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Some studies on six American varieties of eggplants with particular reference to floral morphology, fruit set and fruit characters

C. N. Sambandam

To the Graduate Council:

I am submitting herewith a thesis written by C. N. Sambandam entitled "Some studies on six American varieties of eggplants with particular reference to floral morphology, fruit set and fruit characters." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Plant Sciences.

Bill Pickett, Major Professor

We have read this thesis and recommend its acceptance:

Homer D. Swingle, Thomas S. Osborne

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

December 7, 1960

To the Graduate Council:

I am submitting a thesis written by C. N. Sambandam entitled "Some Studies on Six American Varieties of Eggplants with Particular Reference to Floral Morphology, Fruit Set and Fruit Characters." I recommend that it be accepted for nine quarter hours credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Horticulture.

Major Professor

We have read this thesis and recommend its acceptance:

Homer D. Sauvigle

Thomas S. Osborne

Accepted for the Council:

W. E. Spivey

Acting Dean of the Graduate School

SOME STUDIES ON SIX AMERICAN VARIETIES OF EGGPLANTS WITH PARTICULAR REFERENCE TO FLORAL MORPHOLOGY, FRUIT SET AND FRUIT CHARACTERS

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

C. N. Sambandam

December 1960

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CHAPTER I

INTRODUCTION

The eggplant (Solanum melongena L.) is also known as Guinea squash (3,4), Jew's apple (28), aubergine and as brinjal (78). India is considered to be the country of origin for eggplant, since it is found in India in the wild state (17), since the first report of its use as a vegetable came from India (7) and since several varieties, viz, green, white, purple, yellow, etc. are in constant cultivation in that country (4).

In the United States, eggplant is a vegetable of minor importance. The estimated annual acreage under commercial cultivation in Florida, Texas, Louisiana and New Jersey for the period 1948-1953 was only 5,285 acres yielding 1,458,000 bushels valued at $2,168,000. However, the above area was about 50 per cent greater than that for the preceding quinquennial period of 1938-1942 (80) and these figures indicate a probable increase in the popularity of eggplants in the United States. As stated by Bailey as early as 1891 (2), some of the neglect of the eggplant is perhaps due to the fact that cooks in this country are not familiar with eggplant and are not aware of recipes for fixing it into tasty dishes. The very small number of varieties available in this country is also perhaps attributable to the limited popularity.

The place of eggplant in the Far Eastern countries is quite different and it is cultivated much more extensively than tomato in India, China and Japan (9). In India eggplant has been in cultivation

from time immemorial and there are hundreds of favored varieties. According to Rao (62), in the Madras State alone more than sixty varieties are cultivated. Each locality has its own choice variety. A great many kinds of curries, roasts, stews, chutneys and sauces are prepared with eggplant. In the Madras State and in most other sections of Southern India, eggplants are as popular with the farmers, especially the small farmers, as with the consumers. This is because of several factors, the important among them being the favorable climatic condition which enables cultivation of eggplants all the year round, comparatively low cost of cultivation, short duration of the crop which brings in quick returns and above all, ready marketability in any season of the year, thereby assuring fair profits to the farmer (7).

When compared with the quantum of research that has been carried out on vegetables like tomato, potato and pepper, very little has been done on eggplants, even in countries where it is extensively grown. It is an interesting and significant fact that the first systematic work on this vegetable was done in the United States in the year 1891 (2). Japanese geneticists and horticulturists appear to have started research on eggplants beginning from the second decade of this century. In India itself investigations on eggplants seem to have commenced only as late as 1934 (61). Except for a few occasional reports, information on most eggplant varieties are unavailable even with regard to basic characters.

The object of the present work is threefold: firstly, to study the basic characters such as plant growth habit, number of flowers per inflorescence, floral composition, number of fruits that set per in-

florescence and fruit characters of six American eggplant types; secondly to study the success of fruitset under selfing, emasculation without pollination (so that parthenocarpic set may be induced) and crossing (so that the compatability of the varieties may be known); and thirdly to compare the production potentialities of the varieties.

CHAPTER II

REVIEW OF LITERATURE

I. TAXONOMY OF THE EGGPLANT

The eggplant belongs to the genus Solanum of the family Solanaceae and both cultivated and wild forms are at present included in the species melongena. Bailey (2) reported that Linnaeus divided eggplants into two species: those with large edible fruits as S. melongena L. and those with small inedible fruits, commonly known on the continent as the mad apple as S. insanum L. He reported that Dunal in 1816 discarded Linneaeus' nomenclature since he believed that it included too many types and he divided the garden varieties into two species and called them S. esculentum and S. ovigerum. Then, according to Bailey, Nees von Esenbeck considered that Dunal's species were not well founded and in 1832 he combined them again into the original Linnaean species S. melongena. Dunal also united S. insanum too with S. melongena since he decided that the former was only the wild form of the latter. Bailey in 1889 subdivided eggplants into three subspecies as detailed below:-

I Plants tall and stout, spiny or spineless, leaves usually large and thick, scurfy, conspicuously angled or lobed, flowers very large, fruits mostly large, spherical or oblong

S. Melongena var. esculentum

A. Fruit purple

B. Fruit white or striped

II Plant medium to tall, leaves large, angled, scarcely downy, fruit very long and slender

var. serpentinum

III Plant small, weak and spreading, spineless, leaves small, thin, smooth or nearly so, rounded and more or less undulate, flowers small and long peduncled, fruit medium to small, pear shaped, purple.

var. depressum

Bailey pointed out that spinescence in eggplant is so inconsistent that the same variety may vary from strongly armed to unarmed and hence is undependable as a taxonomic criterion. Halsted, primarily a plant breeder (27), grouped eggplants into the following types founded on pigmentation, as a basis for calculations in breeding work: (i) green fleshed, (ii) white fleshed, (iii) purple skinned and (iv) colorless skinned. Sturtevant's (28) classification of American eggplant varieties was based on fruit shape: (i) the oval, (ii) the round, (iii) the long and (iv) the oblong or pear shaped; he divided each of the above types into two, viz, (i) calyx spiny and (ii) calyx not spiny. Further he made the observation that eggplant types had remained unchanged through long continued cultivation and that there was no evidence to indicate that the types originated in recent years through cultivation. It is reported that in Russia Filov (22) formulated an agro-ecological classification in 1940. Cheema et al. (12) attempted a classification of 47 Indian varieties based on plant habit, fruit color and size as the major characteristics and leaf shape, size, margin, spinescence and pigmentation of plant parts

as secondary characters. In 1951 Bhaduri (8) in India worked on the interrelationships of nontuberiferous species of Solanum and postulated that the eggplants had multiple sites of origin because of the large number of cultivated varieties and the wide distribution. In Madras State, India, Rao (62) drew up a tentative classification of 32 varieties, based on fruit shape, duration of the variety and color of ripe fruit; he observed that fruit shape is least variable and hence is a better taxonomic criterion than duration or ripe fruit color.

