STUDIES ON THE INTERVARIETAL F$_2$ HYBRIDS OF *Solanum melongena* L.

By

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THESIS

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CERTIFICATE

This is to certify that the thesis herewith submitted contains the results of bonafide research work carried out by Shri. P.D. Vijayagopal, under my supervision. No part of the work embodied in this thesis has been submitted earlier for the award of any degree.

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CONTENTS

INTRODUCTION

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Plant breeders were using hybridization as a method of improvement of cultivated plants well in advance of the discovery of Mendelian Laws in 1900. Hybridisation between cultivated crop plants and their wild relatives is a potent tool in the hands of the breeder in improving cultivated varieties. The wild relatives compared to their cultivated varieties possess many desirable characters like resistance to pest, disease, drought and unfavourable conditions. In a wide cross involving such wild plants and cultivated varieties as parents the breeder expects to incorporate the desirable characters of the wild relatives into the cultivars by genetic recombination in the progenies, as hybridisation provides the tool by which new recombinations are effected.

In many cases such hybridisation works involving interspecific or similar alien crosses are not an easy task as various isolating mechanism are in operation to keep the two groups of plants which are genetically apart. In this respect, there is no absolute correlation between the degree of similarity in morphological characters and the effectiveness of isolation barriers between the two groups of plants. This is evident from the fact that while in certain intervarietal crosses the F_1 progenies were found to be sterile while in certain interspecific crosses the F_1 progenies were fertile and have become valuable materials for further investigation and production of new and useful plants. The success of crosses involving wide relatives depends on genetic relationship apart from other factors.

The study of the F_1 of a cross between *Solanum melongena* L. (cultivars) and *Solanum melongena* L. var. *insanum* was carried out in the Agricultural College and Research Institute, Vellayani, during 1967-1968, with special reference to the characters like resistance to pest and diseases, better fruit production etc. and has been found to be better.

Certain economically important characters like hardiness, more fruit set, resistance to pest and disease increased branching etc. are inherent in this variety which most of the high yielding cultivated varieties of egg plants lack. As a part of the long term breeding programme to transfer these desirable qualities to the cultivated brinjal varieties the present investigation was taken up.

The object of the present investigation is to study further the breeding behaviour of the F_2 segregating generation with respect to some of the important characters of the cross between *Solanum melongena* var. Purple Long Datta and *Solanum melongena* var. *insanum*.

REVIEW OF LITERATURE

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1 Centre of origin and distribution

Roxburg (1832) considered *Solanum melongena* (egg plant) as a native of Amboyana. De Candolle (1886) opined that egg plant was known to India since ancient times. Vavilov (1028, 1931) indicated that India-Burma region as the centre of origin of egg plants. According to Sampson (1936) *S. melongena* is indigenous to tropical Africa. Filov (1940) and Coulter (1942) considered India as the centre of origin of *S. melongena*. According to Bhaduri (1951) the presence of a large number of cultivars and wild relatives in the Indo-Burma region strongly supports the view of Vavilov. Garenbus (1962) considered India as the centre of origin of *S. melongena*.

2 Taxonomic position of *S. melongena* Linn.

The family Solanaceae includes the cultivated brinjal plants. From the economic point of view Solanaceae is an important family, for it includes a large number of widely cultivated plants such as tobacco, potato, tomato, brinjal, chillies etc.

The genus *Solanum* has been left practically unchanged since the time Clarke (1883) published the classification of Solanaceae in British Flora. Later, Bitter (1917) classified the genus *Solanum* on the basis of the presence or absence of tubers into tuberiferous and non-tuberiferous groups. Hassler (1917) bifurcated the genus into Solanum and Lycianthes which was followed and amplified by Bitter (1920). Santapau (1947) transferred six out of 28 species indigenous to India from genus Solanum to the new genus Lycianthus.

The genus Solanum consists of approximately 2000 species out of which about 100 are tuberiferous and the rest non-tuberiferous.

Solanum melongena L.has a large number of cultivated forms or races recognised principally according to shape or colour of the fruits. Filov (1940) has classified these various forms, both cultivated and wild on agro-ecological basis. According to Filov (1940) the different forms of *S. melongena* L. are grouped in 5 sub-species. He considered that the wild forms are found only in India. These forms which were characterised by extremely bitter and inedible fruits were put under a separate sub-species *S. melongena* L. spp. *agrestis* Fil. Four other sub-species of *S. melongena* L. are

1 spp. *occidentale*

2 spp. *orientale*

3 spp. *palestinium*

4 spp. *arabico-italicum*

Bhaduri (1951) considered that all the twenty two Indian species of *Solanum* would fall into two natural and distinct groups or section as:

(a) Species which are without spines

(b) Species which are armed with spines.

Solanum melongena Linn. belongs to the section (b) (Bhaduri, 1951). Based on the morphological characters he considered *S. melongena* Linn, *S. coagulans*, *S. xantho-carpum*, *S. indicum* and *S. maccanii* as an assemblage of related species.

3 Taxonomic position of *Solanum melongena* var. *insanum* Prain

Linne (1806) and Roxburg (1832) gave status of a separate species as *S. insanum* to the variety *insanum* of *S. melongena*. Clarke (1883) did not separate this variety from the parent species *S. melongena* Linn. Voigt (1884) and Bentham and Hooker (1885) also considered *insanum* under *S. melongena* L.

Prain (1903) made mentions of two varieties of *S. melongena* as variety *esculenta* and *insanum* and described *S. melongena* var. *insanum* as a very prickly herb with quite round fruits. Gamble (1915) described *S. melongena* var. *insanum* Prain on identical morphological terms. Hanes (1922) considered *insanum* as a variety of *S. melongena*.

Bhaduri (1951) considered *S. melongena* var. *insanum* as related to the cultivar *S. melongena* and believed it as one of the ancestors of the cultivated type of *S. melongena*.

Rao (1966) while quoting stebbins (1965) has expressed the view that the taxonomy of the genus *Solanum* was misleading.

However, much confusion still exists with regard to the taxonomic position of this wild variety of egg plant.

4 *Crossability studies*

Eventhough many workers on inter-specific and intervarietal hybridization have been reported in the non-tuberiferous group of *Solanum* by different investigators, none of them was on an extensive scale as in tuberiferous group. Also comparatively few reports have been known with regard to the breeding behaviour of the non-tuberiferous group.

The following is an account of the various attempts made by hybridisation at inter generic, interspecific and intraspecific levels and their results.

A. *Inter generic crosses*

Only very few works have been done at the intergeneric level involving *Solanum* and none of them have been successful. Miwa *et al* (1958) attempted the following five intergeneric crosses.

1 *Solanum integrifolia* x *Petunia violaceae*

2 *S. esculentum* x *Lycopersicum esculentum*

3 *Lycopersicum esculentum* x *S.melongena*

4 *Capsicum annuum* x *S. melongena*

6 *Capsicum annuum* x *S. integrifolia*

The crosses were possible only with the help of plant hormones and in every case the F_1 was sterile.

Krishnappa and Chenna Veeriah (1964) attempted an intergeneric cross between *S. pseudocapsicum* and *Capsicum annuum*; but found unsuccessful.

B. *Inter specific crosses*

Tatebe (1927) attempted a cross between *S. melongena* and *S. integrifolia*.

Jorgensen (1928) effected a cross between *S. nigrum* and *S. luteum* and got a sterile F_1 further producing an amphidiploid which proved to be fertile.

Sarvayya (1936) crossed *S. xanthocarpum* with *S. melongena* treating the *melongena* as pollen parent and obtained a hybrid which was very vigorous in growth; but fruit set was found to be very poor.

Ellison (1930) attempted a cross between *S. nigrum* and *S. nitidibaccatum*. The cross resulted in failure.

Tatebe (1936) conducted crossing between S. *integrifolium* with S. *melongena*. The F_1 was completely sterile.

Hagiwara and Iida (1938) effected successful crossing between S. *melongena* and S. *integrifolium* but the F_1 was reported to be partially sterile.

Paddock (1942 and 1943) made crosses between S. *douglassi* and S. *nodiflorum* and obtained male sterile hybrids.

Tatebe (1944) made crosses between S. *melongena* and S. *tamago*; and S. *integrifolium* and S. *tamago*.

Watergaard (1948) studied the nature of interspecific crossability in 6 diploid, nine tetraploid and seven hexaploid species.

Swaminathan (1949) effected crosses among the species S. *incanum*, S. *xanthocarpum* and S. *melongena*, and found the hybrids ranging from completely sterile to completely fertile ones.

Rzhavitin (1956) made crosses between S. *guinese* and S. *luteum* using *luteum* as pollen parent. The F_1 plants obtained were exactly like the female parents. Though the F_2 plants were variable all of them were well developed and strong.

The works of Miwa *et al.* (1958) and Rai (1959) support the view of Hagiwara and Iida.

Ramirez (1959) obtained interspecific hybrids between *S. melongena* and *S. grandiflorum* and expressed the possibility of introducing the perennial habit and resistance to certain pests and diseases, to *S. melongena*.

Magoon *et al* (1962) reported that nine dibasic species of *Solanum* whose crossability was studied, viz. *S. villosum*, *S. curtipes*, *S. flavum*, *S. miniatum*, *S. alatum*, *S. bengalensis* *S. rubrum* *S. ochroleucum* and *S. retroflexum*, crossed readily with each other to give rise to fertile hybrids except in the case of *S. retroflexum*. Also regular Mendelian segregation could be demonstrated for a number of characters with first segregating generation.

Nasrallah and Hopp (1963) tried the following interspecific crosses.

1 *S. melongena* x *S. gilo* - F_1 semi sterile

2 *S. melongena* x *S. indicum* - F_1 semi sterile

3 *S. melongena* x *S. mammosum* - cross unsuccessful

4 *S. mammosum* x *S. cilliatum* - cross unsuccessful

5 *S. melongena* x *S. ciliatum* cross unsuccessful

6 *S. indicum* x *S. mammosum* - cross unsuccessful

7 *S. indicum* x *S. ciliatum* - cross unsuccessful

8 *S. gilo* x *S. mammosum* - cross unsuccessful

9 *S. gilo* x *S. ciliatum* - cross unsuccessful

Capinpin, Lande and Panchoo (1963) effected inter-specific crosses between S. *melongena* Linn. and S. *cumingii* Dunal and obtained highly fertile F_1 and F_2 plants. Krishnappa and Chenna Veeriah (1964) attempted a large number of interspecific crosses and the result obtained are as follows:-

	Crosses	*Result*
1	S. *indicum* x S. *melongena*	Successful
2	S. *aculeatissimum* x S. *khasianum*	Obtained healthy seeds but F_1 plant did not survive.
3	S. *khasianum* x S. *melongena*	partly successful
4	S. *xanthocarpum* x S. *melongena*	Weak F_1 plants which did not survive.
5	S. *torvum* x S. *indicum*	Cross successful
6	S. *torvum* x S. *melongena*	Not successful
7	S. *khasianum* x S. *torvum*	Not successful
8	S. *khasianum* x S. *indicum*	Seeds aborted
9	S. *indicum* x S. *aculeatissimum*	Shrivelled seeds

Balu Rao (1965) obtained fertile hybrids of S. *incanum* x S. *melongena* and S. *melongena* var. *insanum* x S. *xanthocarpum*. Narasimha Rao (1966) obtained fertile F_1 and F_2 from the crosses of all combinations among S. *melongena* (cultivar), S. *melongena* var. *insanum* and S. *incanum*. Popova and Georgiev (1966) crossed S. *melongena* varieties and S. *gilo* and obtained F_1, F_2 and F_3

generations. Pal and Rajki (1966) obtained interspecific hybrids by crossing *S. melongena* and *S. gilo*.

C. *Intraspecific crosses*

Though several intervarietal crosses with *S. melongena* have been reported, most of them are in connection with study of heterosis. Some of the crosses are reviewed here.

Swaminathan (1949), Mittal and Bhaduri (1951) obtained fertile hybrids from crosses, *S. melongena* var. *insanum* x *S. melongena* var. *potangi* and *S. melongena* var. *insanum* x *S. melongena* cultivar.

Argikar (1952) crossed a new variety of *S. melongena* var. *bulsarensis* with a few Gujarat varieties of *S. melongena*; but failed to get fruits.

Anonymous (1950) effected cross between *S. melongena* var. Wynad Giant and *S. melongena* var. pusa purple and obtained fertile hybrids.

Rai (1959) made successful crosses between *S. melongena* (cultivat) and *S. melongena* var. *insanum*.

Magoon *et al.* (1962) obtained fertile hybrids from the crosses involving *S. melongena* (cultivar) *S. melongena* var. *insanum* and *S. melongena* var. *potangi*.

Rajki Cicer and Pal (1964) effected successful crosses between *S. melongena* (long purple) ssp. *occidentale* var. *bulgaricum* x *S. melongena* (white variety) ssp. *subspontaneum*, var. *leucoum*.

Krishnappa and Chennaveeriah (1964) effected the following crosses:

Cross	*Result*
1 *Solanum indicum* (race No.213) x *S. indicum* (race No. 70)	Fertile hybrid
2 *Solanum indicum* (race No. 17) x *S. indicum* (race No. 70)	Fertile hybrid
3 *S. indicum* (race No. 17) x *S. indicum* (race No. 109)	Sterile hybrid
4 *S. indicum* (race No. 17) x *S. indicum* (race No. 158)	Unsuccessful
5 *S. melongena* (race No. 1) x S. melongena (race No.20)	Unsuccessful

5. Inheritance of characters

A. Pigmentation

Bailey (1892) found that in egg plants hybrids between green stemmed white fruited varieties and purple stemmed very dark purple fruited parents, had purple tinged stem and purple fruits.

