinjal is about 114.57 thousand hectare and winter brinjal is about 159.92 thousand hectare with a total production of 268.83 thousand metric tons. It contributes about 23% of total production of summer vegetables. Likewise, the area and under winter brinjal is about 43 thousand hectare with a production of about 280 thousand mt. BBS, (2006).

The share of land of this crop is about 29% with about 27% production during winter. This vegetable is grown round the year but large-scale production is done during winter.

Farmers grow it in homestead for family consumption and in field plots for commercial purpose. Land races and traditional technologies still dominate over improved varieties resistant to pests/disease (bacterial wilt. Shoot and fruit borer), environmental stress (drought, high temperature and rainfall of summer), seasonal guilt in winter, post harvest lose, poor marketing infrastructure are some of the constrains of brinjal production in Bangladesh.

In aspect of Bangladesh, information about the availability of variability in the brinjal germplasm is not sufficient. Keeping the foregoing problems in view, present investigation will be undertaken with the following objectives.

Objectives

- To study the variability in F_2 population,
- To select suitable plant (s) for advancing the generation,
- To know the yield potentiality of genotypes.

Chapter II
Review of Literature

CHAPTER II
REVIEW OF LITERATURE

A study was conducted by Prabhu *et al.* (2007) with four interspecific crosses of aubergine in generation: EP 45 x *Solanum viarum*, EP 65 x *Solanum viarum*, CO 2 x *Solanum viarum* and MDU 1 x *Solanum viarum*. Data were recorded on plant height, number of branches per plant, mean fruit weight, fruit length, fruit girth, number of fruits per plant, fruit and shoot borer (*Leucinodes orbonalis*) infestation, calyx length and marketable yield per plant. The genotypic coefficient of variation was found to be high for fruit and shoot borer infestation. High heritability with high genetic advance was noted for fruit and shoot borer infestation, branches per plant and marketable yield per plant, indicating the predominant role of additive gene action. High heritability with moderate genetic advance was observed for plant height, mean fruit weight, length and girth of fruits, number of fruits per plant, indicating either additive or non additive gene action.

Ivey *et al. (*2007*)* studied the diversity of *Ralstonia solanacearum* strains isolated from eggplant (*Solanum melongena*) grown in five provinces of the Philippine island group of Luzon was assessed using a recently described hierarchical system. All strains keyed to race 1, biovar 3 or 4. Phylotype-specific multiplex polymerase chain reaction (PCR) indicated that, like most other strains of Asian origin, all the strains in our Philippine collection belong to phylotype I. Taxometric and phylogenetic analyses of partial endoglucanase gene sequences of strains from this collection and those previously deposited into GenBank revealed at least four subgroups among the otherwise monophyletic phylotype I strains. Nucleotide polymorphisms within each subgroup were infrequent and, among the subgroups identified in this study, variation was always <1.3%, indicating that the large majority of strains could be assigned to a single sequevar. Genomic DNA fingerprinting using enterobacterial repetitive intergenic consensus (ERIC)-PCR revealed additional fine-scale genetic variation that was consistent with the endogluconase sequence data. Whole-pattern and band-based analyses of the genomic fingerprint data revealed four and eight distinct genotypes, respectively, within our collection. Eggplant from infested fields in different provinces tended to harbor mixed populations of ERIC genotypes. With the predominant genotype varying by location.

An investigation was carried out by Sherly and Shanthi (2009) with 24 genotypes of brinjal for variability, heritability and genetic advance. The study indicated that high estimate of phenotypic coefficient of variation and genotypic coefficient of variation was observed for fruit length, number of fruits per plant, fruit weight and fruit yield per plant. High heritability coupled with high genetic advance was registered for all the characters except total number of harvest and ascorbic acid. These characters can be effectively improved through selection.

Kumar *et al*. (2008) stated that Brinjal (*Solanum melongena* L.) is an important solanaceous vegetable in many countries of Asia and Africa. It is a good source of minerals and vitamins in the tropical diets. Assessment of genetic resources is the starting point of any crop improvement programme. In India, the National Bureau of Plant Genetic Resources is the nodal institute for management of germplasm resources of crop plants and holds more than 2500 accessions of brinjal in its genebank. In the present study, morphological diversity in a set of 622 accessions, comprising 543 accessions from indigenous sources and 79 accessions of exotic origin, was assessed. Wide range of variations for 31 descriptors, 13 quantitative and 18 qualitative, were recorded. The wide regional variations for plant, flower and fruit descriptors revealed enough scope for improvement of yield characters by selection. The genetic differences among the landraces are potentially relevant to breeding programmes in that the variability created through hybridization of the contrasting forms could be exploited.

The aim of this study was to determine the mode of inheritance, the combining ability and the components of genetic variance for fruit weight and fruit number per plant in five divergent aubergine genotypes. The investigation was based on data from the generation. Testing of mean values of the generation in relation to parents showed that in most hybrids, partial dominance was estimated as the mode of inheritance for both characters. The high values of heritability for yield components indicated a more important role of additive genes. It can be concluded that selection of genotypes with high average values for fruit weight and fruit number per plant could be a way for the improvement of aubergine breeding. (Damnjanovic *et al.* 2002).

The present study was conducted by Kumar *et al.* (2000) in Haryana, India, during 1996 to evaluate the performance of eleven advance lines along with three standard control cultivars of brinjal [aubergines] (Solanum melongena) under spring summer season. HLB-25 genotype recorded the highest fruit yield (980.38 g/plant) followed by HLB-18 (at 863.76 g/plant), HLB-106 (at 858.28 g/plant) and HLB-24 (at 824.23 g/plant). Hisar Jamuni genotype exhibited the highest number of seeds/fruit (540.93) followed by HOB-108 (at 487.42). Fourteen genotypes of brinjal (aubergine) were assessed for genetic diversity for 10 yield components in three different environments created by manipulating the dates of sowing (20 February, 10 March and 30 March 1996). The experiment was conducted in Hisar, Haryana, India. Highly significant differences were observed for all the characters under study. Higher values of phenotypic than genotypic coefficient of variation in all the three environments indicated the role of environmental influence in the expression of various characters.

Rai *et al.* (2001) mentioned in his paper eleven cultivars of aubergine having long-shaped fruits (Punjab Sadabahar, PB-33, PB-30, KS-331, KS-352, NDB-26-1, NDB-28-2, JB-15, BB-46, BB-13-1 and Purple Long) were evaluated in Madhya Pradesh, India for stability parameters with respect to yield and its contributing characters (plant height, fruit weight, and longitudinal and equatorial fruit lengths) over four environments (1995-99). Variations among cultivars for all the characters under study, except plant height, were significant. Genotype x environment interactions for different characters were also significant, indicating different response of cultivars among different environments. However, the linear effect and the linear interaction with genotype were both non-significant for all characters under study. However, pooled deviations from regression for all characters were highly significant. This means that the environmental interaction with cultivars were, in general, non-linear in nature. For the characters plant height and equatorial and longitudinal fruit lengths, all cultivars were stable. As regard fruit weight, all cultivars, except PB-33 and BB-13-1, were either stable or linearly predictable. As for the yield, PB-30 and JB-15 were stable as well as linearly predictable. PB-30 had the second highest yield (472.53 q/ha). Pusa Purple Long was also stable in yield, however, it performs well for poor environments only.

Singh *et al.* (2002) stated combining ability effects were estimated for different characters in a diallel crossing programme comprising 36 crosses developed using 10 parental lines in all possible combinations excluding reciprocals. Parents and crosses differed significantly for general combining ability (gca) and specific combining ability (sca) effects. On the basis of gca and sca variances, most of the characters under study indicated the predominance of additive gene action. The parents, CH-190, and CH-586 were good general combiners for fruit breadth and number of branches per plant. Swarna Shree, CH-586, CH-757, and CH-190 were the best general combiners for most of the yield-contributing characters. The crosses CH-757 x CH-792, CH-190 x CH-792, and CH-792 x BL-22 were superior on the basis of sca value and per se performance, which may be evaluated for further promotion.

A local currant tomato cultivar at 20 days after sowing was grafted onto 3 cultivars of aubergine (Long Green, Long Purple and Round Purple) and 2 tomato (TM01 and CL-6046BC3F2-51-0-20-5-15-15-14-1, tolerant to Ralstonia solanacearum) rootstocks with 3 different ages in an experiment in Thailand. The result showed that survival rate of scion on tomato rootstock was higher than on aubergine rootstock (20 days after sowing of rootstock). At 26 and 29 days after sowing of rootstock, all grafted plants survived 100%. In general, grafted plants produced higher marketable yield than the control mainly due to less disease prevalence. The highest marketable yield (5864 kg/rai) was currant tomato grafting on long green fruit aubergine rootstock with the lowest of disease prevalence (11.1%). The study showed the rootstock influence on yield and disease prevalence, with the use of grafting applications in currant tomato production. Ekpong and Somkul (2007).

Golani et al.(2007) conducted an experiment onTwenty-three genotypes of brinjal (aubergine) were assessed during the late kharif season of 2001/02-2003/04 in Junagadh, Gujarat, India to determine the nature and magnitude of genetic divergence and genetic variability for fruit yield and its contributing characters: plant height, plant spread, fruit length, fruit girth and 10-fruit weight. The population was grouped into 6 clusters. Cluster I comprised 6 genotypes, followed by clusters II and III, each with 5 genotypes, while cluster VI was a solitary cluster. The clustering pattern indicated that there was no association between the geographical distribution of the genotypes and genetic divergence. However, the shape and colour of fruits and the genotypes played a major role in the grouping of the genotypes into various clusters. The maximum intercluster D^2 value was reported between clusters II and III. The genotypic coefficient of variation, heritability and genetic advance as percentage of mean were high for fruit length, fruit girth and 10-fruit weight, indicating additive gene action, which contributed to maximum divergence and played a major role in the improvement of brinjal yield.