It is seen from the foregoing that so far classifications of eggplants have been exclusively based on morphological characters alone. Greater knowledge of the varieties may offer in the future other taxonomic criteria.

II. FLORAL MORPHOLOGY OF THE EGGPLANT

Smith (71) studied the number of flowers in the clusters in eight varieties and found that some varieties rarely bore more than one flower per cluster, while some bore more. Magtang (44) studied the floral morphology of one of the Philippine varieties; curiously, he stated that the flowers were borne at the axils of the upper leaves; the floral composition observed by him was in conformity to the general floral formula for Solanaceae except for the observation that the stigma was 5 lobed.*

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*The floral description of Solanaceae given by Porter is attached as Appendix I.

Smith (71) made the observation that single flowers had long styles and set fruits, while in inflorescences having two or more flowers, only the first flower, viz the lowermost, had a long style and set fruit while others had short styles and aborted; he found a direct correlation between the style length and the diameter of the pedicel. Magtang (44) noted that flowers produced early and late in the season were short styled. Based on the style length, Pal and Singh (55) classified eggplant flowers into three categories, namely, (i) long styled, (ii) pseudo short styled and (iii) true short styled: in the long styled type the style protruded beyond the anther tips carrying the stigma well above, while in the other two types, the stigmas were below the level of the anther tips. Krishnamurthi and Subramaniam (41) proposed a fourth category, namely, the medium styled flower in which the stigma lay flush with the level of anther tips. Reddi and Subramaniam (63) reported a cluster bearing variety, in which probably more than one flower in the inflorescence was of the long or medium styled category.

Floral abnormalities such as syncarpy, fusion of flowers and fission in different parts of the gynoecium were reported by Cooper and Gonzalves (14), Singh (68) and Sinha (69).

III. FRUIT SET AND PARTHENOCARPY IN EGGPLANTS

Fruit set in eggplants appear to be conditioned by several factors. Kakizaki (35) found that flowers emasculated and left to natural pollination rarely set fruit; he proved the need for insect pollination since

eggplants grown in a screened house excluding insects did not set fruit; he also estimated the amount of natural crossing in eggplants to range from 0.24 per cent to 46.8 per cent, the average being 6.75 per cent. Bailey (4) recommended artificial pollination for obtaining large fruits, since he found that non-pollinated fruits grew only for some time and remained small; this recommendation seems to indicate that at least in some varieties pollination is not indispensable for fruit set. Tatebe (77) reported a case of phenospermy, viz setting of fruits containing empty or abortive seeds, with or without pollination. Macabasco (43) ascribed the shedding of a large number of eggplant flowers to poor development of styles, weak joint at abscission layer and too heavy rainfall on hot days. Pal and Singh (55) found that long styled flowers set fruits with natural pollination, pseudo short styled flowers set fruit with hand pollination while short styled flowers did not set at all. Krishnamurthi and Subramanian (41) observed fruit set with natural pollination in long styled as well as in medium styled fruits. Fujii and Itagi (27) reported on cyclic setting of fruits in Japanese varieties.

Occasional development of parthenocarpic fruits from emasculated flowers, especially in hybrid eggplants, was reported by Munson (47); such fruits contained abortive seeds. Yasuda (83) was able to produce parthenocarpic fruits by pollinating eggplant flowers with Petunia violacea pollen; tomato pollen was ineffective. The following year he (84) reported that injection of water extract of petunia pollen in the ovary gave successful parthenocarpy. In a subsequent experiment he induced parthenocarpy by self pollination (85). Gustafson (24) produced seedless

fruits through interspecific pollination, under greenhouse conditions. The use of fluorescein in lanolin for inducing parthenocarpy in eggplants was reported by Liu Chin and Cherng-How Lou (42). Capinpin and Berenguar (11) tried pollination with pollen of petunia, Jimsonweed and tobacco and reported success with the first two in inducing parthenocarpy, while tobacco pollen was useless; they did not observe any instance of natural parthenocarpy. Krishnamurthi and Subramanian (41) reported the efficacy of 2,4-dichlorophenoxy acetic acid for obtaining fruit set and parthenocarpy in eggplants.

IV. GENETICS OF THE EGGPLANT

Ploidy

Kojima (39) examined 21 races of eggplants and found that all had the same number of chromosomes, viz, the haploid number was 12 and the diploid number 24; he noted that chromosomes of all the varieties had the same size and shape. Kostoff (40) was able to induce heteroploidy by fumigating eggplants with nicotine sulphate; following fumigation irregular meiosis took place leading to the formation of unequal and abortive pollen and this pollen when used to pollinate normal emasculated flowers gave rise to some heteroploids. Janaki Ammal (30,31) reported on a triploid, a tetraploid and several heteroploids obtained by selfing: 4 n - 2, 4 n - 3, 4 n - 4. Tanaka (74) was able to produce tetraploid eggplant by colchicine treatment of young seedlings; the tetraploids in general were bigger, the fruits tastier and in one case more resistant to drought and insects than the diploid; but the seeds were only a few

in the fruits and were of low fertility.

Inheritance of Color

The earliest report on the inheritance of characters in eggplants appears to be that of Bailey and Munson (2) in 1891. Bailey and Munson found that purple color was dominant over green in the plant parts. In 1892 Bailey (3) published the data on F_2 populations of crosses involving purple and green types and the data indicate a 9:7 ratio, which suggests that two factors control the color inheritance in plant parts. Reports by Munson (46,48) and Owen (53,54) also lead to a similar conclusion. But Kakizaki (35) reported that purple stem color as well as fruit color was due to a single genetic factor, purple being dominant over white. Nolla (50) also found a 3:1 ratio for purple to green plant color as well for purple to green striped; he assumed a one unit factor of Pr for the inheritance. Pal and Singh (56) on the other hand found that hybrids were intermediate between their parents with regard to plant color.

Regarding flesh color in the fruit, Halsted (27) reported a 3:1 ratio for green to white. Regarding fruit skin color he found a 3:1 ratio for purple to white or colorless skin. In a cross between a white skinned and purple skinned variety he secured a 9:3:3:1 ratio for purple, green, pink, and white skin. This also points to a two factor inheritance, where double dominance produced purple, double recessive white and single dominance green or pink as the case may be. Nolla (53) found that red, purple and pink color of fruit were dominant over green and were inherited in a 3:1 ratio; green purple striped dominant over white

purple striped and was inherited in a 3:1 ratio; purple was dominant over white purple striped and was inherited in a 3:1 ratio; and purple or pink was dominant over green purple striped and was inherited in a 3:1 ratio. He assumed that the fruit color was influenced by the allelomorphic pair Cc.