Halstead (1918) separated purple colour into two classes, namely, light dependent and light independent. He indicated that there would be different intensities of this colour characteristic particular to varieties. Further more, the purple colour disappeared to a large extent, if not totally, as the fruits mature and was replaced by a dull yellow. Striped fruit group when crossed with white fruited ones, he got F_1, slightly striped. When the striped variety was crossed with purple, that F_1 was purple and only a small fraction of stripped fruits appeared in F_2 indicating its recessiveness. When white variety was crossed with purple he got the F_1 all purple fruits; but in F_2 four types were observed, viz. purple, pink, green and white in the ratio of 9: 3: 3: 1 suggesting that two factors were responsible for the expression of the characters. According to Nagai *et al* (1926) the inheritance of fruit colour in brinjal was complex.

Nolla (1932) reported that plant, fruit and crolla colour and striping of anthers were simply inherited showing 3: 1 ratio in F_2 with colour and striping being dominant over absence of colour and non striping. It was not clear whether these characters were controlled by a single factor or by several completely linked factors.

Tatebe (1936) reported dominance of purple plant colour over green of the scarlet egg plants.

Hagiwara and Iida (1938, 1939) explained the inheritance of anthocyanin pigments in stem in a cross between *S. integrifolium* and *S. melongena*. The F_1 had green stem and F_2 gave green, light purple and purple stemmed plants.

Tatebe (1939) studying intervarietal crosses in egg plants found that dark purple plant colour was monogenic dominant over both green and light purple plant colour. He also proposed the following factors to explain the segregation obtained in hybrid progenies:- P,- a dominant factor for the production of dark purple fruit skin and violaceous corolla; G,a dominant factor producing green fruit skin and light green flesh; D,a dominant factor producing dark purple fruit skin.

Tatebe (1944) crossed different coloured varieties in egg plant to formulate the genotype of different varieties with the fruit colour such as Aoshima with green variegated fruits, Oserikawa with purple fruits, Dakoshiro with white fruits, Kanto-ao and Aonasu with green fruits. He found that purple colour was dominant over green variegated and green variegated is dominant over white. But Kanto-ao and Aonasu (both green) behaved differently in crosses with green variegated, ie, Aoshima. The F_1 of the cross between - Aoshima and Kanto-ao was green variegated in fruit colour and the F_2 was in the ratio of 3 green variegated: 1 green. Unexpectedly, in the combination between Aoshima and Aonasu the F_1 was dark purple and in F_2 36 dark purple, 21 green variegated and 7 green fruited plants were observed. According to his study he found that the influence of 3 genes (C, P and D) was necessary for the development of purple pigment to the skin. G, a gene for the production of green skin and light green flesh and Gv, a gene for green variegation were also assumed in addition to C, P and D. He suggested that the probable genotypes of Aonasu, Kanto-ao and Aoshima would be CCppDDGGgvgv, CCPPddGGgvgv and CCPPddGGGvGv respectively.

Pal and Singh (1946) reported that the intensity of purple colour in F_1 was intermediate between parents in egg plants.

Khan and Hamzon (1953) indicated that purple and green colour of the stem are governed by a single gene pair P_p . Besides P another factor G resulted in green fruits which was dominant to white where G was hypostatic to P. The striped Vs non-striped condition in green fruit depended upon a single gene pair Aa. In the presence of both G and P, A was responsible for a mosaic condition of the fruit. No linkage was detected between P, G and A.

Laginora and Toleda (1957) reported that purple colour is dominant over yellow.

Vella (1961) reported that red, purple, and pink fruit colour were dominant over green.

Capinpin et al (1963) found that purple fruit was dominant over green and showed a modified digenic type of inheritance. They also showed that purple pigmentation was dominant over green.

Janick and Tppoleski (1963), based on crosses among four varieties, reported that the action of two complementary genes was necessary to control the occurrence of pigment in a light dependent action. These genes were incompletely dominant and distinct gradation of fruit colour occurred as the number of dominant alleles increased from two to four.

Sambandam (1964, 1967) reported that purple hypocotyle colour was monogenic dominant over green and also found that fruit colour in egg plant was determined by two characteristics, viz., the skin colour and flesh colour. He also reported that purple, purple striped and colourless skin constituted one allelomorphic series while green striped, light green striped, green and white flesh colours constituted another allelomorphic series. In both the series the gene sequence represented the order of dominance.

B. Fruit shape

Tatable (1943) reported that in crosses between round and long fruited egg plants, the F_1 plants had fruits approximating to geometrical mean of the fruit of the parents while in F_2 generation a range of fruit shape occurred following a positively skewed curve about the same mean as in F_1. He believed that at least 3 partially dominant genes controlled the shape of the fruit. But the exact manner of the inheritance of fruit shape was not indicated. He also gave some physiological explanation for the length and width difference assuming that they were governed by two separate entities.

Khan and Ramzan (1953) estimated 5 pairs of genes to be governing the fruit shape.

Capinpin et al (1963) reported that F_1 progenies had fruits with intermediate size of the fruits of the parents and showed quantitative variation for this character.

Narasimha Rao (1966) reported that in the cross between long fruited and round fruited egg plants, the F_2 progeny did not represent the parental extremes, but ranged from an intermediate size to that of the round fruited parents. He attributed this to the strong inhibitory effect of the genes brought in form S. melongena var insanum (round fruited - parent) on the primary genes controlling fruit length in the cultivars resulting in the reduction of fruit length.

Gopimony (1968) in crosses between S. melongena (cultivar) and S. melongena var insanum found that in the F_1 generation, the fruit size approached the geometrical mean of the parents rather than the arithmetic mean.

C. Spininess and other characters

Hagiwara and Iida (1938) showed that the presence of spines on the stem and leaf of *S. integrifolium* was dominant over that in *S. melongena*.

Khan and Rozman (1963) reported that spiny condition was monogenic dominant over smoothness.

Capinpin *et al.* (1963) found that spiny nature was dominant over non-spiny nature and was monogenically inherited.

Narasimha Rao (1966) reported that the presence of spines on the leaves of the egg plants was determined by a single dominant gene. He also found that the intensity of spines vary much, for which he did not offer any explanation.

Gopimony (1968) found the F_1 plants to be spiny in the crosses between *S. melongena* (cultivars) and *S. melongena* var. *insanum*.

Narasimha Rao (1966) reported that the flowering habit and the nature of petal tip were monogenically controlled while most of the other morphological characters were under polygenic control.

D Floral biology

Smith (1931) and Magtang (1936) classified the flowers in egg plants with regard to the position of stigma in relation to anthers, into long-styled and short-styled flowers. They showed that fruits were formed only from long-styled flowers.

Based on the measurements of style Pal and Singh (1943) further classified that short styled to short styled and pseudo short styled and indicated that only long styled and pseudo short styled flowers normally produced fruits while the short styled flowers fell off and seldom produced fruits.

Krishnamoorthi and Subramaniam (1954) classified 4 types of flowers based on style length as follows:

1 Short styled	Style is rudimentary
2 Pseudo short styled	Stigma comes upto half way of the anther length
3 Medium styled	Stigma comes upto the anther tip level
4 Long styled	Stigma comes well above the anther tip

They observed that out of 1451 flowers 47% were long styled, 0% medium styled, 8% pseudo short styled and 39% short styled while Muthukrishnan (1957) found that percentage occurrance of the different type of flowers was 22, 12, 16 and 50 in summer and 25, 5, 16 and 54 in winter, respectively. According to him the frequency of occurrence of the particular type of flowers in different varieties varied in the two reasons.

7. Fruit set

Smith (1931) reported that 50% of short styled flowers set fruit when hand pollinated while Pal and Singh (1943) observed that the short styled flowers did not set fruit in nature.

Krishnamoorthy and Subramanian (1954) showed that under natural conditions 27 per cent of flowers set fruit and 93 per cent of these came from long styled flowers.

Popova (1962) showed that the highest percentage of fruit set was observed when the stigma was above the anther tip.

Sambandam (1964) reported that in egg plants the natural crossing is from 0.7 per cent to 15.0 per cent of which an average of 6.7 per cent was inter plant crossings.

Bhore, et al (1965) in an experiment to find the best method of selfing in brinjal found that the embroidary cloth bags gave the highest fruit set of 83.3% followed by perforated butter paper bags with 56.6 per cent.

Pal and Oswald (1967) reported that the percentage of fruit set in an interspecific cross increase by 2-3 folds by excision treatment on the pistil.

8. Earliness and fruit bearing habits

Schmidt (1935) reported that the character of earliness was dominant and transgressive in certain egg plant crosses. Inouye (1936) showed that production of twin fruits characteristic to a particular variety was dominant. Reddi and Subramonian (1954) reported that cluster bearing nature of Guttivanga is due to the production of long and medium styled flowers both in the central and lateral position of the inflorescence.

Nassarellah and Hopp (1963) showed that the cluster bearing habit of S. gilo which behaved as dominant could be transferred to the egg plant and suggested its practical utility in breeding programme.

9. Study on pest and disease resistance

Davidson (1935) reported that green varieties of egg plants were generally resistant to wilt disease.

Hutton et al. (1947) showed that the field immunity to Fusarium wilt was dominant in tomato crosses. The F_1 plants were completely dominant and were immune. In F_2 generation a prepondarance of field immunity was noticed so that the expected 3:1 ratio was exceeded.

Sinclair and Walker (1965) in a study of inheritance fo mosaic virus in cowpea, showed that the resistance is governed by a single dominant gene.

Clarke (1955) reported that in tomato, disease resistance was genetically controlled and that character of resistance was dominant over susceptibility and linked with the production of small fruits.

Ramiros (1959) suggested that hybridisation between egg plant (cultivars) and S.*grandiflorum* might be useful in introducing resistance to certain pests and disease in the cultivars.

Suzuki, Sugahara, Kotani, Todaka and Shimada (1964) obtained quantitative inheritance in breeding of egg plants, for resistance to *Pseudomonas solanacearum*.

Acosta, Gilbert and Qinon (1964) in a study of heritability of bacterial wilt resistance in tomato reported that in mature plants the resistance was controlled by recessive genes.

Cirulli and Alexander (1966) reported that a single dominant gene was responsible for resistance to 5 strains of T.M.V. in tomato.

Randall (1966) found that resistance to diseases in tomato was associated with morphological characteristics.

Suzuki (1967) in his studies on breeding of egg plants suggested that bacterial wilt resistance in certain egg plant varieties is hereditary.

10 Cytology

Kojima (1925) showed that different varieties of S. *melongena* cultivated in Japan have 2n = 24.

Vilmorin and Simonet (1927) made a report of the chromosome numbers in the non-tuber forming Solanum species as 2n = 24.

Jorgensen (1928) reported the existence of species with 48 and 72 somatic chromosomes in some of the unarmed species especially those belong to the section Morellae. Bhaduri (1928) reported the gametic number as 12 in 4 Solanum species., ie. S. trilobatum, S. indicum, S. torvum, S. verbascifolium. Tokunga (1934) reported that n = 24 in S. miniatum and n = 36 in S. nigrum. Magoon and Swaminathan (1962) showed 24 to be the somatic chromosome number in several species of Solanum.

Janaki Ammal (1934) could recognise atleast 5 different types of chromosomes in the mitotic plates of S. melongena. In the early stages of meiosis 5 different groups based on length of chromosomes, all with medium centromere, could be recognised by her. She pointed out that a single long chromosome stands out conspicuously in all the cells at differents stages of meiosis. Such a long chromosome is characteristic to many genera of the family as observed by Lesley (1926) in tomato, Belling and Blackeslee (1923) in Datura, and Janaki Ammal (1932) in Nicandra.

Janaki Ammal (1934) observed regular meiosis in S. melongena (2n = 24). Studies conducted at the Bose Research Institute, Calcutta showed that meiosis was normal in a number of Solanum sp. Jorgenson (1928) and Stebbins and Paddock (1949) have found occasional formation of multivalents and univalents in meiosis.

Swaminathan and Magoon (1962) reported that constant occurrance of closed type of ring in an interspecific cross between S.torvum and S. hispidum and concluded that these two species differ by a segmental inter-change.

Campinpin et al (1963) found that in F_1 and F_2 progenies obtained by crossing with different species of Solanum with 2n = 24 Chromosomes, meiosis was regular indicating complete homology.

Rai (1959) studied the chromosome morphology in 8 S.melongena varieties including var. insanum, and also two intervarietal crosses. In all varieties the diploid number of chromosomes was found to be 24. Out of these 2 medianly constricted chromosomes bear satellite. He also reported that in some cells of var. insanum an acentric fragment was clearly observed.

MATERIALS AND METHODS

MATERIALS AND METHODS

The present study was carried out in the Division of Agricultural Botany of the Agricultural College and Research Institute, Vellayani during the year 1968-1969. Two crops were raised, one for studying the inheritance of characters except resistance towards wilt disease and other for studying the inheritance of resistance towards wilt disease.

A. Materials

Materials involved in the present investigation consists of the cultivated variety of *S. melongena* Linn., viz., *S.melongena* var. Purple Long Dutta (used as PLD in this investigation for convenience); one wild variety, *Solanum melongena* var. *insanum* Prain and the F_2 generation plants of the cross between these two varieties using the cultivar as the female parent.