An investigation to study the variability and selection parameters was undertaken by Ram *et al.*(2007) during kharif 2003-04 in Uttar Pradesh, India using fifteen aubergine lines (KS 219, KS 247, KS 253, KS 262, KS 228, KS 233, KS 250, KS 263, KS 235, KS 227, ACC 5114, ACC 8204, ACC 8206, ACC 8207 and ACC 2623) and four testers (T 3, AB 1, KS 224 and DBR 8). The estimates of phenotypic coefficient of variation were higher than the genotypic coefficient of variation for all the characters studied. High magnitude of variability was observed in the mean among the parents for number of branches per plant, number of fruits per plant, length of fruit, width of fruit and yield per plant. The high genotypic and phenotypic coefficients of variation were observed for yield per plant, plant spread and number of fruits per plant in parents, suggesting the improvement by selection. High heritability coupled with high genetic advance indicating additive gene action was exhibited by characters, plant height, days to marketable maturity, plant spread, days to flowering, yield per plant, fruit weight and number of branches per plant in all the three populations. These characters can be improved by simple selection to get higher yield.

Chapter III

Materials and Methods

CHAPTER III

MATERIALS AND METHODS

It consists of a short description of locations of the experimental site, characteristics of soil, climate, materials, layout and design of the experiment, land preparation, manuring and fertilizing, transplanting of seedlings, intercultural operations, harvesting, data recording procedure, economic and statistical analysis etc., which are presented as follows:

3.1. Experimental site

The experiment was carried out at the experimental farm of Horticulture & Post Harvest Technology of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagor, Dhaka-1207. During March 2008 to August 2008. Plate 1 showing overview the research plot.

3.2 Geographical Location

The experimental area was situated at 23°77'N latitude and 90°33'E longitude at an altitude of 8.6 meter above the sea level (Anon., 2004). The experimental field belongs to the Agro-ecological zone of "The Modhupur Tract", AEZ-28 (Anon., 1988a). This was a region of complex relief and soils developed over the Modhupur clay, where floodplain sediments buried the dissected edges of the Modhupur Tract leaving small hillocks of red soils as 'islands' surrounded by floodplain (Anon., 1988b). The experimental site was shown in the map of AEZ of Bangladesh in (Appendix I).

Plate: 1 Layout of the experimental plot

3.3 Climate

Area has subtropical climate, characterized by high temperature, high relative humidity and heavy rainfall in Kharif season (March-September) and scanty rainfall associated with moderately low temperature during the Rabi season (October-March). Meteorological information regarding temperature, relative humidity, rainfall and sunshine hours prevailed at the experimental site during the study period was presented in Appendix II.

3.4 Characteristics of soil

Soil of the experimental site belongs to the general soil type, Shallow Red Brown Terrace Soils under Tejgaon Series. Top soils were clay loam in texture, olive-gray with common fine to medium distinct dark yellowish brown mottles. Soil pH ranged from 6.0- 6.6 and had organic matter 0.84%. Experimental area was flat having available irrigation and drainage system and above flood level. Soil samples from 0-15 cm depths were collected from experimental field. The analyses were done by Soil Resource and Development Institute (SRDI), Dhaka.

3.5 Planting materials

The experiment was conducted using 12 genotypes of brinjal which were given in following (Table 1).

Table 1: Name and sources of twelve Brinjal genotypes used in the present study

Genotypes	**Sources**
BARI-1	Department of Genetics & Plant Breeding, SAU
BARI-2	Department of Genetics & Plant Breeding, SAU
Line-8	Department of Genetics & Plant Breeding, SAU
Line-14	Department of Genetics & Plant Breeding, SAU
Line-15	Department of Genetics & Plant Breeding, SAU
Line-23	Department of Genetics & Plant Breeding, SAU
Line-27	Department of Genetics & Plant Breeding, SAU
Line-01× Line-25F_1	Department of Genetics & Plant Breeding, SAU
Line-23× Line-24F_1	Department of Genetics & Plant Breeding, SAU
Line-01× Line-25F_2	Department of Genetics & Plant Breeding, SAU
Line-14× Line-27F_2	Department of Genetics & Plant Breeding, SAU
Line-23× Line-24F_2	Department of Genetics & Plant Breeding, SAU

3.6 Design and layout of the experiment

The experiment was laid out Randomized Complete Block Design (RCBD) with three replications (Figure1). The genotypes were distributed into every plot randomly. The twelve genotypes of the experiment were assigned at random into plots of each replication. The distance maintained spacing row to row 75 cm and plant to plant 60 cm. The distance maintained between two blocks was 50 cm. (Fig. 1) showing layout of the experimental plot.

3.7 Germination of Seed

Seeds of all genotypes were soaked separately for overnight in a disposable glass. Soakedseeds were picked out from water and sunken down for 30 minutes in vita vex 100 separately as seed treatment for facilitating germination.

3.8 Preparation of Seedbed

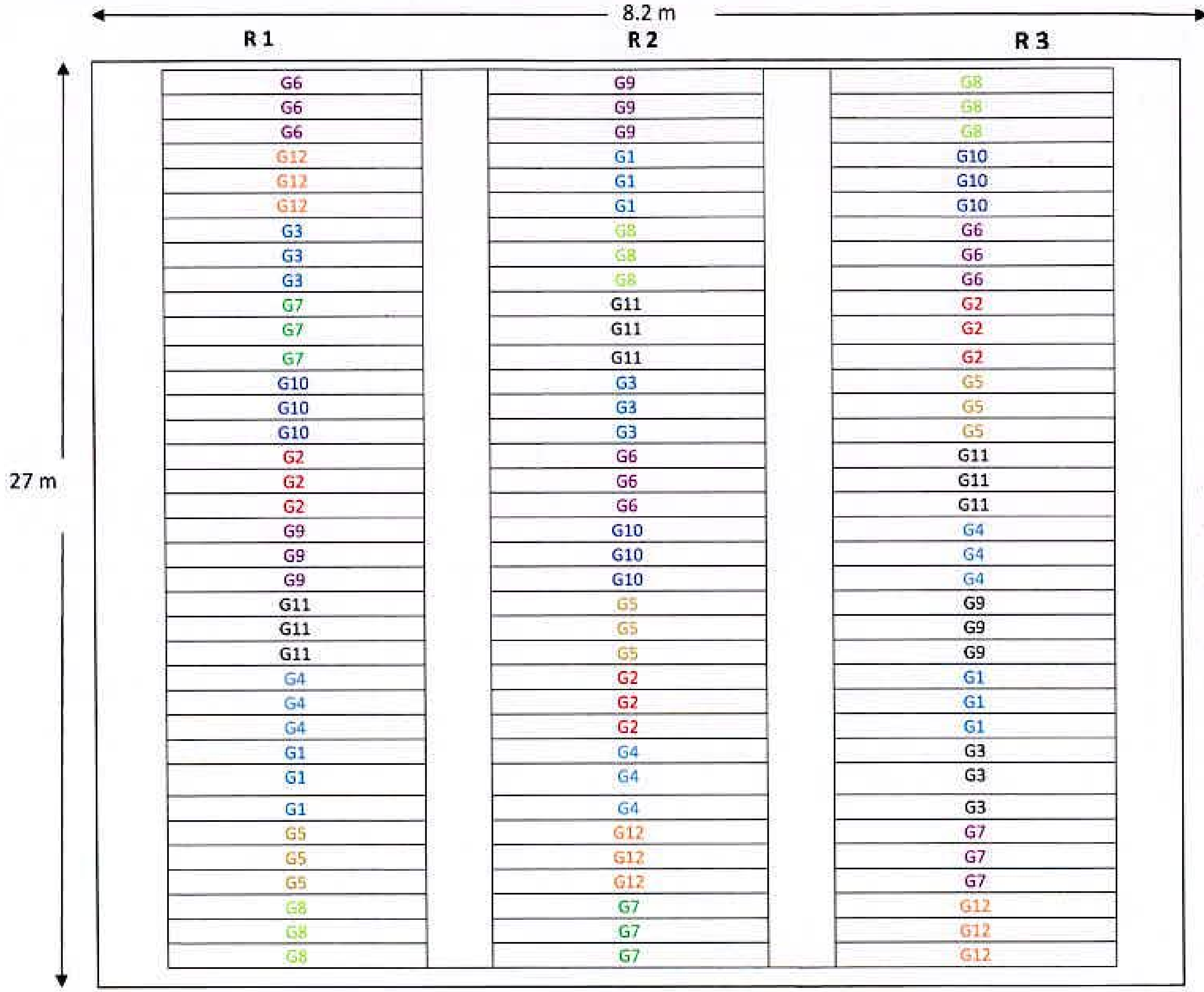
The seedbed was 3m × 1m.There was two seedbed and each bed contains 6 genotypes.