Inheritance of Corolla and Anther Colors

Dominance of violet or purple corolla color over white was reported by Nolla (50); he found that purple and white segregated in 3:1 ratio in the F_2 generation; he assumed the allelomorphic pair C_1c_1 was responsible for the corolla color inheritance. Regarding anther color, he found that striping was dominant over non-striping and that these characters were inherited in the F_2 generation in a 3:1 ratio; he assumed the allelomorphic pair Ststfor striping and non-striping respectively. In certain crosses made by Pal and Singh (56) the corolla color in the hybrids was intermediate between those of the parents. Nolla (50) suggested that there may be complete linkage between corolla color, striping or non-striping of the anthers, fruit color and plant color: white corolla and non-striped anthers always stood for green fruit and green plant color and all these were recessive characters.

Fruit Shape Inheritance

Bailey (2) and Kakizaki (38) reported that in the hybrids the fruit shape was intermediate between those of the parents. Munson (46) observed that white fruited types were stronger than purple fruited types in the power to transmit form to their progeny.

Heterosis in Eggplant

Reports dealing with heterosis in eggplant are much more numerous than those dealing with any other aspect of the crop. This is probably because of the economic advantage of hybrid vigor.

Although Bailey and Munson (2) made several crosses as early as 1889, they did not make mention of any hybrid vigor but found the crosses to be intermediate between the parents. Bailey (3) subsequently reported that his crosses between purple and white fruited types were unfruitful; he did not explain the causes for unfruitfulness.

The earliest indication of hybrid vigor in eggplants appears to have been made by Munson (46) in 1892 from the United States. Since then several reports have appeared from several countries and in the following review reports are grouped in such a way that those emanating from adjacent geographical regions will be together.

In the Philippines Bayla (5) crossed some local varieties and found that the hybrids were very much more vigorous, stronger and healthier than their parents. Capinpin and Alviar (10) reported from the Philippines that hybrid seeds exhibited higher germination percentage; they also recorded earlier flowering and fruit set, greater number of fruits per plant, longer fruits (in crosses between long fruited types) greater mean equatorial diameter and greater mean weight of fruits.

Nagai and Kida (49) of Japan studied some quantitative characters in crosses and found that hybrid vigor was exhibited with regard to yield, the number of fruits, earliness of flowering, earliness of maturity, height of plants, number of branches, number of spines in the fruit stalk and the

length of the fruit; no heterosis was found with regard to leaf length and breadth. Tatebe (76) observed higher productivity in some Japanese hybrids. Kakizaki (36) also of Japan, reported considerable hybrid vigor in respect to seed weight, stem diameter, stem height and earliness of harvest. In a subsequent paper (37) he reported higher yields also. In 1931 he made a detailed report of the crosses (38) in which he stated that hybrid seedlings exhibited greater vigor in growth, earliness of bearing and yields than their parents; he also found that the best hybrids were crosses between parents of widely differing characteristics. Regarding the vitamin B_1 content of the fruits, Iijima (29) found that hybrids were not superior to their parents.

The first attempt to hybridize eggplants in India appears to have been made by Rao (61) in 1934; he reported a high degree of partial sterility due to abortive pollen in hybrids between wide varieties. Sarvayya (65) carried out an interspecific cross with Solanum xanthocarpum and found that the hybrid was very poor in fruit set although the plant was vigorous. Venkataramani (82) reported that hybrid eggplants were taller, spread more, flowered earlier than the early parent and yielded more than either parent. Pal and Singh (56,57) also reported considerable vigor and higher productivity in hybrids between Indian varieties. Pal (58) stated that breeding within the indigenous material would offer greater scope for improvement of eggplants in India.

Schmidt (66) reported from Crimea that in eggplant crosses the character of earliness was dominant and even transgressive. Aver' Janova (1) from Bulgaria reported higher yields from hybrid eggplants.

Daskalov (18) also of Bulgaria reported favorable results regarding the productivity of crosses. Heterotic varieties of eggplants were reported from Russia also (79). Daskaloff (16,17) indicated the possibility of utilization of heterosis in commercial eggplant production in Germany. A report from the Netherlands (81) stated that hybrid eggplants were superior in growth, fruit set and yield.

In the United States, subsequent to Munson (46) cited above, Halsted (25,26) reported that hybrids were double the size of the parents and yielded more. Odland and Noll (51) experimented with sixteen hybrid types and found that in every case the hybrids yielded more than the parents and that they were earlier too. They noted that two parent lines of the lowest mean yields were able to combine to produce hybrids of exceptional productivity. In other varietal trials, the same authors (52) obtained heaviest yields from hybrid eggplants. Studying some diallel crosses for the genetic basis of heterosis, Jinks (33) observed that wherever overdominance was found epistasis also was found; that specific combining ability was the outcome of uncomplicated dominance and that epistasis led in all cases to a drop in the degree of overdominance. Jasmin (32) reported a case of male sterility due to non-dehiscence of anthers in a hybrid between an American and a Japanese variety. An anonymous report (60) from Canada attributed a similar case of male sterility in a hybrid to a recessive monofactorial inheritance of the character.

The review on heterosis indicates that hybrid vigor was exhibited in most crosses, while in some the hybrids were intermediate between

their parents and that in a few cases the hybrids manifested abnormalities such as abortion of pollen and indehiscence of anthers.

V. FACTORS AFFECTING PRODUCTIVITY OF EGGPLANTS

As the edible part in the eggplant is the fruit, it follows that a higher percentage of fruit set will result in higher production. Factors which influence fruit set have already been reviewed under "Fruit Set and Parthenocarpy." Increased yield arising from hybrid vigor has also been already reviewed under "Heterosis in Eggplants." Hence in this section factors other than fruit set and heterosis only are reviewed. Original papers based on experiments in fertilization, spacing, irrigation and other field operations are very scarce for eggplants.

The variety: Spring and Milson (73) reported that some Malayan varieties begin to yield in about 4 months after planting and continue to bear for several months. Comparing the yields of early and late varieties, Rolfs (64) stated that early varieties were not as productive as late varieties. Cheema et al. (12) studied 47 Indian varieties and came to the conclusion that the yield factor in eggplants was a definite varietal character; they were also able to observe a significant correlation between the size and the average number of fruits yielded: the variety bearing the smallest fruits gave the largest number of fruits. Decker (20) produced some promising hybrids that were resistant to Phomopsis or "tip-over" disease of eggplant; such resistant varieties

will naturally yield more than susceptible varieties where the disease is prevalent. Smith (70) obtained the following yield per plant under identical treatments: New Hampshire, 2.27 lbs., Florida High Bush, 3.60 lbs., New York Improved, 2.53 lbs. and Black Beauty, 3.60 lbs. Childers (13) reported the existence of varieties that could produce marketable fruits for a year or more, which indicated that such varieties could out-yield varieties that have limited productive period. Tanaka and Sakai (75) reported the production of a tetraploid eggplant, which was more resistant to the pest, Epilachna nipponica, Lewis, and it could be expected that the plant would have been more productive than similar but susceptible ones.