The F_1 hybrid generation of the cross between *Solanum melongena* var. PLD and *Solanum melongena* var. *insanum* was studied in the division of Botany during the year 1967-68 (Gopimony 1968). The seeds for the F_2 generation and for the parental plants were obtained by selfing the flowers in the above study.

The morphological description of the parents is summarised in Table I.

TABLE I

		<u>Purple Long Dutta</u> <u>(cultivar)</u>	<u>S. melongena</u>. var. <u>insanum</u> (wild)
1	Habit	Erect, bushy and open	Highly spreading
2	Plant height	113.50 cms	41.00 cms
3	Stem colour	Light purple on lateral branches	Purple pigmented
4	Foliage colour	Dark green with purple tints and purple veins	Dark green with purple veins
5	Leaf size and shape	Large, elliptic	Small, ovate
6	Spines	Spineless	Pigmented spines on leaves, stem and calyx
7	Inflorescence	Solitary	Usually solitary, rarely in cymes
8	Flower colour	Purple	Purple
9	Stigma colour	Purple	Purple
10	Fruit shape and colour	Long, deep purple, turning dull yellow on ripening	Small, globose, with green check on white, turning yellow on ripening.

B. Methods

Technique of selfing

Solanum melongena L. (cultivar) and its wild variety under experimentation and their hybrids are self pollinated under natural conditions. But to ensure against cross pollination the following method was adopted.

Under Vellayani conditions the time of flower opening and dehiscence of anthers were simultaneous and were found to occur between 7 and 10 A.M.

In each case five well developed long-styled flower buds which would open in the next day were covered with butter paper bags in the previous evening and labelled. The bags were retained for 4 days.

The completely matured selfed fruits were harvested, and the seeds extracted, cleaned, dried and stored separately.

The seeds were sown in the nursery separately for raising seedlings.

Field plot technique and study of the F_2 generation

The study of the F_2 generation and their parents were undertaken in the following heads.

I Morphological studies
II Study on the wilt disease resistance
III Chemical studies
IV Cytological studies

The details of the methods adopted are discussed below:

I Morphological studies

1 Lay out

The F_2 plants were raised as a bulk crop and the parents flanked on either side. A total number of 264 F_2 plants were planted in 12 rows of 22 plants in each row. Two rows of each of PLD and *insanum* parents were planted on either side of the rows of the F_2 plants. The spacing provided was 1.5 meters as the spread of F_2 plants were expected to be more.

2 Replication

Only bulk crop was raised and no replication was laid out.

3 Nursery

Good seeds from 3 fruits from the same F_1 plant were sown in pots of size 50 cm x 50 cm. Seeds from one fruit each of the parents were also sown in pots. The pots were filled with standard pot mixture and seeds were sown at the rate of 100 seeds per pot.

The seedlings were watered twice daily.

4 Transplanting

Main field was dug and levelled. Pits 1.5 meter apart in rows of 1.5 meter distance were taken. As a preventive measure against bacterial wilt dry leaves were collected and burnt in the pits. One small basketful of cowdung was applied as basal dressing in each pit and was mixed thoroughly with the soil.

The seedlings were allowed to stand in the pots for 35 days. Healthy seedlings were transplanted at the rate of 2 seedlings in each pit. Fifteen days after transplantation thinning was done leaving one healthy seedlings in each pit. Standard vegetable mixture was applied twice as top dressing, the first 20 days and second 50 days after transplanting at 50 gms. per plant each time. The vegetable mixture was correctly weighed and applied. Pot watering was done twice daily.

Detailed observations on the following characters were recorded for the parents and F_2 plants seperately.

Quantitative characters

1 Tap root length of seedlings

2 Height of seedlings

3 Height of plants

4 Spread of plants

5 Number of branches

6 Number of flowers

a) Long styled flowers

b) Medium styled flowers

c) Short styled flowers

7 Number of fruits

8 Percentage of fruit set

9 Size of fruit

a) Length of the fruit

b) Girth of the fruit

c) Volume of the fruit

d) Total weight of fruits from each plant

e) Fruit index

10 Time of flowering

11 Area of leaves

12 Germination capacity of F_3 seeds

The details of the method by which observations were taken in each case, are as follows.

1 Tap root length of the seedlings

The root length of the seedlings was taken at the time of transplanting. Measurement was made from collar region to the tip of the tap root by the scale and thread method.

2 Height of the seedlings

The height of the seedlings was measured in cms from the collar region for all the seedlings transplanted at the time of transplanting.

3 Plant height

The height was measured from the ground level to the top most bud leaf. The first observation was taken on the 20th day after transplanting and subsequent ones at 10 days interval. The last measurement was made on the 70th day.

4 Spread of the plants

Measurement on the spread of the plants was taken on the 70th day after transplantation. The tips of the branches which provided maximum spread were considered for recording the spread.

5 Number of branches

Primary, secondary and tertiary branches were considered. The observation was taken once on the 70th day after transplantation.

6 Number of flowers

For counting the total number of flowers, the flowers were recognised as:

1 Long styled flowers
2 Medium styled flowers and
3 Short styled flowers

Count on these types of flowers was taken and recorded separately. The number of flowers under each category was counted starting from the date of flowering upto 75th day after transplantation. The counted flowers were identified by tying a red thread on the pedicel of the flowers.

7 Number of fruits

The total number of fruits set from the long and medium styled flowers were counted. The count was taken for all the fruits developed from the flowers which were actually counted.

8 Percentage of fruit set

For the purpose of finding the fruit set percentage the number of fruit set was taken 10 days after the successive count of flower was taken. The percentage was calculated over the total number of flowers.

9 Size of the fruits

(a) Length

The length of the fruits was measured using a thread. For the purpose of length, measurement was taken from the base to the apex. Average length of 10 fruits selected at random from each plant was considered.

(b) Girth

Also measured using a thread. The girth was measured along the centre of the fruits.

(c) Volume

Average volume of 10 fruits from each plant was measured using an one litre measuring flask by displacement method.

(d) Weight

Mature fruits were harvested periodically and the total weight of the fruits harvested from each plant recorded.

10 Time of flowering

The total number of days from transplanting to the first flower blooming was recorded for the parental plants and the F_2 segregants.

11 Area of leaves

The observation was made on the 60th day after transplanting. The arithmetic mean of the measurements of largest 5 leaves was taken. The relation that the area of a leaf

$$\text{in sq.cm} = \frac{\text{length of the leaf in cm} \times \text{breadth of the leaf in cm}}{1.5}$$

followed by Gopimony, (1968) and verified by the author, was made use in calculating the area of the leaves. The distance from the tip of the leaf to the tip of the petiole was taken as the length.

12 Germination capacity of F_3 seeds

Hundred well developed seeds extracted from the fruits of each plant was placed in a petridish containing moist blotting paper. The number of seeds germinated was counted after 14 days and the percentage of germination recorded.

Qualitative characters

1 Colour of stem

2 Presence of absence of prickles

3 Fruit shape

4 Fruit colour

5 Fruit colour at maturity

Counts based on visual observation were made.

Statistical procedures

The F_2 segregating plants were raised as a bulk crop with parents on either side.

1) Quantitative characters

The maximum and minimum value for each observation were located and the range of variation was found out. The range was divided into suitable number of equal classes and the data under each observation was classified using statistical procedure.

The mean, standard deviation, standard error and coefficient of variation were also worked out to study the nature of variation.

ii) Qualitative characters

Where the exact number in each group could be arrived at chi-square test was applied to find the goodness of fit of segregation for further interpretation.

II Study of wilt disease resistance

This study of pot culture experiment was laid out in 170 pots of 30 cm x 30 cm in size. Of the 170 plants 150 were F_2 segregates and 20 parents, ie. *Solanum melongena* var. PLD and *Solanum melongena* var. *insanum*, 10 from each. The pots were arranged in such a manner that the F_2 plants were in the middle flanked on either side by the male and female parents.

Sick soil was collected from the spots in the vegetable garden where egg plants were affected by wilt disease recently. The remains of the affected plants were also chopped and applied along with the soil. The pots were filled with the sick soil and one month old seedlings were transplanted. Twenty days after transplantation 50 gm of standard fertiliser mixture was applied to each pot.

The plants were inoculated with the serum taken from the diseased plants on the 35th days after transplantation.

Pot watering was given twice daily. The number of plants wilted were counted as and when wilting was noticed.

III Chemical studies

A random sample of 50 plants were selected from the F_2 segregants for finding the protein content.

The protein content was estimated by finding out the nitrogen percentage and then converting it to protein percentage by multiplying with the factor 6.25.

IV Cytological studies

1 Pollen sterility

Acetocarmine staining method was used to study pollen sterility. Anthers which would open next day were covered with paper bags. Anthers were collected from such buds and dusted on the slide containing a drop of acetocarmine strain mixed with glycerine and covered with a coverglass. After 15 minutes the slides were examined under microscope. The deeply stained pollen grains were considered as fertile ones while those which were slightly strained or crinkled as sterile ones. Counts were taken from 30 different microscopic fields and percentage of sterility worked out.

2 Pollen size

Slides of fresh pollen grains were prepared in glycerine acetocarmine medium. The size of the pollen grains was measured by

EXPERIMENTAL RESULTS

EXPERIMENTAL RESULTS

I Quantitative characters

Root length of seedlings

The result is presented in Table II. It has been seen that the segregation observed in F_2 is almost typical of quantitative inheritance. The parents, Solanum melongena var. PLD and Solanum melongena var. insanum have recorded a mean root length of 7.85 cms and 17.82 cms respectively. Within each parental lines, however, there is some variability. But the range of variability is considerably high for F_2 as compared to the parents as indicated by the coefficient of variation. The arithmetic mean of the F_2 plants is found to be 11.11 cms which is more near to the geometric mean of the parental values, viz, 11.79 than the arithmetic mean of the parental values, viz, 12.84.

The frequency distribution of individuals in F_2 appears to be almost continuous. The intermediate classes include by far the largest number of individuals with the extreme classes less frequently represented. The extreme measurements in the F_2 are seen to overlap well with the distribution of the parental values.

TABLE II

Frequency distribution for seedling root length (in cms) of the parental and F_2 generations

	Classes	4.25 5.75	5.75 7.25	7.25 8.75	8.75 10.25	10.25 11.75	11.75 13.25	13.25 14.75	14.75 16.25	16.25 17.75	17.75 19.25	19.25 20.75	20.75 22.25	22.25 23.75	N	$\bar{X}$	SE	CV
PLD		..	6	10	4	..	..	..	..	..	..	..	..	..	20	7.85	0.23	13.20
F_2		7	35	25	42	57	29	16	22	10	5	12	2	1	253	11.11	0.15	21.63
Insanum		..	..	..	..	..	..	2	3	5	6	1	2	1	20	17.82	0.50	12.70

Arithmetic mean of the parental values = 11.80

Geometric mean of the parental values = 12.84

N = Total frequency

$\bar{X}$ = Arithmetic mean

SE = Standard error

CV = Coefficient of variation

Height of the seedlings

The Table III contains the results.

The pertinent difference between the parental types, *Solanum melongena* var. PLR and *S. melongena* var. *insanum*, in respect of this character can be seen most readily in a comparison of their respective means which are 10.13 cms and 4.20 cms respectively. The F_2 progenies have the mean seedling height of 8.39 cms. The variability, as indicated by the coefficient of variation and the spread of the histogram (Fig.I) for the F_2, is greater than that of either parent. The F_2 mean is nearer to the arithmetic mean than the geometric mean of the parental values. But almost all the F_2 seedlings appear to be taller than one of the parents. Thus there is no recovery of this parental type among the F_2 segregants. However the F_2 has an almost continuous variation with well represented intermediate types than the extreme types, suggesting the quantitative nature of inheritance of the character.

Height of the plants

Results pertaining to the plant height is tabulated in Table IV.

The data presented (Fig.II) show a greater range of variation for the plant height, the range being from 35.5 cms to 135.8 cms

TABLE III

Frequency distribution for height of the seedlings (in cms) of the parental and F_2 generations

Classes	3.75 4.25	4.25 4.75	4.75 5.25	5.25 5.75	5.75 6.25	6.25 6.75	6.75 7.25	7.25 7.75	7.75 8.25	8.25 8.75	8.75 9.25	9.25 9.75	9.75 10.25	10.25 10.75	10.75 11.25	11.25 11.75	11.75 12.25
1	..	..	..	..	..	..	..	..	..	2	3	4	6	3	1	2	..
2	..	..	..	..	3	2	16	21	30	61	41	29	15	10	7	6	12
3	11	7	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..

1 PLD
2 F_2
3 Insanum.

Arithmetic mean of the parental values = 7.21
Geometric mean of the parental values = 6.60

		PLD	F_2	Insanum
Total frequency	..	20	253	20
Arithmetic mean	..	10.13	8.39	4.30
Standard error	..	0.47	0.16	0.09
Coefficient of variation.	..	20.62	31.46	10.42

TABLE IV

Frequency distribution for plant height (in cms) of parental and F_2 generations

	Classes	25.5 35.5	35.5 45.5	45.5 55.5	55.5 65.5	65.5 75.5	75.5 85.5	85.5 95.5	95.5 105.5	105.5 115.5	115.5 125.5	125.5 135.5	N	$\bar{X}$	S.E	C.V
PLD		..	..	..	..	..	..	..	4	8	6	2	20	113.50	2.00	7.00
F_2		..	2	3	10	29	62	68	41	25	8	6	253	88.14	1.06	10.20
Insanum		3	12	5	..	..	..	..	..	..	..	..	20	41.00	1.38	3.46

Arithmetic mean of the parental values = 77.25

Geometric mean of the parental values = 68.22

N = Total frequency

$\bar{X}$ = Arithmetic mean

S.E = Standard error

C.V = Coefficient of variation

as expected for any quantitative character. The range of variation in either of the parents is much less. The F_2 mean is slightly higher than the parental means; but, however, it approximates more close to the arithmetic mean than the geometric mean of the parental values. The variation of F_2 can also be seen to be continuous. A few F_2 plants have values similar to those of the parents, thus indicating the recovery of parental types in respect of this character in the F_2 generation. However, the intermediate types which are nearer to the parental mean are more numerous than the extreme types.