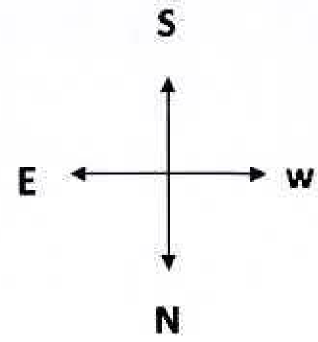
3.9 Preparation of main land

The land was prepared thoroughly by 3-4 times ploughing and cross ploughing followed by laddering to attain a good puddle. Weeds and stubbles were removed and land was finally prepared by addition of basal dose of fertilizers recommended by Anonymous (1988a).

3.10 Fertilizers Application

One third of total urea along with total amount TSP and 1/3 of MoP applied at the time of pit preparation. The rest of the urea and rest amount of MoP applied by





Total Area = (194.4× 3) +1= 584 m^2

Plot size = 27 m × 7.2 m

Plant to plant distance = 60 cm

Row to Row distance= 75cm

Figure 1. Showing the layout of the experimental plot

Table 2. Showing the fertilizer Doses

Sl. No.	Name of Fertilizers	Fertilizers Doses	Application Procedures
01	Cowdung	10 tons/ha	50% used during land preparation and 50% used at the time of pit preparation.
02	Urea	300Kg/ ha	1/3 urea used at the time of pit preparation and rest of the urea had been applied after 21, 40, and 50 days of seedling transplanting.
03	TSP	150 Kg/ha	During pit preparation
04	MoP	250 Kg/ha	1/3 MoP used at the time of pit preparation and rest of the MoP had been applied after 21, 40, and 50 days of seedling transplanting.

three installments. The first, second and third installments applied respectively after 21, 40, and 50 days of transplanting.

3.11 Transplanting

Thirty days old seedling has been transplanted in the experimental plot. Healthy and vigorous seedling has been transplanted and rest seedlings were keeping for gap filling. Shades were given to keep the seedling survive just after transplanting.

3.12 Intercultural operation both in seed bed and main field

Thinning

Seedling was emerging after 7-12 days of seed sowing. Thinning was done when it is necessary for providing a suitable condition to raise better seedlings.

Gap filling

Gap filling was done twice. The first gap filling was done on 14, April,2008 and second gap filling was done on 17, April,2008.

Weeding

First weeding was done after 21 days of transplanting to keep the crop free from weeds, weeding was also done when it was need.

Irrigation

In the early stage of transplanting,watering was done twice daily.In mature stage, flood irrigation was done to the field when it was necessary for the crop.

3.13 Plant protection measures

Different control measures were taken against brinjal fruit & shoot borer during primary branch to harvesting at different label. Bavistin 5ml /1.35 glass @ 30 minutes as seed treatment. Savin powder has been applied for two times around the seed bed against ant infestation. Bavistin 2g/L/Decimal against fungal infestation were also been applied. Somicron @20ml/10 Litre/5dacimal. Mastard, Aktara , were also been applied against Insects Infestation.

3.14 Data collection

Data were collected from 10 randomly selected hills of each genotype on individual plant basis.

3.14.1 Plant height

The length from ground level to the top of the plant was measured in cm and the data were recorded for each genotype.

3.14.2 Number of primary branches per plant

The primary branch was measured during heading stage of brinjal.

3.14.3 Number of secondary branches per plant

The secondary branch was measured during heading stage of brinjal.

3.14.4 Days to 100% flowering

Days to flowering was recorded from the date of soaking seed to date of 100 % flowering.

3.14.5 Number of fruit per plant

The fruit number was recorded during maturity stage of brinjal.

3.14.6 Fruit length

The length was recorded in cm from first node of the rachis to top of the fruit.

3.14.7 Single fruit weight

Single fruit weight was measured after harvesting.

3.14.8 Days to first harvest

Days to first harvest was recorded from the date of soaking seed to date of first harvest.

3.14.9 Days to last harvest

Days to last harvest was recorded from the date of soaking seed to date of last harvest.

3.14.10 Yield per plant

All the fruit of ten plants were harvested at different weight and the cumulative weight divided by ten.

3.15 STATISTICAL ANALYSIS

All the collected data of the present study were statistically analyzed. The statistical analyses for various characters under investigation were done and the analysis of variance for each of the characters was performed by F test and mean values were separated by DMRT (Steel and Torrie, 1980).

The analysis of variance was done according to Goulden's methods (1959). Genotypic and phenotypic coefficients of variations were computed using the formula suggested by Burton (1952). Heritability in broad sense and genetic advance were calculated according to methods given by Allard (1960).

Simple correlation coefficient for all the possible pairs of characters at phenotypic and genotypic levels were analyzed following Hayes *et al.* (1955) and Singh and Chowdhury (1985).

Correlation coefficients were further partitioned into components of direct and indirect effects by path coefficient analysis originally described by Dewey and Lu (1959).

Chapter IV
Results and Discussion

CHAPTER IV
RESULTS AND DISCUSSION

The knowledge of genotypic variation within genotypes in relation to morphology, phonology and yield would help to screen better materials. Therefore, to generate information in the degree of variability twelve genotypes of brinjal were raised in the season of 2007-2008 at the Horticulture field of Sher- E –Bangla Agriculture University, Dhaka. The data pertaining to yield and its contributing characters of 12 genotypes were computed and statistically analyzed and the results thus obtained are discussed below under the following heads:

1. Performance of genotypes
2. Genetic parameters
3. Correlation coefficient
4. Path coefficient analysis

4.1 PERFORMANCE OF THE GENOTYPES

4.1.1 Plant height

Plant height of different genotypes exhibited wide variation (Table 3). The plant height was maximum in Line-14 (95.66 cm) followed by Line-23× Line-$24F_2$ (89.33 cm), Line-01× Line-$25F_1$ (86.11 cm) and Line-15 (83.17 cm). Whereas minimum plant height was in the Line-27 (63.33 cm) which was statistically similar with genotype Line-8 (66.67 cm). Plant height in different genotypes varied may be due to inherent characteristics of genotypes.

Table 3. Performance of brinjal genotypes on plant height, number of primary branch per plant, number of secondary branch per plant, days to flowering, circumference of fruit, number of fruit per plant

Plant Materials	Plant height	Number of primary branch per plant	Number of secondary branch per plant	days to flowering	Circumference of fruit	Number of fruit per plant
BARI-1	77.33de	6.18b	10.83cde	52.97bcd	12.4fg	20.94c
BARI-2	73.83e	6.46b	20.59a	54.69ab	13.44efg	24.47b
Line-8	66.67f	4.6ef	10.39cde	49.58de	27.52a	13.63d
Line-14	95.66a	5.01de	8.86e	57.67a	20.33cd	13.12d
Line-15	83.17bcd	4.65ef	11.67bcd	52.27bcd	18.01d	12.17d
Line-23	80cde	4.5ef	11.59bcd	50.77cde	12.20g	25.83b
Line-27	63.33f	5.4cd	11.55bcd	58.16a	26.1a	10.23d
Line-01× Line-25F_1	86.11bc	4.33f	12.23bc	54.63ab	23.15b	13.02d
Line-23× Line-24F_1	77.83de	5.33d	9.67de	50.61cde	13.42efg	26.52b
Line-01× Line-25F_2	82.05cd	6bc	11.67bcd	50.56cde	21.32bc	24.23bc
Line-14× Line-27F_2	77.26de	6.33b	13b	53.54bc	15.293e	34.93a
Line-23× Line-24F_2	89.33b	8.5a	18.83a	48.18e	14.89ef	37.29a

Mandal and Dana (1992) study 20 genotypes of brinjal for the yield contributing characters and indicated that fruits/plant and plant height are important traits for the selection of superior genotypes.

4.1.2 Number of primary branch per plant

Number of primary branches is an important morphological character which is related to yield and number of fruit per plant (Table 3). It was observed that the maximum number of primary branches is an important morphological character which is related to yield and number of fruit per plant (Table 3). It was observed that the maximum number of primary branches were produced by line Line-23× Line-24F_2 (8.5) followed by BARI-2 (6.46), Line-14× Line-27F_2 (6.33) and BARI-1 (6.18). Genotype Line-01× Line-25F_1 had lowest number of primary branch per plant (4.33) which was statistically similar with genotype Line-8 (4.6), Line-15 (4.65) and Line-23 (4.50). Number of primary branch per plant in different genotypes varied may be due to inherent characteristics of genotypes.

Randhawa et al. (1993) studied 22 genotypes of brinjal on 24 quantitative characters for deriving information on yield co-relation and observed that fruits /plant and number of primary branches/plant had the height direct on yield.

4.1.3 Number of secondary branch per plant

Significant variation on number of secondary branch per plant was observed among the genotypes (Table 3). The genotype BARI-2 had height number of secondary branch per plant (20.59) which was statistically similar with genotype Line-23× Line-24F_2 (18.83) followed by Line-14× Line-27F_2 (13), Line-01× Line-25F_1 (12.23) and Line-27 (11.55). Genotype Line-14 had lowest number of secondary branch per plant (8.86) which was statistically similar with genotype BARI-1 (10.83), Line-8 (10.39) and Line-23× Line-24F_1 (9.67). Number of secondary branch per plant in different genotypes varied may be due to inherent characteristics of genotypes.

Mandal and Dana (1992) study 20 genotypes of brinjal for the yield contributing characters and indicated that secondary branches are important traits for the selection of superior genotypes.