Condition of plants used: Beattie (6) stated that one of the most common causes for failure of eggplants was the use of poor plants, that were stunted or injured by insects and diseases or had become woody or hardened. Boswell (9) stated that the plants should be maintained in hot beds or greenhouses in such a way that their growth is moderately rapid and uninterrupted, as otherwise their future productiveness would be impaired.

Spacing in the field: Benson (7) found that the normal spacing for the varieties in the Madras locality of India was 2 feet x 2 feet. Fernando (21) found that a spacing of 3 feet x 4 feet gave the heaviest yield in Ceylon. Boswell (9) stated that eggplants should usually be set $2\frac{1}{2}$ feet apart in rows 3 feet apart and that small growing varieties could be set $1\frac{1}{2}$ to 2 feet apart in rows $2\frac{1}{2}$ feet apart. Thompson (80) suggests that 2 to 3 feet apart in rows 3 to 4 feet apart will be optimum

for most varieties while for small growing varieties it might be 1½ to 2 feet apart in rows 2½ to 3 feet apart.

Manures and fertilizers: Crandall and Odland (15) reported that eggplants responded markedly to increase in the nitrogen in the fertilizer and that it was possible to substitute green manure and commercial fertilizer for stable manure to a considerable extent, with profit and increased yields. Beattie (6) recommended that well rotted manure be applied at 20 tons per acre and well mixed while preparing the field and 1,200 to 2,000 lbs. per acre of a complete fertilizer analyzing 5 to 7 per cent of nitrogen, 8 to 10 per cent of phosphoric acid and 6 to 8 per cent of potash be broadcast during the final preparation of the soil. Dawis and Labis (19) planted eggplant seedlings into holes filled with different mixtures containing 3 parts of clay loam and different manures such as dried farm manure, bat guano, rice straw compost etc. or ammonium sulphate at 2-8 g. per plant; they found that highest yields were obtained from the ammonium sulphate treatment and lowest from the cow manure and rice straw compost. Boswell's (9) fertlizer recommendations are similar to those of Beattie cited above except that Boswell recommends that the fertilizer mixture be split up into two doses and one dose be applied during preparation and the other dose be applied as a top dressing; he also suggested that if it were not possible to supply a part of the nitrogen in organic form, so as to make it slowly available over a long time, it might be necessary to top dress the crop once or twice with 150 lbs. per acre of nitrate of soda or equivalent amounts of other fertilizers. Thompson (80) recommended 10 to 15 tons per acre of stable manure to be

supplemented by a fertilizer to supply 50 lbs. of nitrogen, 100 lbs. of phosphoric acid and 50 lbs. of potash; one or two applications of additional nitrogen at 20 to 25 lbs. of actual nitrogen were also suggested.

Other factors: Apart from the factors reviewed above, it would seem that frequent harvests also may tend to increase yields since Childers (13) found that fruits allowed to ripen on the plants will reduce subsequent yields; he recommended that the fruits should be harvested regularly.

CHAPTER III

MATERIAL AND METHODS

I. VARIETIES STUDIED

The eggplants used in this study were of six American varieties, the seeds of which were obtained from commercial sources. Descriptions of the varieties as given in the catalog of the respective companies are given below:

1. Black Beauty: 80 days. Widely grown for market and satisfactory for home gardens as well. Blunt oval fruit, very uniform and colored a rich deep purplish black with smooth and glossy skin. They grow to a large size but may be used when smaller, as they are just as tender and delicious at all stages. Plants are husky and each bears several large fruits.[1]
2. Black Magic Hybrid: Tremendously prolific. 72 days. Remarkably early to ripen and heavily productive all season long. It has true hybrid vigor. The vines are husky and vigorous and are tolerant of disease and drought. Most of the fruit are held well above the ground. The quality is excellent, delicate, fine-textured and rich in flavor. The fruits are

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[1]Joseph Harris Company, Inc., Catalog 1960, Rochester 11, New York.

dark glossy purple in color, smooth, medium sized and oval shaped. It is recommended both for home and market use.[1]

3. Florida High Bush: 85 days. Plants are well branched, hardy and disease resistant.[2]

4. Mission Bell Hybrid: 70 days. F_1 hybrid of excellent quality, recommended both for market and home garden. Combines earliness, uniformity, high yield, fine appearance and hybrid vigor. Plant upright and medium tall, bearing deep oval fruit, slightly tapering toward stem with dark shiny smooth skin.[3]

5. New Hampshire: 65 days. Ripens two to three weeks earlier than most varieties. Plants are medium sized and productive. Fruits are of good market size, medium dark purple and firm in texture.[4]

6. Vaughan Hybrid: 85 days. A true hybrid, producing heavy crop of very large fruits. The fruits are extremely dark.[2]

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[2]Vaughan's Gardening Illustrated, 84th Anniversary Catalog, Chicago, Illinois.

[3]D. V. Burrel Seed Growers Company, Catalog 1960, Rocky Ford, Colorado.

[4]Robson Quality Seeds, Inc., Catalog 1960, New York, New York.

II. PLANT PRODUCTION AND FIELD TREATMENTS

The seeds were treated with captan as per the manufacturer's instructions as per prophylaxis against diseases. They were thickly sown on February 10 in flats filled with a 1:1:1 mixture of sterilized soil, sand and compost and covered uniformly with light soil 1/4 to 1/2 inch deep; then the flats were kept on a greenhouse bench and the temperature maintained at 75°F. The above were done on February 10, 1960. The flats were watered as and when necessary. On March 3, the seedlings were pricked in 2" veneer bands filled with the same mixture mentioned above and set in flats. The seedlings were maintained at 70°F in the greenhouse.

The seedlings were set in the field on April 30. The soil series was Abernathy silt loam. During the preparation 800 lbs./acre of 5-10-5 fertilizer was applied broadcast and another 400 lbs./acre of the same analysis fertilizer was applied in the rows. The seedlings were planted according to a randomized block design. There were six varieties replicated four times, each replication consisting of six plants. The guard rows consisted of eight plants per variety to be used in hybridizing studies. The spacing was 4 feet between the rows and 2½ feet within the row. Veneer bands were removed at planting. Seedlings became well established following showers after planting. Weeding and cultivation were done whenever necessary. Top dressing with ammonium nitrate to the equivalent of 30 lbs. of nitrogen per acre was done on July 6th. The crop received 1½ inches of water from irrigation during July when there

was continued drought. The pest control program consisted of bi-monthly sprays of Maneb and methoxychlor, Malathion was used as needed to control aphids.

III. FLORAL STUDIES

Earliness of Flowering

The date of first flower was recorded for each variety and the number of days from the date of seeding to flowering and the number of days from field setting to flowering were calculated. Based on the data the varieties were classified as early blooming, mid-season blooming and late blooming.

Number of Flowers Per Inflorescence

One hundred inflorescences per variety, selected at random, were counted. The range and average were worked out, the percentages of single flowered and multiple flowered inflorescences were also calculated.