Spread of plants

Table V presents the results.

One of the parents, Solanum melongena var. insanum has almost double the spread of the other parent (Plate I). Morphologically the insanum plants are spreading type. The F_2 mean is found to be in between the parental values and is approaching the arithmetic mean of the parents. However the range of variation for F_2 plants (Plates II and III A) is much greater as compared to the parents, as indicated by the coefficients of variation and the spread of the histograms (Fig. III). The F_2 gives a negatively skewed

TABLE V

Frequency distribution of the spread of the plants (in cms) of parental and F_2 generations

	Classes	60.5 75.5	75.5 90.5	90.5 105.5	105.5 120.5	120.5 135.5	135.5 150.5	150.5 165.5	165.5 180.5	180.5 195.5	195.5 210.5	N	$\bar{X}$	S.E	C.V
PLD		4	6	10	..	..	..	..	..	..	..	20	87.50	1.73	8.90
F_2		..	3	53	97	51	32	13	1	3	..	253	119.80	1.10	15.83
Insanum		..	..	..	2	4	3	4	4	2	1	20	156.13	3.64	10.31

Arithmetic mean of the parental values = 121.81

Geometric mean of the parental values = 116.80

N = Total frequency

$\bar{X}$ = Arithmetic mean

S.E = Standard error

C.V = Coefficient of variation

distribution around the mean which approximates the arithmetic mean of the parents as may be seen from the graphical representation (Fig. III). The variation in F_2 is continuous and there is recovery of parental types among the segregants. The intermediate types appear more frequently than the extreme types.

Number of branches

The results are tabulated, classified and presented in Table VI.

Morphologically the parent, *Solanum melongena* var. *insanum* is bushy having high branching nature while the other parent, *S. melongena* var. PLD is erect and sparsely branching. The parental means are 83.00 and 30.50 respectively. The F_2 segregants appear to have an intermediate value of 54.94 as their mean. The F_2 mean approximates the arithmetic mean of the parental values better than the geometric mean. The range of variation exhibited by the F_2 plants, as indicated by the coefficients of variation and the spread of the histograms (Fig. IV), is much high. The range even surpasses the parental extremes in a few cases showing a slight tendency towards transgressive segregation on either side (Plates II and IIIA). The variation in F_2 appears to be continuous. Parental types are recovered with intermediate types having the maximum frequencies. The frequency curve approximates normal

TABLE VI

Frequency distribution for the number of branches of the parental and F_2 generations

Classes	15 24	25 34	35 44	45 54	55 64	65 74	75 84	85 94	95 104	105 114	N	$\bar{X}$	S.E	C.V
PLD	..	18	2	..	..	..	..	..	..	..	20	30.50	0.70	1.02
F_2	1	11	58	76	51	30	12	10	3	1	253	54.94	0.98	26.50
Insanus	..	..	..	..	..	3	8	9	..	..	20	83.00	1.59	8.36

Arithmetic mean of the parental values = 56.75

Geometric mean of the parental values = 50.92

N = Total frequency

$\bar{X}$ = Arithmetic mean

S.E = Standard error

C.V = Coefficient of variation

distribution around the parental mean as the arithmetic mean of the distribution. This is typical of the segregation of quantitative characters.

Number of flowers

a) Long and medium styled flowers

Data are presented in Table VII.

The parents, *Solanum melongena* var. PLD and *S. melongena* var. *insanum* have the mean production of 45 and 63 long and medium styled flowers respectively. The F_2 segregants have the mean production of 59.03 long and medium styled flowers during the same period under observation which is slightly more than the arithmetic mean of the parental values. However the coefficient of variation and the spread of the histogram suggests wide range of variation for F_2 as compared to the parents. A few F_2 plants have the same production capacity as that of the parents. The variation of F_2 in respect of this character appears to be continuous with extreme types represented in lesser frequencies and intermediate types in comparatively higher frequencies. A few plants are observed to be thrown out beyond the extreme values represented by the parents. The distribution as presented in Fig. V is typical to that of an F_2 population for a quantitative character.

TABLE VII

Frequency distribution for the number of long and medium styled flowers produced by the parental and F_2 generations

Classes	10 19	20 29	30 39	40 49	50 59	60 69	70 79	80 89	90 99	100 109	N	$\bar{X}$	S.E	C.V
PLD	..	1	1	15	3	..	..	..	..	..	20	45.00	1.40	14.04
F_2	2	2	17	42	71	65	38	14	1	1	253	59.03	0.89	24.12
Insanum	..	..	1	2	1	12	4	..	..	..	20	63.00	2.38	16.33

Arithmetic mean of the parental values = 54.00

Geometric mean of the parental values = 53.15

N = Total frequency

$\bar{X}$ = Arithmetic mean

S.E = Standard error

C.V = Coefficient of variation

(b) *Short styled flowers*

Table VIII presents the progeny distribution for the short styled flowers of the parents and F_2 generation.

The parent, *Solanum melongena* var. *insanum* produces comparatively lesser number of short styled flowers with a mean of 17, while the *S. melongena* var. PLD produces slightly more than the double, viz, 34.85. The results obtained indicate that the F_2 plants have a mean production of 35.32 short styled flowers which is slightly more than that of the better parent. The range of variation of F_2 as indicated by the coefficient of variation is considerably high. The pattern of segregation shows one sided transgression and the frequency distribution exhibits a positively skewed distribution. However the variation exhibited by the F_2 generation is continuous with extreme values represented less frequently and intermediate types more frequently.

The percentage of short styled flowers to the total number of flowers is worked out for the parental and segregating generations and presented in the Table IX. The Fig. VI shows the graphical representation of the percentage of short styled flowers produced by the parents and their F_2 segregants.

TABLE VIII

Frequency distribution for the number of short styled flowers produced by the parental and F_2 generations

Classes	14 20	21 27	28 34	35 41	42 48	49 55	56 62	63 69	70 76	N	$\bar{X}$	S.E	C.V
FLD	..	..	9	11	..	..	..	..	..	20	34.85	0.77	10.04
F_2	10	34	86	75	23	17	3	4	1	253	35.32	0.61	27.35
Insanum	19	1	..	..	..	..	..	..	..	20	17.05	0.31	8.23

Arithmetic mean of the parental values = 25.95

Geometric mean of the parental values = 24.38

N = Total frequency

$\bar{X}$ = Arithmetic mean

S.E = Standard error

C.V = Coefficient of variation

TABLE IX

Frequency distribution for the percentage of short styled flowers of the parental and F_2 generations

Classes	18.5 21.5	21.5 24.5	24.5 27.5	27.5 30.5	30.5 33.5	33.5 36.5	36.5 39.5	39.5 42.5	42.5 45.5	45.5 48.5	48.5 51.5	51.5 54.5	N	$\bar{X}$	S.E	C.V
PLD	..	..	..	..	..	..	..	6	10	4	..	..	20	43.70	0.47	4.80
F_2	..	4	5	16	34	49	59	48	23	10	3	2	253	37.30	0.34	14.50
Insanum	7	9	4	..	..	..	..	..	..	..	..	..	20	22.55	0.48	9.62

Arithmetic mean of the parental values = 33.13

Geometric mean of the parental values = 30.11

N = Total frequency
$\bar{X}$ = Arithmetic mean
S.E = Standard error
C.V = Coefficient of variation

Number of fruits harvested

The results are presented in Table X.

The means of the number of the fruits harvested from the parents *Solanum melongena* var. PLD and *S. melongena* var. *insanum* are found to be 34.5 and 52.0 respectively while the mean of the F_2 plants is recorded as 44.6. This agrees with the arithmetic mean of the parental values within the limits of error. The range of variability in the F_2 is considerably high as compared to the low variability in the parents as shown by the coefficient of variation. The pattern of segregation shows transgressive segregation on either directions (Fig. VII). The variation is also continuous with maximum frequencies for the intermediate types and a few F_2 individuals agree with the parental values suggestive of the quantitative nature of inheritance of the character.

Percentage of fruit set

Data pertaining to the percentage of fruit set is furnished in Table XI.

Eventhough the range of variation appears to be very narrow for the parents, the F_2 shows a very wide range of variation. The magnitude of variation is indicated by a comparison of coefficients of variation. Some of the F_2 plants appear to have values

TABLE X

Frequency distribution for the number of fruits harvested per plant from the parental and F_2 generations

Classes	1 10	11 20	21 30	31 40	41 50	51 60	61 70	71 80	81 90	N	$\bar{X}$	S.E	C.V
PLD	..	1	2	14	3	..	..	..	..	20	34.5	1.403	10.39
F_2	1	5	21	65	81	49	27	3	1	253	44.6	0.709	28.52
Insanum	..	..	..	1	7	9	3	..	..	20	52.0	1.731	15.02

Arithmetic mean of the parental values = 43.25
Geometric mean of the parental values = 42.38

N = Total frequency
$\bar{X}$ = Arithmetic mean
S.E = Standard error
C.V = Coefficient of variation

TABLE XI

Frequency distribution for the percentage of fruit set of the parental and F_2 generations

Classes	22.5 25.5	25.5 28.5	28.5 31.5	31.5 34.5	34.5 37.5	37.5 40.5	40.5 43.5	43.5 46.5	46.5 49.5	49.5 52.5	52.5 55.5	55.5 58.5	58.5 61.5	61.5 64.5	64.5 67.5	Total frequency
PLD	..	..	..	..	..	1	14	5	..	..	..	..	..	..	..	20
F_2	1	3	4	1	13	15	24	36	57	44	27	18	5	5	..	253
Insanum	..	..	..	..	..	..	..	..	..	..	..	..	4	8	8	20

	PLD	F_2	Insanum
Arithmetic mean	42.6	47.5	63.0
Standard error	0. 34	0.42	0.50
Coefficient of variation	3.61	14.34	3.69

Arithmetic mean of the parental values = 52.80

Geometric mean of the parental values = 52.05

beyond the lower limit of variation exhibited by the less bearing parent suggesting one sided transgression. Yet, the variation is continuous with intermediate types having maximum frequencies and extreme classes less frequencies. The F_2 mean is less than both arithmetic mean and geometric mean of the parents. Some of the F_2 plants represent parental types. These facts suggests the quantitative nature of inheritance. The figure VIII shows the graphical representation of the F_2 segregation.

Fruit size

a) Length of the fruits

The table XII represents the tabulated and classified data.

The pertinent difference between the parental types can be seen most readily in a comparison of their respective means. *Solanum melongena* var. PLD is characterised by almost cylindrical, elongated fruits having a mean length of 25.8 cms. Small globose shape is characteristic to *S. melongena* var. *insanum*. The mean fruit length of the wild parent is found to be 3.7 cms with very narrow range of variation. The data obtained show much small F_2 means, viz. 7.2 cms which is considerably less than the arithmetic mean and geometric mean of the parental values. None of the F_2 plants show a greater fruit length than 14.05 cms which is slightly

TABLE XII

Frequency distribution for fruit length (in cms) of parental and F_2 generations

Classes	2.55 - 3.55	3.55 - 4.55	4.55 - 5.55	5.55 - 6.55	6.55 - 7.55	7.55 - 8.55	8.55 - 9.55	9.55 -10.55	10.55 -11.55	11.55 -12.55	12.55 -13.55	....	21.55 -22.55	22.55 -23.55	23.55 -24.55	24.55 -25.55	25.55 -26.55	26.55 -27.55	27.55 -28.55	28.55 -29.55	29.55- 30.55	30.55 -31.55	31.55-32.55	N	$\bar{X}$	S.E	C.V
PM	7	13	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.	.	20	2.7	0.10	13.0
F_2	.	2	29	84	44	28	11	6	4	3	1		.	.	.	.	.	.	.	.	.	.	.	253	7.2	0.12	26.3
Insanam	.	.	.	.	.	.	.	.	.	.	.		3	1	1	5	3	2	2	.	1	1	1	20	26.8	0.62	11.0

Arithmetic mean of the parental values = 14.75

Geometric mean of the parental values = 9.77

N = Total frequency

$\bar{X}$ = Arithmetic mean

S.E = Standard error

C.V = Coefficient of variation

more than half of that of the cultivar (Plate III B). The fruit length ranges down to 3.55 cms and some of the plants overlap with the insanum parent. There is, therefore, no recovery of the other parental type among the F_2 population. As against the narrow range of variation exhibited by the parents, the F_2 population shows a wide range of variation as indicated by the coefficient of variation. The variation also seems to be continuous within its range. The distribution appears to be negatively skewed rather than to be symmetrial.

(b) Girth of the fruits

The results are tabulated in Table XIII.