4.1.4 Days to flowering

A wide range of variability was observed in case of flowering time among the genotypes (Table 6). The genotype Line-23× Line-24F_2 flowered early (48.18 DAT) followed by Line-8 (49.58 DAT), Line-01× Line-25F_2 (50.56 DAT), Line-23× Line-24F_1 (50.61 DAT) and Line-23 (50.77 DAT). Genotype Line-27 required maximum time for flowering (58.16 DAT) which was statistically similar with genotype Line-14 (57.67 DAT), BARI-2 (54.69 DAT) and Line-01× Line-25F_1 (54.63 DAT). Days required for flower initiation in different genotypes varied may be due to inherent characteristics of genotypes.

4.1.5 Circumference of fruit

A distinct variation was available in the circumference of fruit among the genotypes (Table 3). The genotype Line-8 had maximum circumference of fruit (27.52) which was statistically similar with genotype Line-27 (26.10) followed by Line-01× Line-25F_1 (23.15), Line-01× Line-25F_2 (21.32) and Line-14 (20.33). Genotype Line-23 required minimum circumference of fruit (12.20) which was statistically similar with genotype BARI-2 (13.44) and Line-23× Line-24F_1 (13.42). Circumference of fruit in different genotypes varied may be due to inherent characteristics of genotypes.

Sarma *et al.* (2000) evaluated thirty four genotypes of brinjal (*Solanum melongena*) of diverse origin were in plots at Jorhat and reported that fruit circumference and average fruit weight were the main character s affecting grouping of genotypes.

4.1.6 Number of fruit per plant

The total number of fruit per plant significantly varied and that was observed among the genotypes (Table 3). The genotype Line-23× Line-24F_2 had maximum number of fruit per plant (37.29) which was statistically similar with genotype Line-14× Line-27F_2 (34.93) followed by Line-23× Line-24F_1 (26.52), Line-23 (25.83) and BARI-2 (24.47). Genotype Line-27 required minimum number of fruit per plant (10.23) which was statistically similar with genotype Line-8 (13.63), Line-14 (13.12), Line-15 (12.17) and Line-01× Line-25F_1 (13.02). Number of fruit per plant in different genotypes varied may be due to inherent characteristics of genotypes.

The differences in respect of number of fruits produced per plant might be due genetical characteristics of the genotypes. Sambandam (1960) recorded the fruit per plant of different lines of brinjal and reported that the number varied from variety to variety due to the difference in their yield potential.

In brinjal, it has been reported that there is a strong association between the number of fruits per plant and yield per plant .Similarly path analysis in brinjal showed that the number of fruits per plant exhibited maximum direct effects on yield. It is therefore to be considered useful to select the best variety of brinjal on the basis of number of fruits per plant for effective improvement of this crop.

4.1.7 Fruit length

Incase of fruit length average marked difference was observed among the genotypes (Table 4). The genotype BARI-2 had the maximum fruit length (13.70 cm) which was statistically similar with genotype Line-8 (12.98 cm) followed by BARI-1 (11.70 cm), Line-27 (11.62) and Line-15 (11.35 cm). Genotype Line-23× Line-24F_1 required minimum fruit length (4.1 cm) which was statistically similar with genotype Line-14× Line-27F_2 (4.61 cm).

4.1.8 Single fruit weight

Marked variation on single fruit weight was observed among the genotypes (Table 4). The genotype Line-01× Line-25F_2 had maximum single fruit weight (157.25 g) followed by Line-8 (137.97 g), Line-01× Line-25F_1 (121.57 g) and Line-14 (109.29 g). Genotype Line-23 required minimum singal fruit weight (25.49 g) which was statistically similar with genotype Line-23× Line-24F_1 (27.20 g) and Line-14× Line-27F_2 (30.92 g). Single fruit weight in different genotypes varied may be due to inherent as well as environmental factors.

Table 4. Performance of brinjal genotypes on Fruit length, Singal fruit weight, Days to first harvest, Days to last harvest and Yield per plant

Plant materials	Fruit length	Single fruit weight	Days to first harvest	Days to last harvest	Yield per plant
BARI-1	11.7b	59.31g	64.37a-d	114.22abc	1.28cd
BARI-2	13.7a	60.38g	65.41ab	110.31abc	1.35c
Line-8	12.98a	137.97b	59.59e	116.52a	1.34c
Line-14	8.90d	109.29d	64.91abc	111.38abc	1.16cd
Line-15	11.35bc	102.12de	62.19b-e	110.85abc	1.3c
Line-23	5.16e	25.49h	62.40b-e	109.25abc	0.93ef
Line-27	11.62b	97.24e	67.53a	115.52ab	1.21cd
Line-01× Line-25F_1	10.5c	121.57c	64.45a-d	107.71c	3.06b
Line-23× Line-24F_1	4.1f	27.20h	61.27de	111.37abc	0.78f
Line-01× Line-25F_2	10.83bc	157.25a	61.76cde	113.2abc	5.25a
Line-14× Line-27F_2	4.61ef	30.92h	62.84bcd	110.33abc	1.10de
Line-23× Line-24F_2	5.2e	85.81f	64.89abc	108.43bc	3.18b

4.1.9 Days to first harvest

A wide range of variability was observed in respect of harvesting time among the genotypes (Table 4). The genotype Line-8 early (59.59 DAT). Genotype Line-27 required maximum time for days to first harvest (67.53 DAT) which was statistically similar with genotype BARI-1 (64.37 DAT), BARI-2 (65.41 DAT), Line-14 (64.91 DAT), Line-01× Line-25F_1 (64.45 DAT), and Line-23× Line-24F_2 (64.89 DAT). Days required for first harvest in different genotypes varied variety to vatiety.

4.1.10 Days to last harvest

Variation on days to last harvest was observed among the genotypes (Table 4). The genotype Line-01× Line-25F_1 early (107.71 DAT). Genotype Line-8 required maximum time for days to last harvest (116.52 DAT) which was statistically similar with genotype BARI-1 (114.22 DAT), BARI-2 (110.31 DAT), Line-14 (111.38 DAT), Line-15 (110.85 DAT), Line-23 (109.25 DAT), Line-27 (115.52 DAT), Line-23× Line-24F_1 (111.37 DAT), Line-01× Line-25F_2 (113.20 DAT), Line-14× Line-27F_2 (110.33 DAT) and Line-23× Line-24F_2 (108.43 DAT). Days required for the last harvest in different genotypes varied which depended on variety as well as harvestor.

4.1.11 Yield per plant

Twelve genotypes of brinjal lines under study showed wide variation in their fruit yield per plant (Table 4). The genotype Line-23× Line-24F_1 had low yield (0.78 g) followed by Line-23 (0.93 g) and Line-14× Line-27F_2 (1.10 g). Genotype Line-01× Line-25F_2 showed maximum yield per plant (5.25 g).

Inspite of its maximum Yield, we have seen (Plate 2) different variable fruits among which plant-10 of R2 and Plant 21 of R1 produced maximum size fruits without spine but plant 9 of R2 of the same genotype provide spine on its calyx. We have also seen (Plate 3) in the genotype line14×Line27F_2 different variable plant where Plant 29 of R2 and Plant 34 of R2 provides large size fruits than other plants of the same genotypes. In the genotype Line 23×24F_2 (plate 4) we have observed Plant 15 of R2 and Plant27 of R3 provides largest size fruit compare with other plant of the same genotypes. Yield per plant in different genotypes varied may be due to inherent characteristics of genotypes as well as environmental factors.

Ahmad (1968) and Siddique (1968) obtained carried out an experiments with deferent varieties/lines of Bangladesh. Ahmad (1968) reported that the variety Nayankazal tended to out yield all other varieties/lines including Islampur and D.R.C. while Siddique (1968) obtained superiority of Singnath over Islampuri. Siddique and Husain (1971) obtained the highest yield (280 t/ha) from the Singnath followed by khotkhotia and Islampuri in Mymensingh areas. Sarkar and Hague (1980) recorded the highest yield from Japani (29.0 t/h followed by Khotkhotia (22.3 t/ha) in ishuridhi area and Ahmed *et al.* (1983) reported Singnath as the highest yielder (38.5 t/ha) followed Japani (30 t/h), D.R. Chowdhury (25.5 t/ha) and Khotkhotia (22.9 t/ha) at Jamalpur areas. The yield difference within the cultivars observed in different investigations was provably due to agro-climatic variations and effect of different germplasm.

4.2 GENETIC PARAMETERS

The analysis of variance indicated the existence of highly significant variability for all the characters studied. The mean sum of square, mean, range, variance components, coefficients of genotypic and phenotypic variations, heritability estimates, genetic advance and genetic advance in percent of mean (GAPM) are presented in (Table 5). The results are discussed character wise as follows:

Genetic parameters of different genotypes of brinjal:

4.2.1 Plant height (cm)

Plant height (cm) was widely varied due to genotypes in brinjal (Table 3) indicating existence of considerable difference for this trait. The maximum plant height was found 95.66 cm and the minimum was recorded 63.33 cm with mean value 79.38 cm. The σ^2_g (76.613), σ^2_p (90.134), GCV (11.027) and PCV (11.960) were close to each other

Table 5. Genetic parameters , yield and its contributing traits of different Brinjal genotypes.