Types of Flowers in the Inflorescence

For this study 25 inflorescences in each of the one-flowered, two-flowered and three-flowered inflorescences were selected at random in each variety and tagged. Each of the flowers in these inflorescences was studied for its type and classified into three categories, viz., long styled, medium styled and short styled. In this study the short styled flowers were not subdivided into pseudo short styled and true short styled as done by Pal and Singh (55) because the distinction between the two was based on the success or failure of the short styled

flowers to set fruit on hand pollination. Under natural conditions, neither type of short styled flowers set fruit (41) and hence for all practical purposes both are indistinguishable. Correlations between position of the flower in the inflorescence and the types of the flowers were drawn.

Floral Composition

It was noted very early in the course of the studies that the number of floral parts did not conform to the general description of eggplants in the literature or the floral formulas for Solanaceae The floral parts were always in excess. To record the degree of variations in this respect, counts were made on 50 flowers per variety with regard to the number of calyx lobes, corolla lobes, stamens and the number of carpellary locules as indicated by the number of stigmatic lobes. The percentage distribution of the variations were worked out for each variety.

IV. STUDIES IN FRUIT SET

Relation of the Position of the Flower on the Multiple-Flowered Inflorescence to Fruit Set

To determine which of the flowers in multiple-flowered inflorescence set fruit 25 inflorescences were tagged, carefully observed and records taken. For the sake of convenience of identity, the flowers in an inflorescence were referred to in this study as flower No. 1, flower No. 2 and flower No. 3, respectively, starting from the basal flower upwards.

Correlations between the position of the flower, the type of flower and fruit set were drawn.

Selfing and Fruit Set

To study whether self-pollination could take place in eggplant flowers without insect activity, ten long styled flower buds that were about to blossom the next day were selected in each variety and enclosed in glassine bags using paper clips, so that no insect could have access to the flower. That a bud was of the long styled type was easily indicated by the stout pedicel in the case of the solitary bud and by the stout pedicel as well as by the basal position of the bud in the case of the multiple-flowered inflorescences. The treated buds were watched every day and observations recorded until they set fruit or dropped off.

Intervarietal Crossing and Fruit Set

For this study the possible combinations between the varieties excluding reciprocal crosses were determined first and were found to be 15. For each combination 5 crosses were made and the fruit set recorded. The technique of crossing is given below.

Emasculation: Flower buds of the long styled type that were about to open the following day were selected on the female parent. The corolla was gently opened and the anthers pulled out without injuring the pistil, with the help of a small pair of clean surgical forceps. Then the emasculated bud was enclosed in a glassine bag as in the selfing experiment described above.

Pollen collection: On the same day an adequate number of buds that would open the following day were selected on the male parent and bagged as described above, so that the anthers would retain the pollen until the following day.

Cross pollination: On the following day the anthers were carefully separated from the bagged buds of the male parent. The bags from the emasculated flower of the female parents were removed carefully without injuring the pistils. The anther collected from the male parent was split open longitudinally with the sharp point of the forceps and the pollen was applied to the green, sticky and receptive stigma. To assure that failure of fruit set would not occur from dearth of pollen, pollen from two anthers were applied to the stigma of every emasculated flower. Then the flower was rebagged and properly labeled.

The crossed flowers were watched daily until they set fruit or were shed. When the fruit set and grew to some size, the glassine bag was removed and a tag showing the details of the cross was tied loosely on the fruit pedicel stalk so that the fruit would develop normally.

Fruit Set Without Pollination

To study whether the development of parthenocarpic fruit is possible without pollination, 10 flowers per variety were emasculated and bagged as described above but were not pollinated. Observations were made daily until the flowers set fruit or dropped off.

V. FRUIT CHARACTER STUDIES

To study the differences in fruit characters between the six varieties, a minimum of 50 fruits at table mature stage were used for each variety. Only normal fruits were used.

Length

The lengths of the fruits from the blossom end to the calyx base were measured using a measuring tape. The average length and the range were calculated.

Circumference

Some of the previous workers had measured the diameter of the fruits. Since two varieties in the present study, viz., Black Beauty and Vaughan Hybrid produced somewhat flattened fruits, it was felt that it would be more appropriate to measure the girth than the diameter, which would be more fitting for varieties with more or less circular cross sections. The circumference of the fruits at their broadest portion were measured with a measuring tape. The averages and ranges for the respective varieties were worked out.

Shape

The general shape of the fruit for each variety was recorded based on the fruit conformation.

Weight

The fruits were weighed individually and their weights were recorded in pounds. From these data the range for the variety was found.

The average weight of the fruit for each variety was calculated from the yield data, which were recorded both in terms of numbers and weight.

Color

Both unripe color and ripe color were studied. Measurements of color were made by using Munsell's Color Charts (45).

a. Unripe color. Table mature fruits such as those used for study of length, etc. were utilized for the study of unripe color. A minimum of 50 fruits were used for each variety. The range of color was recorded as well as the percentage distribution of fruits among the different shades.

b. Ripe color. For each variety a minimum of 20 vine-ripened fruits were studied. The range of color was recorded.

Seediness

For each variety 10 ripe fruits were collected and the weight of individual fruit was recorded after discarding the calyx. The seed was extracted separately from each fruit, dried in shade for 3 days and weighed. The seediness of the fruit was expressed as the percentage of the weight of the seeds of the weight of the fruit. The average of 10 fruits were calculated for each variety.

From the seeds of each variety 100 seeds were sampled at random and weighed and the seed weights of different varieties were compared.

VI. PLANT HABIT STUDY

The height and spread of the plants were measured at the end of the bearing phase and were recorded in inches. The averages and ranges were calculated. Twenty-four plants were measured for each variety.

The growing habit of the variety was recorded based on the general appearance of the plants.

VII. YIELD STUDIES

Table mature fruits were harvested twice a week, graded according to the United States Department of Agriculture Standards (Appendix II) and the yield data were recorded for each replication in terms of number of fruits and weight of fruits. Yield data were subjected to analysis of variance. Based on the yield data, correlations with regard to the fruit size and total yield, fruit size and number of fruits, duration and yields were drawn.

CHAPTER IV

EXPERIMENTAL RESULTS

I. FLORAL STUDIES

Earliness of Flowering

In order to classify eggplant varieties according to time of flowering, the number of days from seeding to first flower and the number of days from field planting to first flowering were recorded. Based on the date the six varieties were classified as shown in Table I.

The results indicate that Mission Bell Hybrid, New Hampshire and Vaughan Hybrid were early blooming, Black Beauty and Black Magic Hybrid were mid-season blooming, while Florida High Bush was late blooming.

Number of Flowers Per Inflorescence

To study the varietal differences as regards the number of blossoms carried on the inflorescence, this experiment was undertaken. It was found that the inflorescences were invariably extra-axillary in position and sometimes consisted of solitary flowers and sometimes more than one flower. In the multiple flowered type the inflorescence was a cyme. The results of the study are summarized in Table II.