The data presented show a segregation almost typical to F_2 population for quantitative characters. The parents Solanum melongena var. PLD and S. melongena var. insanum have the mean fruit girth of 10.95 cms and 7.05 cms respectively. The mean of F_2, viz, 9.40 cms is intermediate between the parental values (Plate III B) and approximates more closely to the arithmetic mean than to the geometric mean. The F_2 is appreciably more variable than either of the parents as shown by the coefficients of variation and by the spread of the histograms presented as Fig. IX. The extreme measurements in the F_2 overlap well into the distribution of parental values. The intermediate types are more numerous

TABLE XIII

Frequency distribution for the girth of the fruits (in cms) of the parental and F_2 generations

	Classes	5.25 6.00	6.00 6.75	6.75 7.50	7.50 8.25	8.25 9.00	9.00 9.75	9.75 10.50	10.50 11.25	11.25 12.00	12.00 12.75	12.75 13.50	N	$\bar{X}$	S.E	C.V
PLD		..	..	..	..	..	..	3	12	5	..	..	20	10.95	0.10	4.25
F_2		..	1	14	28	52	72	50	21	12	2	1	253	9.40	0.07	12.34
Insanum		2	3	10	5	..	..	..	..	..	..	..	20	7.05	0.15	9.53

Arithmetic mean of the parental values = 9.00

Geometric mean of the parental values = 8.75

N = Total frequency
$\bar{X}$ = Arithmetic mean
S.E = Standard error
C.V = Coefficient of variation

than the extreme types which are less frequently represented. The variation appears to be continuous within its range.

(c) Volume of the fruits

Data relating to the volume of the fruits is presented in Table XIV.

The parental means are found to represent the extreme values, the cultivar having a mean of 80.08 ml and wild variety 24.20 ml. The F_2 population appears to have a mean (30.04 ml) much nearer to that of the insanum parent. The range of variation of F_2 plants is greater as compared to the parents, as suggested by the coefficients of variation and the spread of the histogram in Fig.X. While some of the F_2 plants overlap well into the values of insanum parent none of the segregants represent the other parental values. Within its range of variation the F_2 distribution is continuous and the distribution appears to be negatively skewed rather than symmetrical.

(d) Total weight of the fruits harvested per plant

The summary of the results of the weight in grams of the fruits harvested per plant are represented in Table XV.

The data presented reveal that the F_2 mean (934 gms) is intermediate between the parental means, viz, 1122 gms for MD

TABLE XIV

Frequency distribution for the volume of the fruits (in ml) for the parental and F_2 generations

	Classes	9.5 16.5	16.5 23.5	23.5 30.5	30.5 37.5	37.5 44.5	44.5 51.5	51.5 58.5	58.5 65.5	65.5 72.5	72.5 79.5	79.5 86.5	86.5 93.5	93.5 100.5	N	$\bar{X}$	S.E	C.V
PLD		..	..	..	..	..	..	..	..	..	2	2	11	5	20	89.65	1.34	6.71
F_2		10	59	89	49	27	9	7	3	1	2	..	..	..	258	30.04	0.66	35.02
Insanum		2	4	14	..	..	..	..	..	..	..	..	..	..	20	24.20	1.03	10.38

Arithmetic mean of the parental values = 56.92

Geometric mean of the parental values = 46.57

N = Total frequency
$\bar{X}$ = Arithmetic mean
S.E = Standard error
C.V = Coefficient of variation

TABLE XV

Frequency distribution for total weight of the fruits harvested (in gms) for the parental and F_2 generations

Classes	200 350	350 500	500 650	650 800	800 950	950 1100	1100 1250	1250 1400	1400 1550	1550 1700	1700 1850	1850 2000	2000 2150	N	$\bar{X}$	S.E	C.V
PLD	..	..	..	..	3	7	6	2	2	..	..	..	..	20	1122	38.33	15.37
F_2	2	18	32	52	40	33	31	14	13	9	6	2	1	253	934	21.87	37.20
Insanum	..	1	8	9	2	..	..	..	..	..	..	..	..	20	710	24.33	15.44

Arithmetic mean of the parental values = 916

Geometric mean of the parental values = 893

N = Total frequency
$\bar{X}$ = Arithmetic mean
S.E = Standard error
C.V = Coefficient of variation

and 710 gms for *insanum*. It agrees well with the arithmetic mean (within the limits of error) of the parental values. Within each parental lines, however, there is some variability. But the F_2 is appreciably more variable as indicated by the coefficients of variation and the spread of the histograms (Fig. XI). Also the F_2 variation appears to be continuous. There is a slight tendency for one sided transgression and the curve of distribution appears to be skewed and not symmetrical around the mean of the parents. The intermediate classes by far include the largest number of individuals while the extreme classes are less frequently represented. Some F_2 individuals are seen to overlap with the parental values suggesting that the parental types have been recovered in the F_2 generation.

(e) Fruit size index

A comparison of fruit size index (taken as length x girth) of the parental and F_2 means reveals that the arithmetic mean of the parental values is 154.29, the geometric mean of the parental values is 83.93 and the F_2 mean fruit index is 67.68. The F_2 mean value is considerably less and it agrees neither with the arithmetic mean nor with the geometric mean of the parents.

Time of flowering

Data are summarised in Table XVI.

TABLE XVI

Frequency distribution for earliness in flowering (number of days from sowing to flowering) of parental and F_2 generations

Classes	65 67	68 70	71 73	74 76	77 79	80 and beyond	N	$\bar{X}$	C.V
PLD	..	..	3	6	7	4	20	76.80	3.75
F_2	3	28	81	51	12	10	253	75.55	4.33
Insanum	2	2	11	5	..	..	20	71.85	1.13

Arithmetic mean of the parental values = 74.33
Geometric mean of the parental values = 74.27

N = Total frequency
$\bar{X}$ = Arithmetic mean
C.V = Coefficient of variation

Eventhough the F_2 mean appears to be intermediate between the parental means, it is nearer to the means of the cultiver. The observations show that there is greater variability for PLD than *insanum*., but however, the F_2 is more variable than both the parental lines as indicated by the coefficient of variation.

Leaf area

The results are tabulated, classified and presented in the Table XVII.

The cultivar parent has elliptic leaves while the wild parent is characterised by small ovate leaves. The mean leaf areas are found to be 208.20 sq. cms and 58.05 sq.cms respectively. The F_2 mean is intermediate, but is seen to be more close to the lower parental value and is considerably less than the arithmetic mean and geometric mean of the parental values. But the range of variation observed among the F_2 segregants is considerably high when compared to the parents as indicated by the coefficient of variation. However the segregation is found to be continuous. It appears that among the F_2 segregants none of the progeny resembles the PLD parent in respect to this character while many overlap with the other parental values. Eventhough the distribution presents a negatively skewed curve, there is evidence to consider that the character is quantitatively inherited.

Germination capacity of F_3 seeds

The results are presented as Table XVIII.

TABLE XVII

Frequency distribution for the leaf area (in sq. cm) of the parental and F_2 generations

	Classes	35.5 50.5	50.5 65.5	65.5 80.5	80.5 95.5	95.5 110.5	110.5 125.5	125.5 140.5	140.5 155.5	155.5 170.5	170.5 185.5	185.5 200.5	200.5 215.5	215.5 230.5	230.5 245.5	Total frequency
PLD		..	..	..	..	..	..	..	..	..	1	4	6	8	1	20
F_2		10	52	72	60	37	11	6	4	1	..	..	..	..	..	253
Insanum		3	13	4	..	..	..	..	..	..	..	..	..	..	..	20

	PLD	F_2	Insanum
Arithmetic mean	208.20	81.55	58.05
Standard error	0.93	1.33	1.18
Coefficient of variation	7.33	26.12	9.08

Arithmetic mean of the parental values = 133.12
Geometric mean of the parental values = 109.80

TABLE XVIII

Frequency distribution for the germination capacity (in %) for the parental and F_2 generations

Classes	67.5 70.5	70.5 73.5	73.5 76.5	76.5 79.5	79.5 82.5	82.5 85.5	85.5 88.5	88.5 91.5	N	$\bar{X}$	S.E	C.V
PLD	..	..	..	..	3	2	15	..	20	85.80	0.49	2.57
F_2	5	23	46	77	69	24	3	6	253	78.51	0.25	3.19
Insanum	..	..	..	2	13	4	1	..	20	81.60	0.45	2.50

Arithmetic mean of the parental values = 83.70
Geometric mean of the parental values = 83.68

N = Total frequency
$\bar{X}$ = Arithmetic mean
S.E = Standard error
C.V = Coefficient of variation

The cultivar parent *Solanum melongena* var. PLD show slightly more germination capacity than the wild parent, *S. melongena* var. *insanum*., but the F_2 has a still less mean germination capacity. However, the F_2 generation show a wide range of variation as indicated by the coefficient of variation while the parental lines are considerably less variable. Among F_2 the intermediate types appear more frequency than the extreme types.

II Qualitative characters

Colour of the stem

The stem colour of the parents *Solanum melongena* var. PLD and S. *melongena* var. *insanum* is green with purple pigmentation. Among the F_2 segregants a few plants were intensely purple while most of them were green with purple pigmentation. A few plants were also green without purple pigmentation.

Presence or absence of spines

The cultivar is devoid of spines while the wild variety is armed with spines. In the F_2 , out of 253 plants 71 were found to be without spines and the rest with spines. This is roughly approximating to 3:1 segregation as shown in Table XIX.

Table XIX showing the χ^2 test of goodness of fit

Phenotype	Observed frequency O	Expd: frequency E	$d = O-E$	χ^2
Spineless	71	63	+ 8	1.01
Spined	182	190	- 8	0.34

While the *insanum* parent is intensely spined, the intensity of the spines on the leaf and stem of the F_2 segregants, as indicated by the number of spines, vary widely. Some of the F_2 plants were found to have as many as 12 spines on the leaves while some were found to possess only 3 to 4 spines.

Fruit shape

While Solanum melongena var. PLD has an elongated more or less cylindrical fruit, *insanum* has almost round, small, globose type of fruits. The maximum size of the fruit yielded by the F_2 segregants is slightly less than half of the fruit of PLD. These fruits are found to be almost cylindrical with tapering apex (more or less oblong) (Plate VII B). Shape of the fruits varied from this extreme to the globose type with all intermediaries appearing.

Fruit colour

The colour of the fruits of *Solanum melongena* var. PLD is deep purple while *S. melongena* var. *insanum* has fruits with green checks half way from top and the rest is white. Among the F_2 segregants fruit with deep purple, purple, light purple, light purple with green check pattern, green checks like that of the wild parent etc. appeared of which light purple with green in alternate bands giving a check pattern was far more numerous than the others. Even within the purple, the colour intensity seems to vary to some extent.

III *Wilt disease resistance*

Of the 150 F_2 plant subjected to artificial epiphytotics 39 plants were found to succumb to the wilt disease. This is approximately $\frac{1}{4}$th of the total population as can be seen in Table XX.

Table XX showing the χ^2 test of goodness of fit

Phenotype	Obs:fre: O	Expd:fre: E	d = O-E	χ^2
Susceptible	39	37.5	1.5	0.06
Resistant	111	112.5	-1.5	0.02
	150	150	..	0.08

However the plants succumbed to the disease at different stages of their growth.

All the cultivar parent subjected to epiphytotics showed the symptoms of the disease while none of the wild parent was affected by the disease.

IV Chemical studies

Table XXI presents the segregation for protein content in the selected F_2 plants.

The parents, Solanum melongena var. PLD and S. melongena var. insanum are found to have a mean of 1.810% and 2.90% of protein. The F_2 mean is intermediate between the parental values. It appears that the F_2 generation is more variable than the parental plants as indicated by the coefficient of variation. The variation also seems to be continuous within the range. None of the segregants has similar values as that of the insanum parent. However, some F_2 plants have similar values as that of the other parent. This indicates that types similar to the insanum parents are not recovered while the other parental types are represented among the segregants. The distribution shows that the intermediate types appear more frequently than the extreme types.

V Cytological studies

Pollen sterility

The results are tabulated and presented in TableXXII.

TABLE XXI

Frequency distribution for the protein content (in %) of the parental and F_2 generations

	Classes	1.65 1.75	1.75 1.85	1.85 1.95	1.95 2.05	2.05 2.15	2.15 2.25	2.25 2.35	2.35 2.45	2.45 2.55	2.55 2.65	2.65 2.75	2.75 2.85	2.85 2.95	N	$\bar{X}$	S.E	C.V
PLD		2	7	1	..	..	..	..	..	..	..	..	..	..	10	1.810	0.017	4.65
F_2		..	3	1	6	6	15	9	3	4	3	..	..	..	50	2.212	0.027	8.86
Insanum		..	..	..	..	..	..	..	..	..	1	1	5	3	10	2.900	0.028	3.09

Arithmetic mean of the parental values = 2.355
Geometric mean of the parental values = 2.291

N = Total frequency

$\bar{X}$ = Arithmetic mean

S.E = Standard error

C.V = Coefficient of variation

TABLE XXII

Frequency distribution for pollen sterility (in %) of parental and F_2 generations

Classes	2.5 5.5	5.5 8.5	8.5 11.5	11.5 14.5	14.5 17.5	17.5 20.5	20.5 23.5	23.5 26.5	26.5 29.5	N	$\bar{X}$	S.E	C.V
PLD	1	4	8	2	4	..	1	..	..	20	12.70	1.14	40.15
F_2	2	6	26	19	23	32	87	45	13	253	19.13	0.34	29.17
Insanum	..	..	3	3	6	6	2	..	..	20	16.15	0.80	22.33

Arithmetic mean of the parental values = 14.43
Geometric mean of the parental values = 14.32

N = Total frequency
$\bar{X}$ = Arithmetic mean
S.E = Standard error
C.V = Coefficient of variation

Pollen sterility of the parents, *Solanum melongena* var. PLD and *S. melongena* var. *insanum* ranges from 2.5% to 23.8% and from 8.5% to 23.5% respectively. Some of the F_2 plants show a high pollen sterility as 29.5% while the F_2 mean is 19.13% which is slightly more than the arithmetic mean of the parental values. Fig. XII shows the graphical representation.