Parameter	Plant height	Number of primary branch per plant	Number of secondary branch per plant	days to flowering	Circumference of fruit	Number of fruit per plant	fruit length	Single fruit weight	Days to first harvest	Days to last harvest	Yield per plant
Mean sum of square	243.36**	4.19**	37.49**	28.85**	87.99**	247.71**	36.85**	5854.99**	14.18**	22.8**	5.28**
Mean	79.380	5.608	12.573	52.804	18.173	21.366	9.222	84.545	63.466	111.591	1.829
Range	63.33-95.66	4.33-8.5	8.86-20.59	48.18-58.16	12.20-27.52	10.23-37.29	4.10-13.70	25.49-157.25	59.59-67.53	107.71-116.52	0.78-5.25
$\sigma^2 g$	76.613	1.354	12.110	8.288	28.691	81.278	12.181	1944.125	3.776	2.876	1.758
$\sigma^2 e$	13.521	0.129	1.166	3.989	1.921	3.879	0.312	22.618	2.858	14.180	0.011
$\sigma^2 p$	90.134	1.483	13.276	12.277	30.612	85.157	12.493	1966.743	6.634	17.056	1.769
$h^2 b$	84.999	91.299	91.217	67.507	93.725	95.445	97.503	98.850	56.917	16.860	99.378
GA (5%)	166.237	22.901	68.465	48.726	106.824	181.439	70.992	903.062	30.198	14.344	27.228
GAPM	209.419	408.366	544.543	92.277	587.818	849.194	769.814	1068.144	47.582	12.854	1488.704
GCV	11.027	20.747	27.678	5.452	29.475	42.195	37.845	52.152	3.062	1.520	72.493
PCV	11.960	21.713	28.979	6.635	30.445	43.190	38.327	52.455	4.058	3.701	72.719
ECV	4.632	6.405	8.588	3.782	7.627	9.218	6.057	5.625	2.664	3.374	5.734

** = Significant at 1% level, σ^2_g = Genotypic variance, σ^2_e = Environmental variance, σ^2_p = Phenotypic variance, h^2b = Heritability in broad sense, GA = Genetic advance, GAPM = Genetic advance in Percent Mean, GCV = Genotypic Coefficients of Variations, PCV = Phenotypic Coefficients of Variations and ECV = Environmental Coefficients of Variations indicating less environmental influence in case of plant height. Heritability estimates for this trait was high, GA and GAPM was found high, indicated that selection for this character would be effective.

4.2.2 Number of primary branch per plant

Number of primary branch per plant was highly significant due to genotypes in brinjal (Table 5). indicating existence of considerable difference for this trait. The maximum number of primary branch per plant was found 8.5 and the minimum was recorded 4.33 with mean value 5.608. The σ^2_g(1.354), σ^2_p(1.483), GCV (20.747) and PCV (21.713) were close to each other indicating less environmental influence in case of number of primary branch per plant. Heritability (91.299) estimates for this trait was high, GA and GAPM was found moderate.

4.2.3 Number of secondary branch per plant

Number of secondary branch per plant was also varied due to genotypes in brinjal (Table 5). indicating existence of considerable difference for this trait. The maximum number of secondary branch per plant was found 20.59 and the minimum was recorded 8.86 with mean value 12.573. The σ^2_g(12.110), σ^2_p(13.276), GCV (27.678) and PCV (28.979) were close to each other indicating less environmental influence in case of number of secondary branch per plant. Heritability (91.217) estimates for this trait was high together with considerable low GA and GAPM.

4.2.4 Days to flowering

Incase of days to flowering of brinjal genotypes (Table 5). indicating existence of considerable variability for this trait. The maximum days to flowering were found 58.16 and the minimum was recorded 48.18 with mean value 52.804. The σ^2_g (8.288), σ^2_p (12.277), the GCV (5.452) and PCV (6.635) were close to each other indicating less environmental influence in case of days to flowering. Heritability (67.507) estimates for this trait was moderate GA and GAPM was also found high.

4.2.5 Circumference of fruit

Circumference of fruit was highly varied due to genotypes in brinjal (Table 5) indicating existence of considerable difference for this trait. The maximum circumference of fruit was found 27.52 and the minimum was recorded 12.20 with mean value 18.173. The σ^2_g (28.691), σ^2_p (30.612), the GCV (29.475) and PCV (30.445) were close to each other indicating less environmental influence in case of circumference of fruit. Heritability (93.725) estimates for this trait was very high together with considerable moderate GA and GAPM.

4.2.6 Number of fruit per plant

Number of fruit per plant was highly significant due to genotypes in brinjal (Table 5) indicating existence of considerable difference for this trait. The maximum number of fruit per plant was found 37.29 and the minimum was recorded 10.23 with mean value 21.366. The σ^2_g (81.278), σ^2_p (85.157), the GCV (42.195) and PCV (43.190) were close to each other indicating less environmental influence in case of number of fruit per plant. Heritability (95.445) estimates for this trait was high, GA and GAPM was found moderately high, indicated that selection for this character would be effective.

4.2.7 Fruit length

Fruit length was considerably varied due to genotypes in brinjal (Table 5) indicating existence of considerable variation for this trait. The maximum fruit length was found 13.70 and the minimum was recorded 4.10 with mean value 9.222. The σ^2_g (12.181), σ^2_p (12.493), the GCV (37.845) and PCV (38.327) were close to each other indicating less environmental influence in case of fruit length. Heritability (97.503) estimates for this trait was high, GA and GAPM was found moderately high, indicated that selection for this character would be effective.

4.2.8 Single fruit weight

Different weight of single fruit of brinjal genotypes (Table 5) indicated existence of considerable variability for this trait. The maximum single fruit weight was found 175.25 g and the minimum was recorded 25.49 g with mean value 84.545 g. The σ^2_g (1944.125), σ^2_p (1966.743), the GCV (52.152) and PCV (52.445) were close to each other indicating less environmental influence in case of single fruit weight. Heritability (98.850) estimates for this trait was very high, GA and GAPM was found moderate.

4.2.9 Days to first harvest

Days to first harvest of genotypes in brinjal (Table 5) considerably difference due to inharitant as well as consumer aspectaion. The maximum days to first harvest were found 67.53 and the minimum was recorded 59.59 with mean value 63.446. The σ^2_g (3.776), σ^2_p (6.634), the GCV (3.062) and PCV (4.058) were close to each other indicating less environmental influence in case of days to first harvest. Heritability (56.917) estimates for this trait was moderate together with considerable high, GA and GAPM .

4.2.10 Days to last harvest

Days to last harvest was highly significant due to genotypes in brinjal (Table 5) indicating existence of considerable difference for this trait. The maximum days to last harvest were found 116.52 and the minimum was recorded 107.71 with mean value 111.591. The σ^2_g (2.876), σ^2_p(17.056), the GCV (1.520) and PCV (3.701) were close to each other indicating less environmental influence in case of days to last harvest. The heritability value (16.860) as well as genetic advance and genetic advance in percentage of mean were observed moderate.

4.1.11 Yield per plant

Yield per plant was highly significant due to genotypes in brinjal (Table 5) indicated existence of considerable difference for this trait. The maximum yield per plant was found 5.25 g and the minimum was recorded 0.78 g with mean value 1.829 g. The σ^2_g (1.758), σ^2_p(1.769), the GCV (72.493) and PCV (72.719) were close to each other indicating less environmental influence in case of yield per plant. The heritability value (99.378) as well as genetic advance and genetic advance in percentage of mean were observed high. The very high heritability with moderate genetic advance in percentage of mean provided opportunity for selecting high valued genotypes for breeding programme.

4.3 CORRELATION COEFFICIENT

Yield is a complex product being influenced by several interdependent quantitative characters. Selection for yield may not be effective unless the other yield components influencing it directly or indirectly are taken into consideration. When selection pressure is exercised for improvement of any character highly associated with yield, it simultaneously affects a number of other correlated traits. Hence knowledge regarding association of character with yield and among themselves provides guideline to the plant breeder for making improvement through selection vis-à-vis provide a clear understanding about the contribution in respect of establishing the association by genetic and non genetic factors. Genotypic and phenotypic correlation coefficients between pairs of characters of present study in brinjal are presented in (Table 6). It is evident that corresponding phenotypic correlation coefficients. Higher genotypic correlations than phenotypic one might be due to modifying or masking effect of environment in the expression of the character under study (Nandpuri *et al.* 1973). The results are discussed under the following heads:

Variability of Brinjal genotypes.

i) Estimation of genotypic and phenotypic variances:

Genotypic and phenotypic variances were estimated according to the formula of Johnson *et al.* (1955).

a. Genotypic variance, $\delta^2 g = \frac{MSG-MSE}{r}$

Where, MSG = Mean sum of square for genotypes

MSE = Mean sum of square for error, and

r = Number of replication

b. Phenotypic variance, $\delta^2 p = \delta^2 g + \delta^2 e$

Where, $\delta^2 g$ = Genotypic variance,

$\delta^2 e$ = Environmental variance = Mean square of error

ii) Estimation of genotypic and phenotypic co-efficient of variation:

Genotypic and phenotypic co-efficient of variation were calculated by the following formula (Burton, 1952).

$$GCV = \frac{\delta_g \times 100}{\overline{x}}$$

$$PCV = \frac{\delta_p \times 100}{\overline{x}}$$

Where, GCV = Genotypic co-efficient of variation

PCV = Phenotypic co-efficient of variation

δ_g = Genotypic standard deviation

δ_p = Phenotypic standard deviation

$\overline{x}$ = Population mean

iii) Estimation of heritability:

Broad sense heritability was estimated by the formula suggested by Singh and Chaudhary (1985).

$$h^2_b(\%) = \frac{\delta^2_g}{\delta^2_p} \times 100$$

Where, h^2_b = Heritability in broad sense.