It is seen from Table II that the number of flowers in the inflorescence ranged from 1 to 10 in Black Beauty, while in the other

TABLE I

CLASSIFICATION OF EGGPLANT VARIETIES AS TO TIME OF FLOWERING

Serial No.	Variety	No. of Days from Seeding to Flowering	No. of Days from Field Setting to Flowering	Classification
1	Black Beauty	124	43	Mid-Season Blooming
2	Black Magic Hybrid	124	43	Mid-Season Blooming
3	Florida High Bush	131	50	Late Blooming
4	Mission Bell Hybrid	115	34	Early Blooming
5	New Hampshire	113	32	Early Blooming

Date of Seeding: February 10, 1960.

Date of Field Setting: April 30, 1960.

TABLE II

NUMBER OF FLOWERS PER INFLORESCENCE IN SIX AMERICAN VARIETIES OF EGGPLANTS

Serial No.	Variety	Percentage Distribution Based on Number of Flowers/Inflorescence						Average No. of Flowers Per Inflorescence
		1	2	3	4	5	6-10	
1	Black Beauty	26	18	22	19	9	6	2.96
2	Black Magic Hybrid	74	11	11	4	-	-	1.45
3	Florida High Bush	33	23	31	13	-	-	2.24
4	Mission Bell Hybrid	66	11	14	6	3	-	1.69
5	New Hampshire	69	12	14	2	3	-	1.58
6	Vaughan Hybrid	30	18	34	13	5	-	2.45

Number of inflorescences studied - 100 per variety.

varieties it did not exceed 4 or 5. It is also seen that solitary flowers were more common than multiple flowered inflorescences in Black Magic Hybrid, Mission Bell Hybrid and New Hampshire. On the other hand, in Black Beauty, Florida High Bush and Vaughan Hybrid multiple flowered inflorescences were much more abundant than solitary flowers. The maximum average number of flowers per inflorescence was in Black Beauty, viz., 2.96 and the minimum average number of flowers per inflorescence was in Black Magic Hybrid, viz., 1.45.

Types of Flowers in the Inflorescence

Previous workers classified eggplant flowers based on the style length, since style length was found to influence the percentage of fruit set. With the object of finding out the proportions in which these types occur in the inflorescences, 25 inflorescences in each of the one-flowered, two-flowered and three-flowered types were studied for every variety, adopting the criteria mentioned under Materials and Methods. The results of the study are given in Table III.

The data in Table III show that in all the varieties the solitary flower was invariably of the long styled type. As regards the two-flowered inflorescence, it is seen that the long styled flowers constituted 50 to 54 per cent, the medium styled 0 to 4 per cent, and the short styled 46 to 50 per cent in different varieties. In the three-flowered inflorescences the distributions were long styled 33.3 to 44.66 per cent, the medium styled 4 to 8 per cent and the short styled 49 to 66.66 per cent. The relative positions of the three types of flowers on the inflorescences were observed and all the six varieties appeared to be

TABLE III

THE RELATION OF INFLORESCENCE TYPE TO STYLE LENGTH IN SIX EGGPLANT VARIETIES

Serial No.	Variety	Type Inflorescence Based on No. of Flowers	Percentage Distribution Based on Style Length		
			Long	Medium	Short
1	Black Beauty	1	100.00	--	--
		2	52.00	--	48.00
		3	36.00	4.00	60.00
2	Black Magic Hybrid	1	100.00	--	--
		2	50.00	--	50.00
		3	38.64	8.00	53.36
3	Florida High Bush	1	100.00	--	--
		2	50.00	--	50.00
		3	33.33	--	66.66
4	Mission Bell Hybrid	1	100.00	--	--
		2	30.00	4.00	46.00
		3	33.3	4.00	62.66
5	New Hampshire	1	100.00	--	--
		2	54.00	--	46.00
		3	44.66	5.33	49.00
6	Vaughan Hybrid	1	100.00	--	--
		2	50.00	--	50.00
		3	33.33	--	66.66

Counts were taken on 25 inflorescences of each type on each variety.

uniform in the following respects. The long styled flowers were usually the basal or first flowers while quite infrequently the second flower also had a long style. The second flowers were usually short styled while rarely they were medium styled or long styled. The third and subsequent flowers were invariably short styled. Never was found a case where the first flower was short styled while the second or third flowers had long or medium styles. Toward the end of the season when the first flower of the inflorescence was short styled the other flowers also were found to be short styled.

Floral Composition

Since the flowers of the varieties under study were observed to be aberrant from the standard floral formula for Solanaceae, counts with regards to the floral parts were taken on 50 flowers per variety. The data for the calyx lobes, corolla lobes, stamens and stigmatic lobes are summarized in Tables IV, V, VI and VII respectively. The range of variations in the six varieties in the calyx, corolla, stamens and stigma are compared in Table VIII.

The data in the Tables II to VIII reveal that in the case of the essential floral parts, viz., the stamens and pistils as well as in the non-essential parts, viz., the calyces and corollas, pleiomery had occurred in all the varieties. There was no case of reduction. It is also seen that the degree of pleiomery was greater in Black Beauty and Florida High Bush than in the other four varieties.

The observations made on the individual flowers in the six varieties showed that there was no correspondence between the number of calyx lobes,

TABLE IV

FLORAL COMPOSITION - VARIATIONS IN THE NUMBER OF CALYX LOBES IN SIX AMERICAN VARIETIES OF EGGPLANTS

Serial No.	Variety	Percentage Distribution of Flowers with Calyx Lobes Numbering						Average No. of Calyx Lobes in the Flower
		5	6	7	8	9	10	
1	Black Beauty	0	4	12	30	36	18	8.52
2	Black Magic Hybrid	22	48	20	6	2	2	6.24
3	Florida High Bush	0	10	28	50	8	4	7.68
4	Mission Bell Hybrid	12	40	28	16	0	4	6.64
5	New Hampshire	14	48	32	4	2	0	6.32
6	Vaughan Hybrid	4	10	42	34	8	2	7.38

Counts based on 50 flowers per variety.

TABLE V

FLORAL COMPOSITION - VARIATIONS IN THE NUMBER OF CORROLLA LOBES IN SIX AMERICAN VARIETIES OF EGGPLANTS

Serial No.	Variety	Percentage Distribution of Flowers with Corolla Lobes Numbering						Average No. of Corolla Lobes in the Flower
		5	6	7	8	9	10	
1	Black Beauty	0	16	38	30	12	4	7.50
2	Black Magic Hybrid	14	56	24	4	0	2	6.26
3	Florida High Bush	0	16	54	28	0	2	7.18
4	Mission Bell Hybrid	8	34	46	10	2	0	6.64
5	New Hampshire	10	66	20	4	0	0	6.18
6	Vaughan Hybrid	4	20	48	28	0	0	7.00

Counts based on 50 flowers per variety.