Pollen size

There seems to be no difference in the size of the pollen of the parents and the F_2 segregants, all of them falling within the range from 23.60 to 30.10 μ.

Studies on pollen mother cells

The meiotic behaviour of chromosomes of the F_2 individuals whose pollen mother cells were studied, was found to be normal. There was normal pairing of the homologous chromosomes and 12 bivalents were formed at pachytene. During anaphase I homologous chromosomes separated in 12 by 12. The behaviour of the parents were also found to be normal at meiosis.

DISCUSSION

DISCUSSION

The results of the observations of the parents, viz, *Solanum melongena* var. PLD and *Solanum melongena* var. *insanum* and the F_2 progenies have been analysed and presented. What remains now is to discuss briefly the results in order to interpret the data to draw valid conclusions regarding the nature of inheritance of the characters.

The height and tap root length of the seedlings both of which contribute to the seedling size were studied in addition to the other characters. The means of the F_2 for these characters are found to be intermediate between the parental values. While the mean root length is approximately close to the geometric mean of the parental values, the mean height is more close to the arithmetic mean of the parental values. The pattern of distribution and the range of variation in the segregating generation indicate that these characters are under polygenic control and are inherited in accordance with Nilsson Ehle's theory of quantitative inheritance. The non recovery of the parental types for the character, tap root length might probably be due to the limited number of F_2 population studied.

Some of the attributes which contribute to the plant size studied are the plant height, spread and the number of branches. The mean plant height, the mean plant spread and the mean number of branches in the segregating generation are found to be intermediate between the respective parental values and are found to agree approximately with either the arithmetic mean or geometric mean of the parental values. The nature of distribution, the wider variability and the reapperance of the parental types in the F_2 generation suggest that these characters are quantitatively inherited and that they are governed by polygenic systems. This is in agreement with the views of Rao (1966); but no inhibitary action is noticed on plant height as suggested by him. Luthra (1964) claimed that the height in Nicotiana was an oligogenic character with complete dominance and Tayel *et al.* (1959) reported that tallness in tomato plants was monogenically controlled. Neither of these hypotheses are in agreement with the present findings where it is suggested that the plant height is governed by polygenes. Eventhough the segregation for the number of branches show a slight transgression towards the higher value, the distribution curve tends to be normal.

The findings with respect to the stem colour are in agreement with the study conducted by Janick and Topolesky (1963) in which stem colour appears to be controlled by complementary genes which are incompletely dominant. A distinct gradation of colour is noticed from intense purple, purple to green.

The results on the size of leaf show that the mean leaf area of the F_2 progenies is closer to that of the *insanum* parent. The insanum has smaller leaf area as compared to the other parent which has not been recovered among the segregants. However, the pattern of segregation indicates the quantitative nature of inheritance of the character. It appears that the insanum parent carries some inhibitory factors which act cumulatively on the leaf size. This observation, in general, is in accordance with the findings of Rao (1966).

Hagiwara and Iida (1938), Khan and Ramzan (1963), Capinpin et al (1963) and Narasimha Rao (1966) reported that spininess in egg plants was dominant over non-spiny nature and was monogenically inherited which is similar to the present observation and is in variance with the results obtained by Babu Rao (1965). However, the intensity of the spine is found to vary very much. This must probably be due to the action of modifiers on the gene primarily controlling the presence or absence of the spines. Similar results were recorded by Narasimha Rao (1966). According to him the variation in the intensity of spines required further study.

The flowers were classified based on the style length into long styled, medium styled and short styled. Krishnamoorthi and Subramaniam (1954) observed that out of the total flowers produced, 39% were short styled flowers. The results of the present investigation are also in agreement with this finding. They also observed that under natural conditions 27% of the flowers set fruits. The present investigation does not agree with this finding of the above authors and records a mean of 47.5% fruit set. However, the total flower production and the percentage occurrence of short styled flowers appear to be governed by polygenes. The arithmetic means of the F_2 generation for these characters are intermediate between the respective parental values and the distribution curves for F_2 tend to be normal. The higher variability as indicated by the higher coefficient of variation and the continuous distribution support the assumption that these characters are quantitatively inherited.

The F_1 progenies studied by Gopimony (1968) did not show significant difference in respect of pollen size and pollen sterility. The F_2 segregants do not show any difference in the pollen size. The mean pollen sterility for F_2 generation is in between the parental values, but more close to the *insanum* parent.

Observations on fruit length, girth along the centre of the fruit and volume of the fruits are recorded. In *Solanum melongena* var. PLD the fruits are long while in *S. melongena* var. *insanum* the fruits are small and globose. Gopimoney (1968) recorded F_1 plants with intermediate fruit size which are approximately close to the geometric mean of the parental values. Tatebe (1943) obtained F_2 progenies following a positively skewed curve about the geometric mean of the parents. Capinpin *et al* (1963) observed quantitative variation in fruit shape in segregating generations. In the present investigation while the F_2 mean fruit length is much less than either the geometric mean or the arithmetic mean of the parental values as opposed to the above findings, the mean F_2 value for the girth of the fruit approximates with the arithmetic mean of the parents. None of the segregants recorded the fruit length exhibited by the cultivar parent. The size seems to vary from the arithmetic mean of the parents down to the size of tho fruits of the wild parent. Similar results were recorded by Rao (1966) who explained this as due to the complementary inhibitory factors contributed by tho *insanum* parent. The cultivar parent did not possess any of these inhibitors and this was indicated by the segregation for the fruit size in the back cross studied by Rao (1966). The present observations also appear to agree with his findings. Several inhibitory factors which act cumulatively appear to inhibit the fruit in its acquiring higher fruit length. However, the variation within the limits are seen to be continuous suggestive of quantitative nature of inheritance. The non-recovery of the other parental type might appear to be due to tho insufficient number of segregants studied compared to the large number of inhibitory factors.

Tatebe (1943) reported that different genes were found to control the length and girth of the fruits. This seems to be the case in the present investigation also. The F_2 mean agrees with the arithmetic mean of the parental values for the girth of the fruits. The F_2 is appreciably more variable than either of the parents. The parental types are recovered among the F_2 progenies with the intermediate types represented more frequently. The variation is continuous. These factors suggest that the character is governed by the polygenic system.

The fruit index of the F_2 progenies is seen to be less than both the arithmetic and geometric mean of the parental values. This is not in agreement with the findings of Gorth (1914), Houghtaling (1935), Bitter (1937) and Mac Arther and Butler (1938) in tomato and Tatebe (1943) in egg plants which is probably due to the inhibitary action the *insanum* parent on the genes primarily responsible for the fruit length as mentioned earlier. Khan and Ramzan (1953) estimated 5 pairs of genes to be governing the fruit shape. In the present investigation the shape of the fruits is seen to vary from globose (similar to *insanum* parent) to almost cylindrical with all gradations in between. Therefore, it seems that the fruit shape is governed by many genes.

With regard to fruit colour Gopimoney (1968) reported that the F_1 was intermediate having fruits with purple and green. According to Nagai *et al.* (1926) the inheritance of fruit colour in brinjal was in itself complex. It appears that the inheritance of fruit colour is complex and depends on the two characteristics, the skin colour and fruit colour, as reported by Sambandam (1967). Purple, purple striped with light green, green striped and light green striped fruits appear in F_2 progenies while the purple fruit colour shows intensive variation indicating the influence of modifying genes. This observation is also in agreement with the findings of Sambandam (1967).

Gopimoney (1968) found that the F_1 plants resulted from the same parents as in the present investigation, were intermediate with regard to their protein content in the fruits. The F_2 mean is also observed to be intermediate. The distribution of the segregating progenies is continuous with wider variability. The present investigation has given an indication that the protein content of F_2 progenies is controlled by polygenic systems; but has to be confirmed by further investigations.

The number of fruits produced and the total weight of the fruits produced are seen to be governed by polygenes and inherited quantitatively. The F_2 means of the characters agree with the respective arithmetic means of the parental values. Eventhough the distribution curve for the total weight of the fruits is slightly skewed and the segregation shows a transgressive tendency, the distribution tends to be normal. The variability exhibited by the segregants is considerably high and is continuous. This is in agreement with the findings of Rao (1966). Eventhough Gopimony (1968) obtained high heterotic effects both for the number of fruits produced and for the total weight of the fruits in F_1 generation, it is not noticed in the F_2 generation to any extent.

Wilt disease resistance

The most important economic object of the study has been the study of the nature of inheritance of the resistance exhibited by the F_1 hybrids studied by Gopimony (1968), towards the wilt disease which is of very frequent occurrence in the locality. The F_1 hybrids showed resistance inspite of artificial epiphytotics suggesting the genetic resistance of the progenies. Suzuki *et al.* (1967) suggested that wilt disease resistance in egg plants was polygenically controlled. As opposed to the views of Suzuki *et al* (1964) and in agreement with the findings of Sinclair and Walker (1955) in cow pea and Cirulli and Alexander (1966) in tomato, the present investigation suggests the monogenic control of the wilt disease resistance, the resistant nature being dominant over susceptibility. The possibility of improving the cultivars by introducing resistance to wilt disease by hybridisation from the wild parent is suggested, as mentioned by Ramires (1959).

Cytological studies

In agreement with the findings of Gopimony (1968), the parents do not show any barrier for hybridisation and the genomic differentiation between the two is not high enough to produce any sterility barrier which prevent gene exchange. This is in agreement with the findings of Swaminathan (1940), Miltal and Bhaduri (1951) and Magoon et al (1962). Rao (1966) recorded high fertility in the F_2 generation involving the same wild parent. The parental varieties in the segregating generation, studied in the present investigation, show high fertility, free crossability and high recombination. These two varieties also have the same ecological preferences. These facts suggest that the wild parent need not be classed into a separate species as recorded by Linne (1806) and Roxburg (1832); but can well be considered under species, melongena assigning status of a variety as has been done by several workers like Voigt (1884), Bentham and Hooker (1885) and Hanes (1922).

SUMMARY

SUMMARY

The present investigation was carried out in the Division of Agricultural Botany, Agricultural College and Research Institute, Vellayani with a view to assess the mode of inheritance of certain characters in the hybrid between the cultivar, PID and the wild variety, insanum of Solanum melongena L. with special reference to resistance to wilt disease. A detailed study of 25 characters of 253 F_2 generation plants along with their parents was carried out. Separate studied were made for assessing the mode of inheritance of the resistance towards wilt disease.

Of the characters studied seedling size, plant height and spread, number of branches, leaf size, flower production, fruit size, number of fruits produced, total weight of the fruits and the protein content of the fruits are found to be quantitatively inherited and appear to be under the control of polygenic systems. However, the action of inhibitary factors which influence the fruit length and leaf size is also observed.

The stem colour and fruit colour are seen to be governed by oligogenes. The fruit colour, however, appears to be affected by both the skin and flesh colour of the fruits.

The present study also reveals that the spininess in egg plants is monogenically inherited, spininess being dominant over nonspiny

nature. The action of the modifying genes is also indicated.

The monogenic control of the resistance to wilt disease in egg plants is also revealed by the present investigation.

The finding that the resistance to wilt disease shown by the wild parent is simply inherited and is controlled by a single gene; the resistance towards the disease being dominant over susceptibility, is of great economic importance. The present investigation also reveals that there is no barrier in hybridising the cultivar with the wild parent which carries the gene for wilt disease resistance, as evidenced by high fertility, frequent recombination and free gene exchange. There is, therefore, immense scope for improving the cultivars of egg plants by incorporating the gene for wilt resistance through hybridisation with this wild parent and by a series of back crosses with the cultivars.

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* Original not seen

ILLUSTRATIONS

Fig. I Histogram showing the distribution of height of seedlings of parents and the F_2 hybrids.

Fig. II Histogram showing the distribution of height of F_2 and parent plants.