δ^2_g = Genotypic variance

δ^2_p = Phenotypic variance

iv Estimation of genetic advance: The following formula was used to estimate the expected genetic advance for different characters under selection as suggested by Allard (1960).

$$GA = \frac{\delta^2_g}{\delta^2_p} . K. \delta_p$$

Where, GA = Genetic advance

δ^2_g = Genotypic variance

δ^2_p = Phenotypic variance

δ_p = Phenotypic standard deviation

K = Selection differential which is equal to 2.06 at 5% selection intensity

Results of genotypic and phenotypic correlation coefficient of different yield and its contributing traits of brinjal genotypes are shown in (Table 6) and discussed character wise as follows:

4.3.1 Plant height (cm)

Plant height (cm) found to display highly significant positive relationships with number of primary branch per plant, days to flowering, number of fruit per plant, single fruit weight and days to first harvest at phenotypic level. It also showed significant positive correlation with circumference of fruit and yield per plant at phenotypic level. The character reflected highly significant negative association with days to last harvest at genotypic level and significant negative association with fruit length genotypically. Plant height (cm) also showed insignificant positive correlation with number of primary branch per plant, number of secondary branch per plant, number of fruit per plant, single fruit weight and days to first harvest genotypically and number of secondary branch per plant, fruit length and days to last harvest phenotypically. It also

Table 6. Genotypic (r_g) and phenotypic (r_p) Correlation coefficient among outcrossing, yield and its contribution traits of intervarietal cross of brinjal

Parameters		Number of primary branch per plant	Number of secondary branch per plant	days to flowering	Circumference of fruit	Number of fruit per plant	fruit length	Single fruit weight	Days to first harvest	Days to last harvest	Yield per plant
Plant height	r_g	0.140	0.080	-0.058	-0.288	0.186	-0.361*	0.090	0.048	-0.666**	0.309
	r_p	0.665**	0.250	0.858**	0.364*	0.562**	0.249	0.781**	0.882**	0.018	0.329
Number of primary branch per plant	r_g		0.690**	-0.291	-0.402*	0.741**	-0.240	-0.167	0.322	-0.177	0.304
	r_p		0.013	0.358*	0.195	0.006	0.453**	0.605**	0.307	0.582**	0.336
Number of secondary branch per plant	r_g			-0.166	-0.337	0.507**	0.074	-0.149	0.371*	-0.426*	0.201
	r_p			0.606**	0.285	0.092	0.820**	0.644**	0.235	0.167	0.531**
days to flowering	r_g				0.274	-0.548**	0.337	0.041	0.692**	0.115	-0.305
	r_p				0.388*	0.065	0.284	0.898**	0.013	0.722**	0.336
Circumference of fruit	r_g					-0.673**	0.499**	0.798**	-0.012	0.502**	0.246
	r_p					0.017	0.099	0.002	0.970**	0.096	0.440*
Number of fruit per plant	r_g						-0.677**	-0.533**	-0.114	-0.437*	0.163
	r_p						0.016	0.075	0.723**	0.155	0.612**
fruit length	r_g							0.605**	0.170	0.508**	0.123
	r_p							0.037	0.598**	0.092	0.704**
Single fruit weight	r_g								-0.071	0.334	0.642**
	r_p								0.827**	0.289	0.025
Days to first harvest	r_g									0.150	0.041
	r_p									0.642**	0.898**
Days to last harvest											0.136
											0.674**

* indicates significant at 5% level of significance, ** indicates significant at 1% level of significance, r_g indicates genotypic correlation coefficient and r_p indicates phenotypic correlation coefficient.

showed insignificant negative correlation with days to flowering, circumference of fruit and yield per plant at genotypic level.

4.3.2 Number of primary branch per plant

The character reflected highly significant positive relationship with number of secondary branch per plant genotypically. Highly significant positive association between Numbers of primary branch per plant and number of secondary branch per plant indicates that the traits are governed by same gene by pleiotropic effect and simultaneous improvement would be effective. The character reflected highly significant positive association with fruit length, single fruit weight and days to last harvest at phenotypic level. Number of primary branch per plant also showed significant positive correlation with days to flowering and yield per plant phenotypically and insignificant negative correlation with circumference of fruit at genotypic level. It also showed insignificant positive genotypic correlation with days to first harvest and yield per plant and number of secondary branch per plant, circumference of fruit, number of fruit per plant, and days to first harvest at phenotypic level and insignificant negative genotypic correlation with days to flowering, fruit length, single fruit weight and days to last harvest.

4.3.3 Number of secondary branch per plant

The character showed highly significant positive relationship with number of fruit per plant at genotypic level and significant positive genotypic correlation with days to first harvest and highly significant positive relationship with days to flowering, fruit length, single fruit weight and yield per plant at phenotypic level. The character showed significant negative relationships with days to last harvest at genotypic level. Number of secondary branch per plant also showed insignificant positive correlation with fruit length and yield per plant at genotypic level and insignificant positive association with circumference of fruit, number of fruit per plant, days to first harvest and days to last harvest at phenotypic level. It also showed insignificant negative correlation with days to flowering, circumference of fruit and single fruit weight at genotypic level.

4.3.4 Days to flowering

Days to flowering showed significant positive correlation with days to first harvest at genotypic level and single fruit weight and days to last harvest at phenotypic level. Days to flowering also showed highly significant negative association with number of fruit per plant at genotypic level. Insignificant negative association with yield per plant at genotypic level and insignificant positive correlation with circumference of fruit, fruit length, single fruit weight and days to last harvest at genotypic level. This character also showed insignificant positive correlation with number of fruit per plant, fruit length, days to first harvest and yield per plant at phenotypic level. This result implies that the interrelationship between these traits was governed by environment.

4.3.5 Circumference of fruit

The character, showed highly significant positive correlation with fruit length, single fruit weight and days to last harvest and highly significant negative correlation with number of fruit per plant at genotypic level. It also showed highly significant positive correlation with days to first harvest and significant positive correlation with yield per plant at phenotypic level. Insignificant negative correlation with days to first harvest and positive correlation with yield per plant at genotypic level. It also showed insignificant positive correlation with number of fruit per plant, fruit length, single fruit weight and days to last harvest.

4.3.6 Number of fruit per plant

Number of fruit per plant showed highly significant positive correlation with fruit length, single fruit weight at genotypic level and days to first harvest and yield per plant at phenotypic level, significant positive correlation with yield per plant at genotypic level. It also showed significant negative correlation with days to last harvest at genotypic level. This character showed insignificant positive correlation with days to first harvest at genotypic level and fruit length, single fruit weight and days to last harvest at phenotypic level. Insignificant association indicated that the association between these traits is largely influenced by environmental factors.

4.3.7 Fruit length

Fruit length showed highly significant positive association with single fruit weight and days to last harvest at genotypic level and days to first harvest and yield per plant at phenotypic level. This result revealed that with more fruit length would have more yield per plant. It also showed insignificant positive correlation with days to first harvest and yield per plant at genotypic level and insignificant positive association with single fruit weight and days to last harvest phenotypic level. Insignificant association indicated that the association between these traits is largely influenced by environmental factors.

4.3.8 Single fruit weight

Single fruit weight showed highly significant positive correlation with yield per plant at genotypic and days to first harvest at phenotypic level. It also showed insignificant positive correlation with days to last harvest at genotypic level and days to last harvest and yield per plant at phenotypic level.

4.3.9 Days to first harvest

The trait, days to first harvest showed highly significant positive correlation with days to last harvest, yield per plant at phenotypic level and insignificant positive association with days to last harvest, yield per plant indicated that the association between these two traits is largely influenced by environmental factors.

4.3.10 Days to last harvest

The trait, days to last harvest showed highly significant positive correlation with yield per plant at phenotypic level and insignificant positive association with yield per plant at genotypic level indicated that the association between these two traits is largely influenced by environmental factors.

4.4 PATH COEFFICIENT ANALYSIS

Partitioning of genotypic correlation of yield and its contributing trais in brinjal genotypes are shown in (Table 7) and discussed character wise as follows:

4.4.1 Plant height (cm)

Plant height showed the positive direct effect on grain yield per plant (0.176). Plant height showed maximum positive indirect effect through number of primary branch per plant (0.041) followed by number of secondary branch per plant (0.037), fruit length (0.019) and circumference of fruit (0.014). The negative indirect effect of this character on yield via number of fruit per plant (-0.163) was the highest followed by days to first harvest (-0.059), days to last harvest (-0.039), single fruit weight (-0.026) and days to flowering (-0.017) which finally made insignificant negative correlation between plant height and yield per plant.

4.4.2 Number of primary branch per plant

Number of primary branch per plant showed negative direct effect on yield per plant (-0.084). This character, however, showed positive indirect effect through days to flowering (0.109), number of fruit per plant (0.185), fruit length (0.041), single fruit weight (0.130) and days to first harvest (0.018). This character also showed negative indirect effect via plant height (-0.086), number of secondary branch per plant (-0.021), circumference of fruit (-0.078) and days to last harvest (-0.214) contributed to result total insignificant positive genotypic correlation with yield per plant. This discrepancy with present finding might be due to environmental variation.