TABLE VI

FLORAL COMPOSITION - VARIATIONS IN THE NUMBER OF STAMENS IN THE FLOWERS OF SIX AMERICAN VARIETIES OF EGGPLANTS

Serial No.	Variety	Percentage Distribution of Flowers with Stamens Numbering						Average No. of Stamens in the Flower
		5	6	7	8	9	10	
1	Black Beauty	0	16	50	24	6	4	7.32
2	Black Magic Hybrid	24	46	24	4	0	2	6.16
3	Florida High Bush	0	14	46	26	12	2	7.42
4	Mission Bell Hybrid	10	36	40	12	2	0	6.60
5	New Hampshire	18	58	22	2	0	0	6.08
6	Vaughan Hybrid	4	18	52	26	0	0	7.00

Counts based on 50 flowers per variety.

TABLE VII

FLORAL COMPOSITION - VARIATIONS IN THE NUMBER OF STIGMATIC LOBES IN THE FLOWERS OF SIX AMERICAN VARIETIES OF EGGPLANTS

Serial No.	Variety	Percentage Distribution of Flowers with Stigmas with Lobes Numbering									Average No. of Stigmatic Lobes in the Flower
		2	3	4	5	6	7	8	9	10	
1	Black Beauty	-	2	22	30	28	10	4	2	2	5.52
2	Black Magic Hybrid	8	4	24	36	22	6	-	-	-	4.78
3	Florida High Bush	-	-	18	20	26	26	8	-	2	5.94
4	Mission Bell Hybrid	4	12	36	16	24	6	2	-	-	4.70
5	New Hampshire	4	20	38	28	10	-	-	-	-	4.20
6	Vaughan Hybrid	2	2	16	34	30	12	4	-	-	5.40

Counts based on 50 flowers per variety.

TABLE VIII

FLORAL COMPOSITION - COMPARISON OF THE FLORAL COMPOSITION OF SIX AMERICAN VARIETIES OF EGGPLANTS

Serial No.	Variety	Calyx Lobes		Corolla Lobes		Stamens		Stigmatic Lobes	
		Range	Average	Range	Average	Range	Average	Range	Average
1	Black Beauty	6-10	8.52	6-10	7.50	6-10	7.32	3-10	5.52
2	Black Magic Hybrid	5-10	6.24	5-10	6.26	5-10	6.16	2-7	4.78
3	Florida High Bush	6-10	7.68	6-10	7.18	6-10	7.42	4-10	5.94
4	Mission Bell Hybrid	5-10	6.64	5-9	6.64	5-9	6.60	2-8	4.70
5	New Hampshire	5-9	6.32	5-8	6.18	5-8	6.08	2-10	4.20
6	Vaughan Hybrid	5-10	7.38	5-8	7.00	5-8	7.00	2-8	5.40

Counts based on 50 flowers per variety.

the number of corolla lobes and the number of stamens which should all be 5 according to the final formula for Solanaceae. For instance, in a Florida High Bush flower the calyx lobes were 8, the corolla lobes 6, and the stamens 7. This indicated that the degree of pleiomery varied even within individual flowers and between the different whorls.

II. STUDIES IN FRUIT SET

Position of the Flower on the Inflorescence and Fruit Set

This observation was carried out to determine the relation of the position of the blossom on the inflorescence to fruit set. The results are presented in Table IX.

The data in the table indicate that fruit set occurred at the basal or first flowers from 92 to 100 per cent, and in the second flowers from 0 to 16 per cent in addition to set on first flower, while there was no fruit set by the third flowers. Through the experiment on the flower types described above, it was found that the first flower was always long styled and the third flower was always short styled while the second flower was short, medium or long styled. Relating these findings with those of the fruit set, it appears that the high degree of set in the first flower was associated with the long style and failure of the third flower to set with the short style; since the second flowers were long, medium or short styled, fruit set occurred when it was of the long or medium styled type but not when short styled.

A comparison of the varieties with regard to the fruit set by the second flower shows that New Hampshire had 16 per cent set, Black Beauty

TABLE IX

RELATION OF THE POSITION OF THE FLOWER ON THE MULTIPLE FLOWERED INFLORESCENCE TO FRUIT SET

Serial No.	Variety	Position of Flower	Number of Fruits Set	Percentage of Fruit Set
1	Black Beauty	1	25	100
		2	2	8
		3	0	0
2	Black Magic Hybrid	1	25	100
		2	1	4
		3	0	0
3	Florida High Bush	1	25	100
		2	0	0
		3	0	0
4	Mission Bell Hybrid	1	23	92
		2	1	4
		3	0	0
5	New Hampshire	1	24	96
		2	4	16
		3	0	0
6	Vaughan Hybrid	1	25	100
		2	0	0
		3	0	0

Observations were made on 25 inflorescences.

8 per cent Black Magic Hybrid and Mission Bell Hybrid 4 per cent, while Florida High Bush and Vaughan Hybrid had none. This indicates that there is greater possibility of obtaining two fruited clusters in the former four varieties than the latter two.

It was observed that the fruit from the second flower was invariably much smaller than that developing from the first flower.

Fruit Set by Selfing

This study was conducted in order to find the feasibility of obtaining selfed seeds in the six eggplant varieties. Table X presents degrees of success of selfing in these varieties.

It is seen from the table that selfing was unsuccessful in two pure line varieties, namely Florida High Bush and New Hampshire, but it was successful in Black Beauty. All the hybrid types tested, namely Black Magic Hybrid, Mission Bell Hybrid and Vaughan Hybrid would set fruit when selfed. In no case did success exceed 20 per cent. The data indicate that at least in some varieties selfing was possible and that pollination could take place in them without the agency of insects. But the percentage of fruit set by selfing was low.

Fruit Set with Intervarietal Crossing

With the object of determining the compatibility of crossing among the six varieties, all possible crosses other than the respective reciprocal crosses were made. The success of fruit set in the crosses are presented in Table XI.

TABLE X

FRUIT SET BY SELFING IN SIX AMERICAN VARIETIES OF EGGPLANTS

Serial No.	Variety	Number of Flowers Bagged	Number of Fruits Set	Percentage of Fruit Set
1	Black Beauty	10	2	20
2	Black Magic Hybrid	10	1	10
3	Florida High Bush	10	0	0
4	Mission Bell Hybrid	10	1	10
5	New Hampshire	10	0	0
6	Vaughan Hybrid	10	2	20

TABLE XI

FRUIT SET IN EGGPLANT FROM INTERVARIETAL CROSSING

Serial No.	Crossed Performed	No. of Crosses Made	No. of Fruit Set	Percentage of Successful Crossing
1	Black Beauty x Black Magic Hybrid	5	1	20
2	Black Beauty x Florida High Bush	5	0	0
3	Black Beauty x Mission Bell Hybrid	5	1	20
4	Black Beauty x New Hampshire	5	2	40
5	Black Beauty x Vaughan Hybrid	5	1	20
6	Black Magic Hybrid x Florida High Bush	5	0	0
7	Black Magic Hybrid x Mission Bell Hybrid	5	2	40
8	Black Magic Hybrid x New Hampshire	5	2	40
9	Black Magic Hybrid x Vaughan Hybrid	5	0	0
10	Florida High Bush x Mission Bell Hybrid	5	0	0
11	Florida High Bush x New Hampshire	5	1	20
12	Florida High Bush x Vaughan Hybrid	5	0	0
13	Mission Bell Hybrid x New Hampshire	5	1	20
14	Mission Bell Hybrid x Vaughan Hybrid	5	1	20
15	New Hampshire x Vaughan Hybrid	5	1	20

The data in the tables show that crosses were successful in 10 combinations out of 15. It is not presumed that failure in the other cases was necessarily due to incompatibility between the varieties concerned. It was possibly due to the severe drought conditions that prevailed at the time when the crosses were performed. The low percentage of fruit set in successful crosses is also perhaps attributable to the same premise. However, the data signify that eggplant varieties can cross freely, irrespective of the fact whether they are pure lines or hybrids.