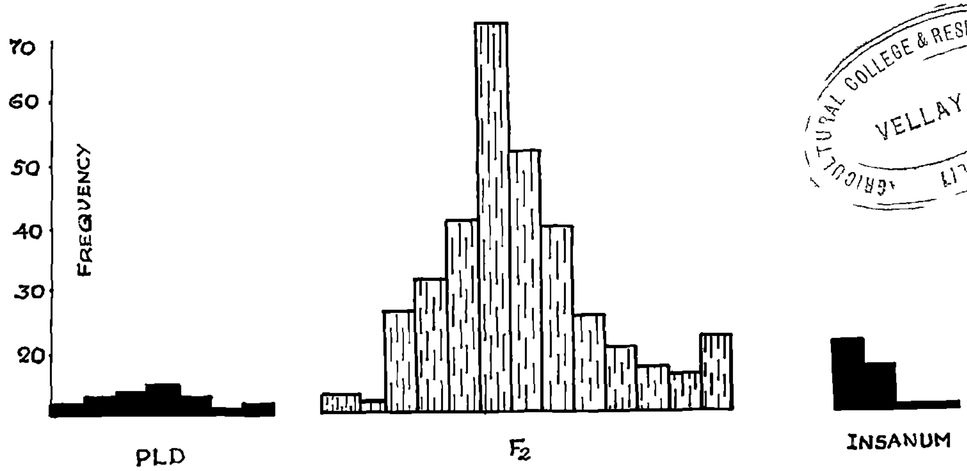

70
60
50
40
30
20
FREQUENCY
PLD
F2
INSANUM

FIG I

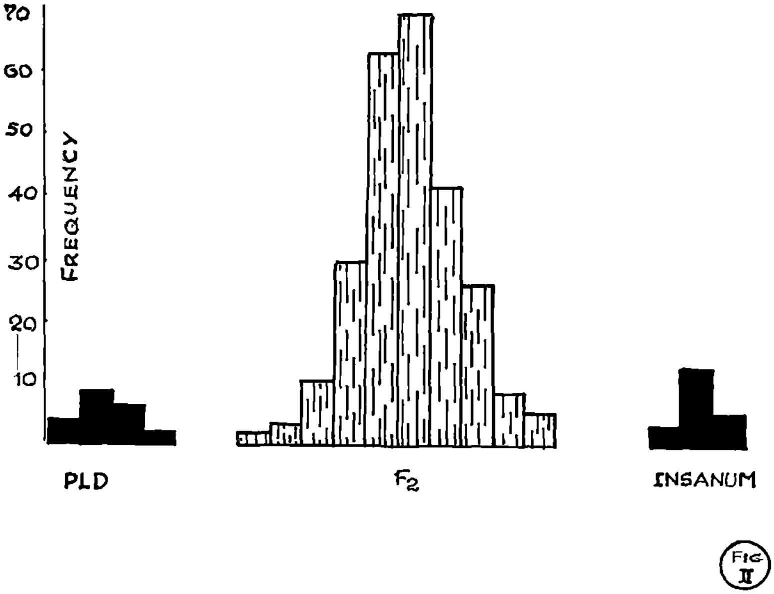

70
60
50
40
30
20
10
FREQUENCY
PLD
F2
INSANUM

FIG II

Fig. III Histogram showing the spread of the F_2 and the parents.

Fig. IV Histogram showing the number of branches of the F_2 and the parents.

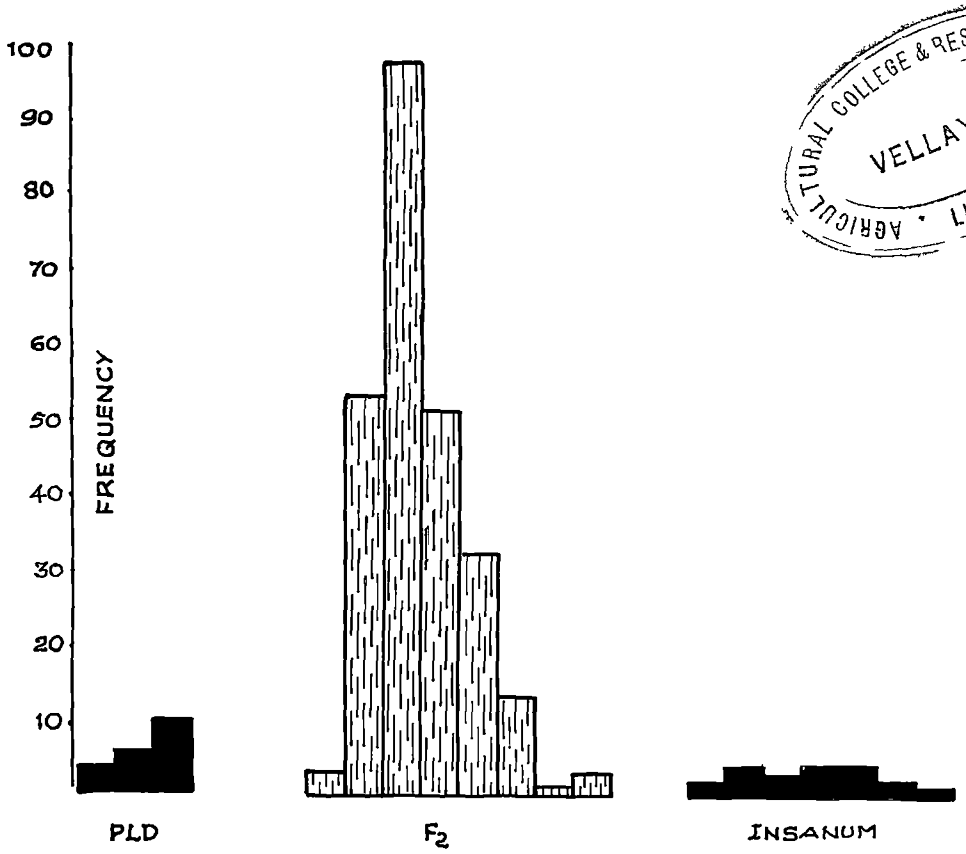


FIG III

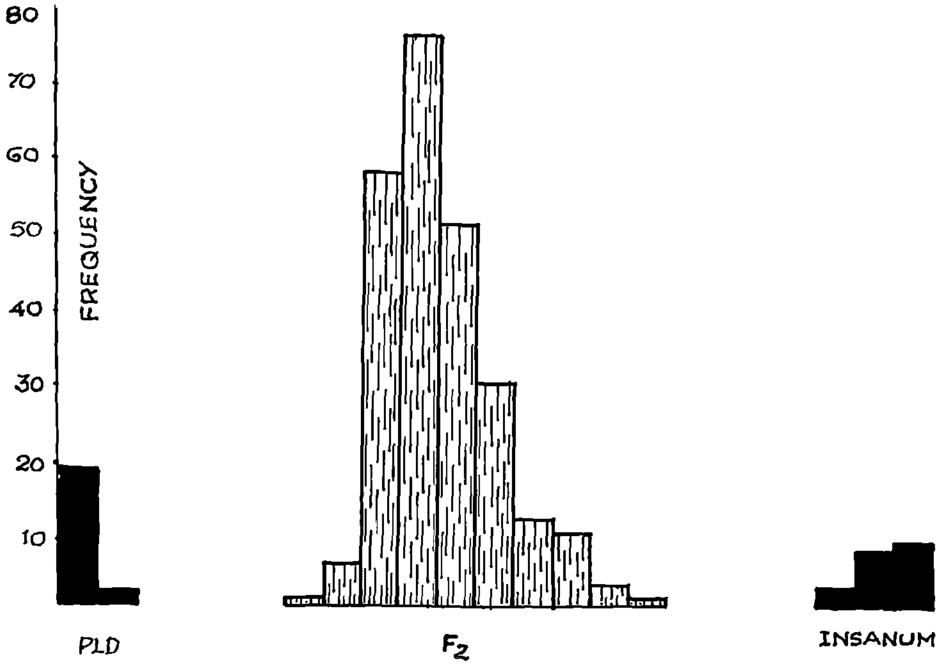
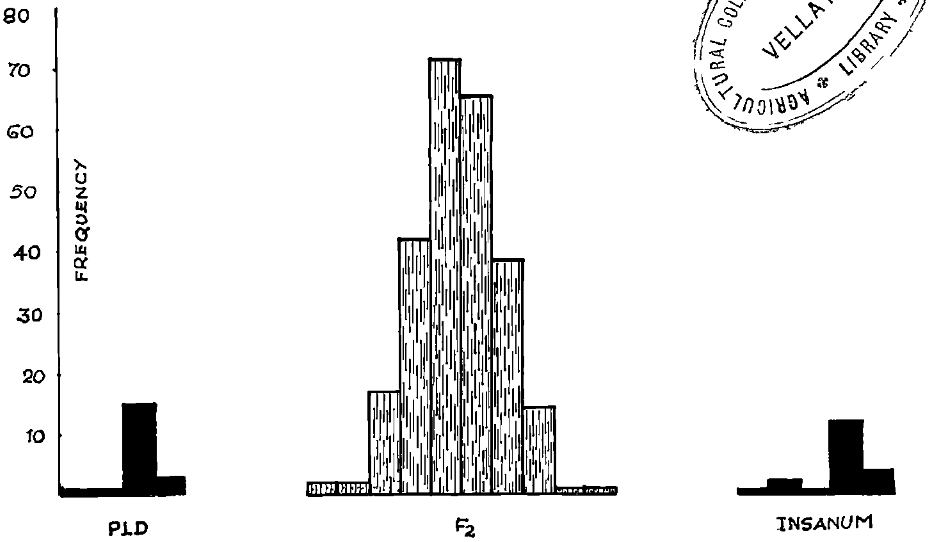


FIG IV

Fig. V Histogram showing the number of long and medium styled flowers produced by the F_2 and parents.

Fig. VI Histogram showing the percentage of the short styled flowers produced by the F_2 and parents.


80
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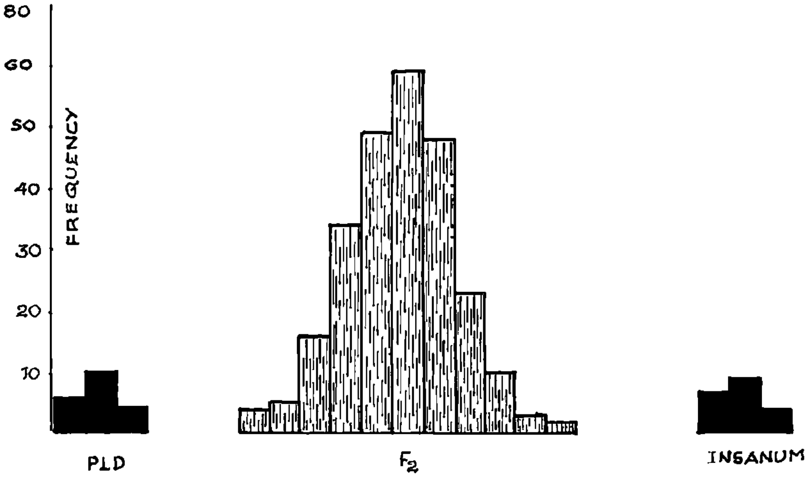
40
30
20
10
FREQUENCY
PLD
F₂
INSANUM

FIG V


80
60
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30
20
10
FREQUENCY
PLD
F₂
INSANUM

FIG VI

FIG. VII

Histogram showing the number of fruit produced by the F_2 and the parents.

(10)

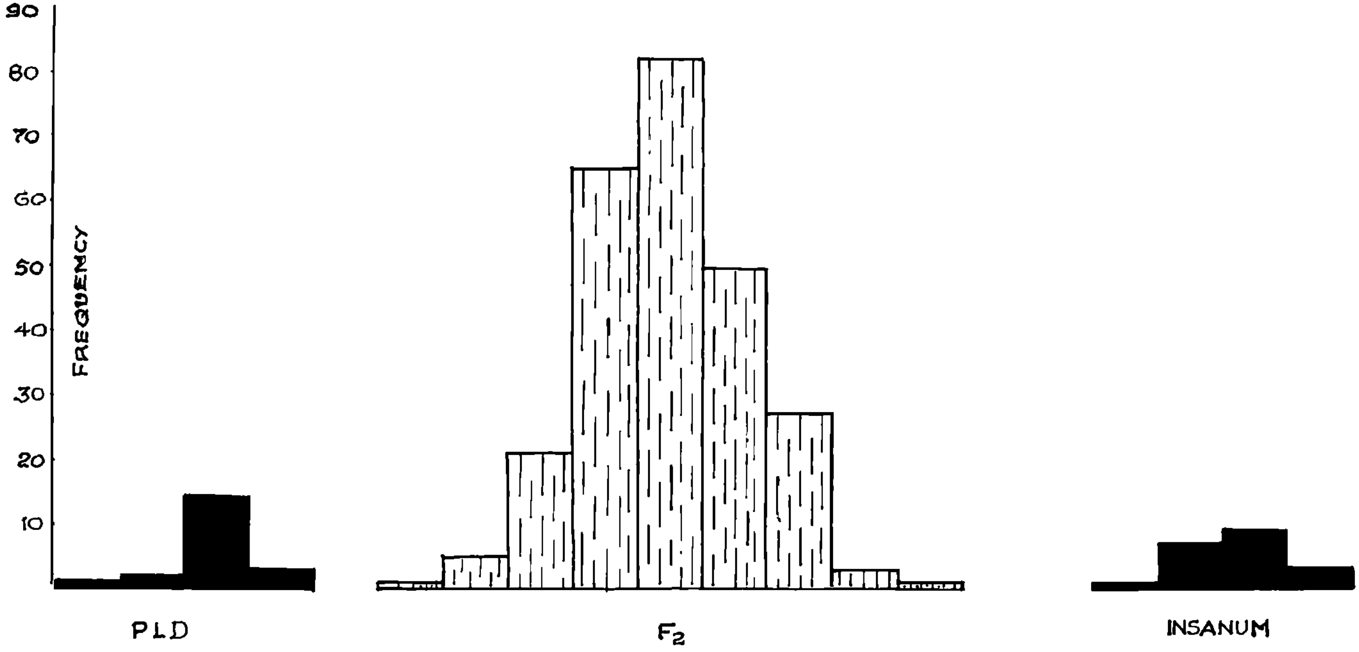


Fig. VIII Histogram showing the percentage of the fruit set of the F_2 and parents.

Fig. XII Histogram showing the pollen sterility of the F_2 and parents.