4.4.3 Number of secondary branch per plant

Number of secondary branch per plant showed positively direct effect on yield per plant (0.070). This character, however, showed positive indirect effect through plant height (0.094), number of primary branch per plant (0.025), days to flowering (0.031), circumference of fruit (0.153) and days to last harvest (0.199). The negative indirect effect via number of fruit per plant (-0.188), fruit length (-0.151), single fruit weight

4.4.4 Days to flowering

A negative direct effect was observed for days to flowering on yield per plant (-0.211). The indirect effect via plant height (0.014), number of primary branch per plant (0.043), circumference of fruit (0.201), days to first harvest (0.172) and days to last harvest (0.250) was found to be positive. The negative high indirect effect via number of secondary branch per plant (-0.010), number of fruit per plant (-0.090), fruit length (-0.159) and single fruit weight (-0.088) was contributed to result totally insignificant negative genotypic correlation with yield per plant.

4.4.5 Circumference of fruit

Circumference of fruit showed the negative direct effect on yield per plant (-0.468). Circumference of fruit showed positive indirect effect through plant height (0.058), days to flowering (0.090), number of fruit per plant (0.454), fruit length (0.241) and single fruit weight (0.124). But the negative indirect effect through number of primary branch per plant (-0.014), number of secondary branch per plant (-0.020), days to first harvest (-0.009), days to last harvest (-0.535) finally made insignificant positive correlation between circumference of fruit and yield per plant.

4.4.6 Number of fruit per plant

A high positive direct effect was registered by number of fruit per plant on yield per plant (0.584). The indirect effect via days to flowering (0.032), fruit length (0.096), single fruit weight (0.141) and days to first harvest (0.008) was observed to be positive. The negative indirect effect via. plant height (-0.049), number of primary branch per plant (-0.027), number of secondary branch per plant (-0.023), circumference of fruit (-

0.364) and days to last harvest (-0.461). The balanced total association positive and significant with yield per plant.

4.4.7 Fruit length

A high positive direct effect was registered by fruit length on yield per plant (0.376). The indirect effect via plant height (0.009), days to flowering (0.089), number of fruit per plant (0.150), single fruit weight (0.069) and days to first harvest (0.160) was found to be positive. The negative indirect effect via number of primary branch per plant (-0.009), number of secondary branch per plant (-0.028), circumference of fruit (-0.300) and days to last harvest (-0.574) was contributed to result totally insignificant positive genotypic correlation with yield per plant (-0.045), days to first harvest (-0.216) contributed to result insignificant positive genotypic correlation with yield per plant

4.4.8 Single fruit weight

Single fruit weight had the high positive direct effect on yield per plant (0.212). This character also showed positive indirect effect through number of primary branch per plant (0.052), number of secondary branch per plant (0.015), days to flowering (0.088), number of fruit per plant (0.389), fruit length (0.122) and days to first harvest (0.036). But negative indirect effect through plant height (-0.022), circumference of fruit (-0.273) and days to last harvest (-0.538) contributed to result highly significant positive genotypic correlation with yield per plant. Yield per plant would be significantly increased by direct selection of genotypes based on these traits.

Table 7. Partitioning of genotypic correlation with yield into direct and indirect effect of out crossing and yield Contributing traits in F_2 materials of brinjal

	Plant height	Number of primary branch per plant	Number of secondary branch per plant	days to flowering	Circumference of fruit	Number of fruit per plant	fruit length	Single fruit weight	Days to first harvest	Days to last harvest	Yield per plant
Plant height	**0.176**	0.041	0.037	-0.017	0.000	-0.163	0.019	-0.026	-0.059	-0.039	-0.309
Number of primary branch per plant	-0.086	**-0.084**	-0.021	0.109	-0.078	0.185	0.041	0.130	0.018	-0.214	0.304
Number of secondary branch per plant	0.094	0.025	**0.070**	0.031	0.135	-0.188	-0.151	-0.045	-0.216	0.199	0.201
days to flowering	0.014	0.043	-0.010	**-0.211**	0.201	-0.090	-0.159	-0.088	0.172	0.250	-0.305
Circumference of fruit	0.000	-0.014	-0.020	0.090	**-0.468**	0.454	0.241	0.124	-0.009	-0.535	0.246
Number of fruit per plant	-0.049	-0.027	-0.023	0.032	-0.364	**0.584**	0.096	0.141	0.008	-0.461	0.363*
fruit length	0.009	-0.009	-0.028	0.089	-0.300	0.150	**0.376**	0.069	0.160	-0.574	0.123
Single fruit weight	-0.022	-0.052	-0.015	0.088	-0.273	0.389	0.122	**0.412**	0.036	-0.538	0.642**
Days to first harvest	-0.030	-0.005	-0.044	-0.107	0.012	0.015	0.176	0.022	**0.341**	-0.231	0.041
Days to last harvest	0.009	-0.024	-0.019	0.070	-0.332	0.357	0.286	0.151	0.104	**-0.755**	0.136

* indicates significance at 5% level of significance, ** indicates significance at 1% level of probability. Residual effect, R= 0.422

4.4.9 Days to first harvest

Days to first harvest showed positive direct effect on yield per plant (0.341). This character also showed negative indirect effect through plant height (-0.030), number of primary branch per plant (-0.005), number of secondary branch per plant (-0.044), days to flowering (-0.107) and days to last harvest (-0.231). This character, however, showed positive indirect effect through circumference of fruit (0.012), number of fruit per plant (0.015), fruit length (0.176), single fruit weight (0.022). So, days to first harvest contributed to result insignificant positive genotypic correlation with yield per plant.

4.4.10 Days to last harvest

Days to last harvest showed negative direct effect on yield per plant (-0.755). This character also showed negative indirect effect through number of primary branch per plant (-0.024), number of secondary branch per plant (-0.019) and circumference of fruit (-0.332). This character, however, showed positive indirect effect through plant height (0.009), days to flowering (0.070), number of fruit per plant (0.357), fruit length (0.286), single fruit weight (0.151), days to first harvest (0.104).

Plate 2: Variation of Fruit size and shape in F2 (Line 1×line 25) Plant of Brinjal (G10)

Plate 3: Variation of Fruit size and shape in F2 (Line14×Line27) Plants of Brinjal.,(G11).

Plate 4: Variation of Fruit size and shape in F2 (Line 23×Line 24) Plants of Brinjal.(G12).

Plate 5: Variation of Fruit size and shape in F_2 segregating materials

Plate 6: Showing variable plant height of the same genotype F_2 (Line-01×Line-25)

Chapter V

Summary and Conclusion

CHAPTER V
SUMMARY AND CONCLUSION

In order to evaluate the variability and to exploit genetics advance, an experiment was conducted in the Horticulture farm of Sher-e Bangla Agricultural University with 12 brinjal genotypes in RCBD with three replication during March to August 2008. Data on different characters were study on the basis of performance of genotypes, correlation coefficient, path coefficient of brinjal genotypes. The salient findings of the present study have been summarized on the basis of the characters studied.

Mean sum of square for plant height, number of primary branch per plant, number of secondary branch per plant, days to flowering, circumference of fruit, number of fruit per plant, fruit length, single fruit weight, days to first harvest, days to last harvest, yield per plant were highly significant due to genotypes in brinjal genotypes indicating wide range of variability among the genotypes for this traits. The σ^2_g and σ^2_p and the GCV and PCV were close to each other for all the traits, indicating less environmental influence and additive gene action for this trait. For most of the characters selection would be effective due to their high and moderate heritability with high and moderate genetic advance and genetic advance in percentage of mean.

Plant height (cm) found to display highly significant positive relationships with number of primary branch per plant, days to flowering, number of fruit per plant, single fruit weight and days to first harvest at phenotypic level. It also showed significant positive correlation with circumference of fruit and yield per plant at phenotypic level. The character reflected highly significant negative association with days to last harvest at genotypic level and significant negative association with fruit length genotypically. Number of primary branch per plant reflected highly significant positive relationship with number of secondary branch per plant genotypically. The character reflected highly significant positive association with fruit length, single fruit weight and days to last harvest at phenotypic level. Number of primary branch per plant also showed significant positive correlation with days to flowering and yield per plant phenotypically. Number of secondary branch per plant showed highly significant positive relationship with number of fruit per plant at genotypic level and significant positive genotypic correlation with days to first harvest and highly significant positive relationship with days to flowering, fruit length, single fruit weight and yield per plant at phenotypic level. The character showed significant negative relationships with days to last harvest at genotypic level. Days to flowering showed significant positive correlation with days to first harvest at genotypic level and single fruit weight and days to last harvest at phenotypic level. Days to flowering also showed highly significant negative association with number of fruit per plant at genotypic level. Circumference of fruit showed highly significant positive correlation with fruit length, single fruit weight and days to last harvest and highly significant negative correlation with number of fruit per plant at genotypic level. It also showed highly significant positive correlation with days to first harvest and significant positive correlation with yield per plant at phenotypic level. Number of fruit per plant showed highly significant positive correlation with fruit length, single fruit weight at genotypic level and days to first harvest and yield per plant at phenotypic level, significant positive correlation with yield per plant at genotypic level. It also showed significant negative correlation with days to last harvest at genotypic level. Fruit length showed highly significant positive association with single fruit weight and days to last harvest at genotypic level and days to first harvest and yield per plant at phenotypic level. Single fruit weight showed highly significant positive correlation with yield per plant at genotypic and days to first harvest at phenotypic level. Days to first harvest showed highly significant positive correlation with days to last harvest, yield per plant at phenotypic level. Days to last harvest showed highly significant positive correlation with yield per plant at phenotypic level.