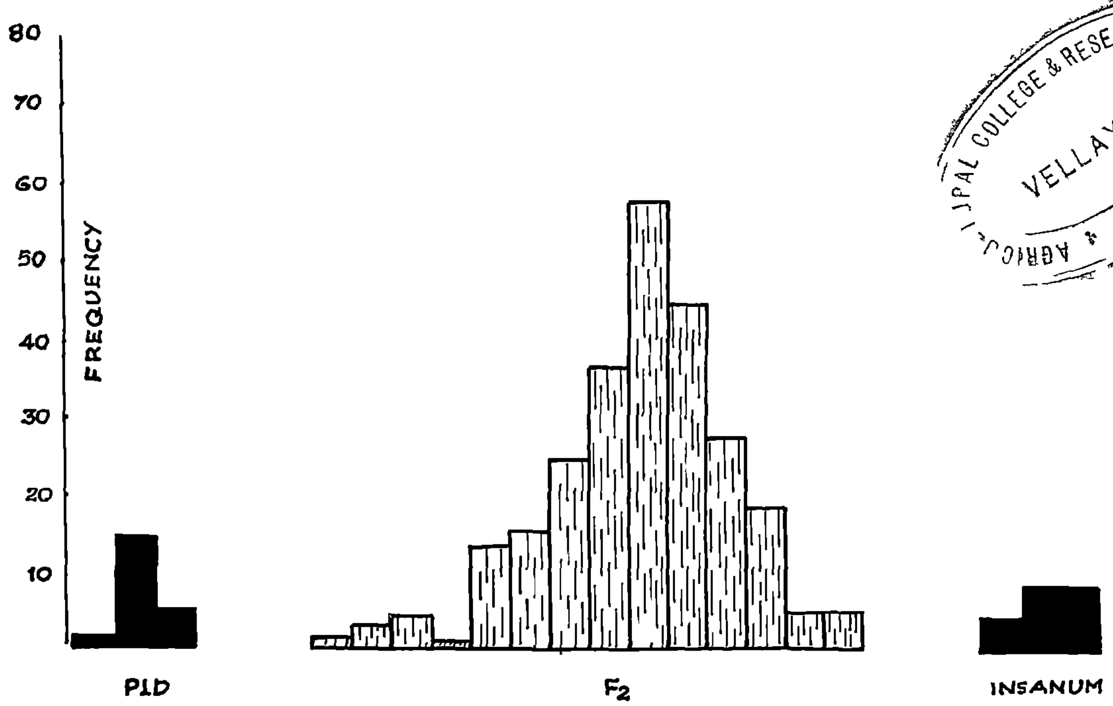


FIG VIII

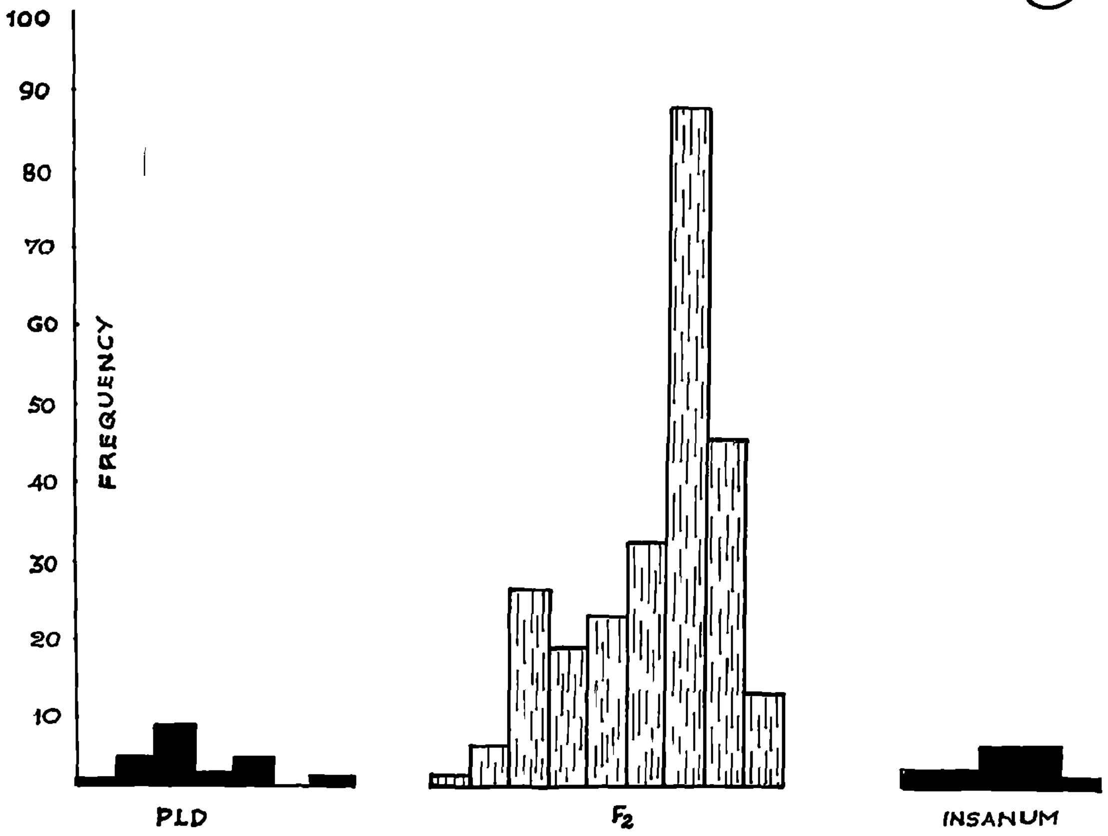
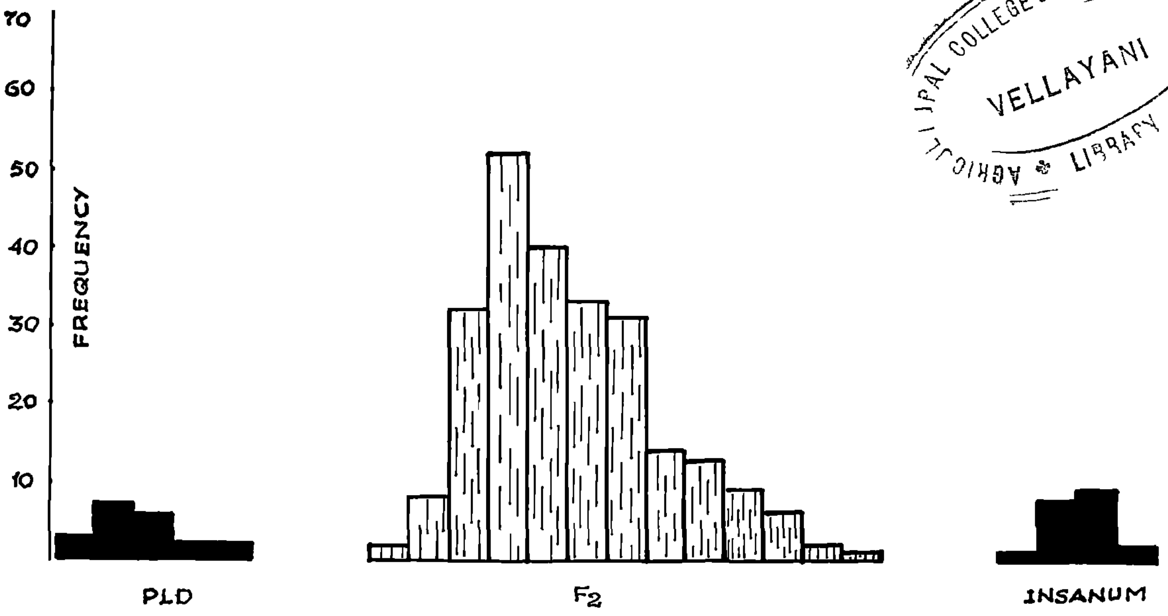


FIG XII

Fig. XI Histogram showing the total weight of the fruits produced by the F_2 and parents.

Fig. IX Histogram showing the girth of the fruits of the F_2 and parents.


70
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20
10
FREQUENCY
PLD
F₂
INSANUM

FIG XI

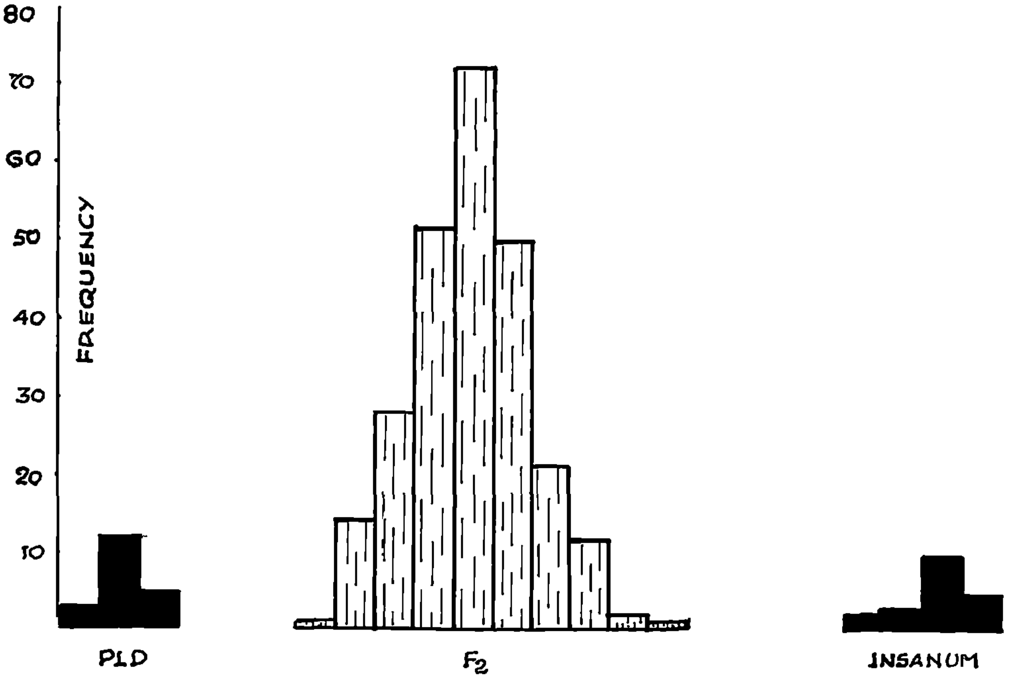
80
70
60
50
40
30
20
10
FREQUENCY
PLD
F₂
INSANUM

FIG IX

Fig. X   Histogram showing the volume of the fruits produced by the F_2 and parents.

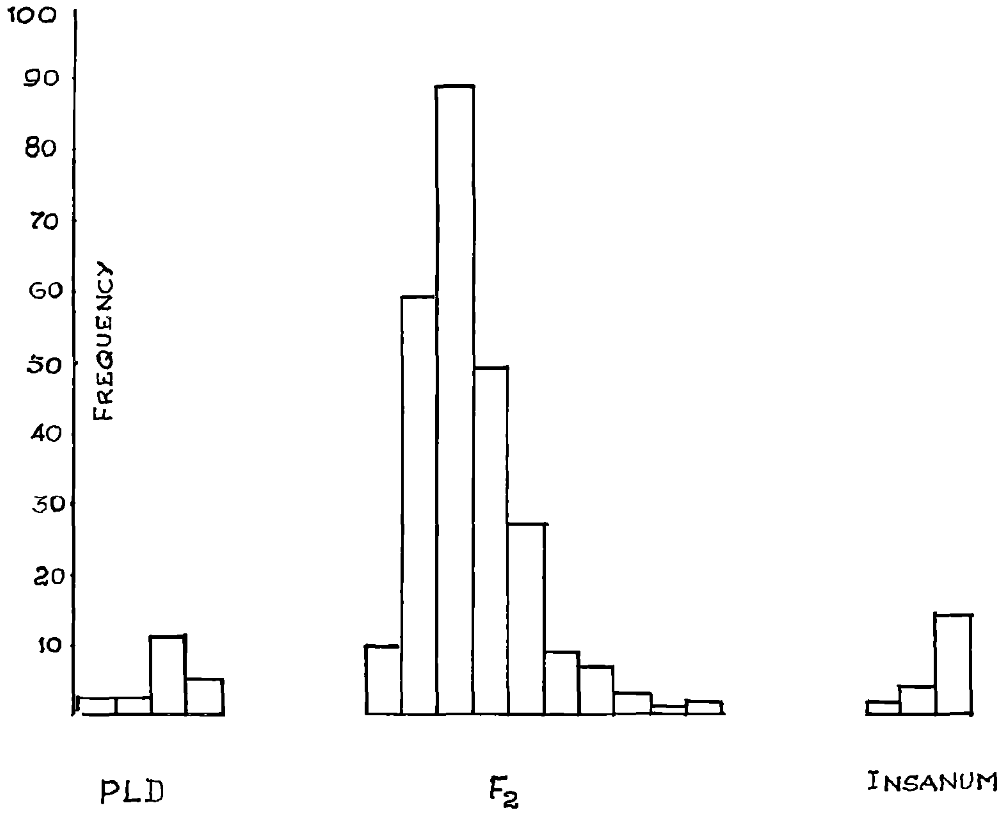

FIG X

PLATE I

A Photograph showing the parent, *Solanum melongena* Linn var. Purple Long Datta.

B Photograph showing the parent, *Solanum melongena* Linn var. *insanum*.

PLATE II

A Photograph of F_2 plant

B Photograph of F_2 plant

PLATE III

A Photograph of F_2 plant.

B Photograph of the fruits of the parents (on either side) and the F_2.