Number of fruit per plant (0.584) and single fruit weight (0.412) showed high positive direct effect on yield per plant followed by fruit length, days to first harvest and plant height. Days to last harvest showed the highest negative direct effect on yield per plant. number of primary branch per plant, days to flowering and circumference of fruit also showed negative direct effect on yield per plant.

Considerable $\sigma^2_{g,}$ σ^2_{p}; considerable difference of GCV and PCV; high heritability with high GA and GAPM; significant r_g and high direct effects were observed for number of fruit per plant and single fruit weight. These two traits might be considered for the improvement of yield per plant of brinjal genotypes.

The genotype Line-14 had height plant height (95.66 cm) and Line-27 had lowest plant height (63.33 cm). The genotype Line-23× Line-24F_2 had height number of primary branch per plant (8.5) and genotype Line-01× Line-25F_1 had lowest number of primary branch per plant (4.33). The genotype BARI-2 had height number of secondary branch per plant (20.59) and genotype Line-14 had lowest number of secondary branch per plant (8.86). The genotype Line-23× Line-24F_2 flowered early

(48.18 DAT) and genotype Line-27 required maximum time for flowering (58.16 DAT). The genotype Line-8 had maximum circumference of fruit (27.52) and genotype Line-23 required minimum circumference of fruit (12.20). The genotype Line-23× Line-24F_2 had maximum number of fruit per plant (37.29) and genotype Line-27 required minimum number of fruit per plant (10.23). The genotype BARI-2 had maximum fruit length (13.70 cm) and genotype Line-23× Line-24F_1 required minimum fruit length (4.1 cm). The genotype Line-01× Line-25F_2 had maximum singal fruit weight (157.25 g) and genotype Line-23 required minimum singal fruit weight (25.49 g). The genotype Line-8 early (59.59 DAT) and genotype Line-27 required maximum time for days to first harvest (67.53 DAT). The genotype Line-01× Line-25F_1 early (107.71 DAT) and genotype Line-8 required maximum time for days to last harvest (116.52 DAT). The genotype Line-23× Line-24F_1 had low yield (0.78 g) and genotype Line-01× Line-25F_2 showed maximum yield per plant (5.25 g).

Findings of the present investigation indicated minimum difference between genotypic and phenotypic variance and coefficient of variation were observed for all traits studied. High to moderate heritability, high genetic advanced and genetic advance in percent of mean were observed for all the trait studied .Number of fruit per plant and single fruit weight showed high degree of significant positive correlation with yield per plant. Based on above conclusion selection should made on number of fruit per plant and single fruit weight to improved the yield of brinjal genotypes. Considering single fruit weight and yield per plant the genotypes Line-01×Line-25F_2 performed best.Line-01×Line-25 F_1; Line-23×Line24F_2 produce higher yield next to the genotype Line-01×Line-25F_2.Inreespect of days to flowering and days to harvesting Line-23×Line-24F_2 was found as earliest genotypes.

Further crossing should be genotype (Line-01×Line-25F_2)×(Line-23×Line-24F_2) by which we may get single fruit with earliest time. (Line-01×Line-25F_2)×BARI-2 by which we may get single fruit with maximum length. (Line-01×Line-25F_2)×(Line-14×Line-27F_2) by which we may get maximum number of fruit with desirable size.

Chapter VI
Recommandation

CHAPTER VI

RECOMMENDATION

- Minimum difference between genotypic and phenotypic variance and coefficient of variation were observed for all the traits studied.
- High to moderate heritability, high genetic advanced and genetic advanced in percent of mean were observed for all the traits studied.
- Number of fruit per plant and single fruit weight showed high degree of significant positive correlation with yield per plant.
- Based on above conclusion selection could be made on number of fruit per plant and single fruit weight to improve the yield of brinjal genotypes.
- Regarding singal fruit weight and yield per plant the genotype Line-01× Line-25F_2 performed best.
- Genotypes Line-01× Line-25F_1, Line-23× Line-24F_2 produced higher yields next to genotype Line-01× Line-25F_2.
- In respect of days to flowering and days to first harvest Line-23× Line-24F_2 was found as earliest genotype.

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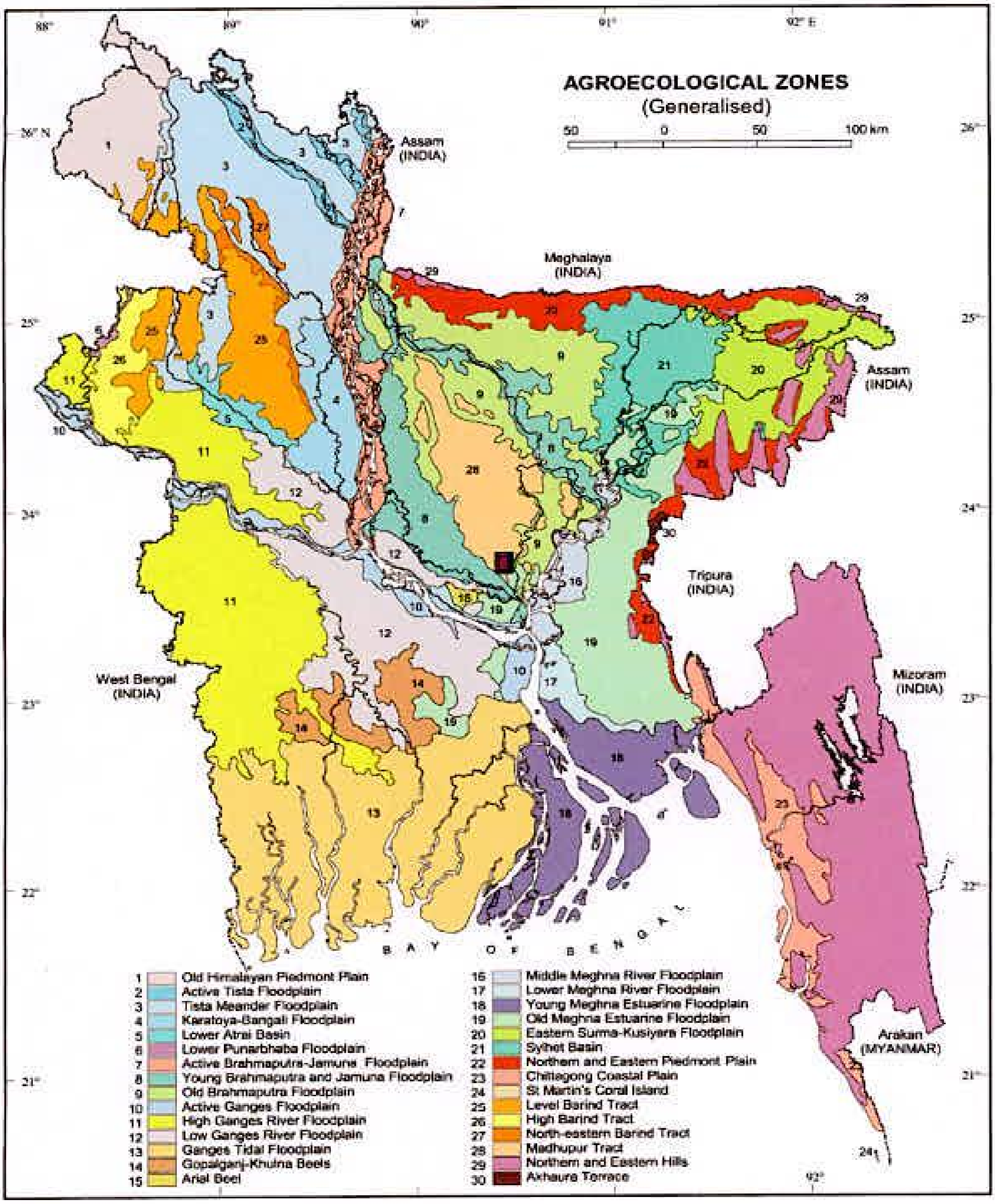
Appendices

APPENDICES

Appendix I. Map showing the experimental site under the study



Appendix II. Monthly average record of air temperature, rainfall, relative humidity, soil temperature and Sunshine of the experimental site during the period from March 2008 to April 2009

Month	Air temperature (°c)		Relative humidity (%)	Rainfall (mm) (total)	Sunshine (hr)
	Maximum	Minimum			
March,2008	36.5	20.1	61	67	7.9
April, 2008	36.9	19.6	64	91	8.5
May, 2008	36.7	20.3	70	205	7.7
June, 2008	35.4	22.5	80	577	4.2
July, 2008	34.0	24.6	83	563	3.1
August, 2008	36.0	23.6	81	319	4.0
September, 2008	34.8	24.4	81	279	4.4
October, 2008	34.8	18.0	77	227	5.8
November, 2008	32.3	16.3	69	0	7.9
December, 2008	29.0	13.0	79	0	3.9
January, 2009	28.1	11.1	72	1	5.7
February, 2009	33.9	12.2	55	1	8.7
March, 2009	34.6	16.5	67	45	7.3
April, 2009	35.8	20.3	65	88	8.3

Source: Bangladesh Meteorological Department (Climate & Weather Division) Agargoan, Dhaka - 1212

Appendix III. Physical characteristics and chemical composition of soil of the experimental plot

Soil characteristics	Analytical results
Agrological Zone	Madhupur Tract
P^H	6.00 – 6.63
Organic matter	0.84
Total N (%)	0.46
Available phosphorous	21 ppm
Exchangeable K	0.41 meq / 100 g soil

Source: Soil Resource and Development Institute (SRDI), Dhaka