Set of Parthenocarpic Fruits

To ascertain the possibility of parthenocarpy in the varieties under study, flowers were emasculated and bagged without pollination. The results of the observations are presented in Table XII. The results presented in the table indicate that under the conditions of the experiment no parthenocarpic fruit set could take place in any of the varieties.

III. FRUIT CHARACTERS

Since the fruit is the produce in which the farmers and consumers are interested, detailed studies were conducted on some of the quantitative and qualitative characters of fruits of the six varieties. The characters studied were length, circumference, shape, weight, seediness, table mature color and mature color. The results of the study are summarized in Tables XIII, XIV, and XV.

TABLE XII

PARTHENOCARPIC SET OF FRUITS IN EGGPLANTS

Sl. No.	Variety	Number of Flowers Treated	Number of Parthenocarpic Fruit Set	Percentage of Parthenocarpic Fruit Set
1	Black Beauty	10	0	0
2	Black Magic Hybrid	10	0	0
3	Florida High Bush	10	0	0
4	Mission Bell Hybrid	10	0	0
5	New Hampshire	10	0	0
6	Vaughan Hybrid	10	0	0

TABLE XIII

FRUIT LENGTH, CIRCUMFERENCE AND SHAPE OF SIX AMERICAN VARIETIES OF EGGPLANTS*

Sl. No.	Variety	Length, Inches		Circumference, Inches		Shape
		Range	Average	Range	Average	
1	Black Beauty	5.5 - 8.5	6.96	11.7 - 21.2	14.38	Ovoid. Sometimes laterally flattened. Blunt blossom end.
2	Black Magic Hybrid	5.1 - 9.2	8.19	10.7 - 19.4	14.81	Spherical. Never laterally flattened.
3	Florida High Bush	5.9 - 9.8	7.53	10.0 - 18.5	13.16	Linear ovoid. Never flattened laterally. Tapering blossom end.
4	Mission Bell Hybrid	4.5 - 9.3	6.99	10.5 - 17.3	15.03	Cylindrical. Never laterally flattened.
5	New Hampshire	4.3 - 7.4	5.69	9.1 - 16.8	13.15	Spherical. Never laterally flattened.
6	Vaughan Hybrid	5.2 - 9.7	7.50	12.9 - 20.9	15.89	Ovoid. Sometimes laterally flattened. Blunt blossom end.

*50 fruits measured per variety.

TABLE XIV

FRUIT WEIGHT AND SEEDINESS OF SIX AMERICAN VARIETIES OF EGGPLANTS

Sl. No.	Variety	Fruit Weight, Lbs.[a]		Seediness[b]		
		Range	Average	Percentage of Seeds in Fruit by Weight	Average Weight of Seed per Fruit g.	Weight of 100 Seeds mg.
1	Black Beauty	0.88 - 2.75	1.01	14.33	10.99	443
2	Black Magic Hybrid	0.75 - 2.62	1.06	12.15	10.23	484
3	Florida High Bush	0.75 - 2.75	1.05	15.17	11.14	470
4	Mission Bell Hybrid	0.75 - 2.38	0.98	15.71	10.21	531
5	New Hampshire	0.31 - 1.88	0.44	13.56	5.76	511
6	Vaughan Hybrid	1.13 - 3.00	1.35	17.05	15.58	489

[a]Minimum fruits studied, 50 per variety.

[b]Studied 10 fruits per variety.

TABLE XV

FRUIT COLOR IN SIX AMERICAN VARIETIES OF EGGPLANT (MUNSELL'S COLOR SYSTEM)

Sl. No.	Variety	Table Mature Fruit Color: Percentage Distribution[a]				Mature Fruit Color[b]
		Purple /2/1	Purple/2/2	Purple/2/4	Purple/2/6	Range
1	Black Beauty	41	43	15	1	Yellow Red 5/8 - Yellow 8/12
2	Black Magic Hybrid	38	47	15	0	Yellow Red 5/8 - Yellow 8/12
3	Florida High Bush	0	38	41	21	Yellow Red 5/8 - Yellow 8/12
4	Mission Bell Hybrid	5	59	29	7	Yellow Red 5/8 - Yellow 8/12
5	New Hampshire	3	60	31	6	Yellow Red 5/8 - Yellow 8/12
6	Vaughan Hybrid	19	54	13	14	Yellow Red 5/8 - Yellow 8/12

[a] 100 fruits used.

[b] 20 fruits used.

Table XIII compares the dimensions and shape of the fruits. The data on length and circumference show that all the varieties except New Hampshire produced large fruits. Regarding both fruit size and shape, the varieties Black Beauty and Vaughan Hybrid were very much more similar than any two of the other varieties. Plates 1 and 2 depict typical fruits of the varieties.

Table XIV compares fruit weight and seediness. It is seen from Table XIV that the lightest fruits were produced by New Hampshire variety, the heaviest by Vaughan Hybrid while the differences between the other four varieties were negligible. It is also seen that all varieties except New Hampshire produced heavy fruits.

The data on seediness indicate that there was a certain degree of constancy in the percentage of seeds in fruit in all the varieties since it did not go below 12.15 per cent (in Black Magic Hybrid) or go above 17.05 per cent (in Vaughan Hybrid). But the actual weight of seeds per fruit varied considerably since New Hampshire had only 5.76 g. of seed per fruit and Vaughan Hybrid 15.58 g. per fruit while in the other varieties they ranged from 10.21 to 11.14 g. per fruit.

The data on weight of 100 seeds show that Mission Bell Hybrid had the heaviest seeds, the weight of 100 seeds being 531 mg., while Black Beauty had lightest seeds, the weight of 100 seeds being 443 mg. The differences in others were not great since they ranged from 484 to 511 mg,

Table XV compares the table mature and mature fruit colors according to Munsell's Book of Colors. It is seen from Table XV that the table mature fruits of all varieties under study were of purple hue of value 2

PLATE 1

1. Black Beauty; 2. Black Magic Hybrid; 3. Florida High Bush

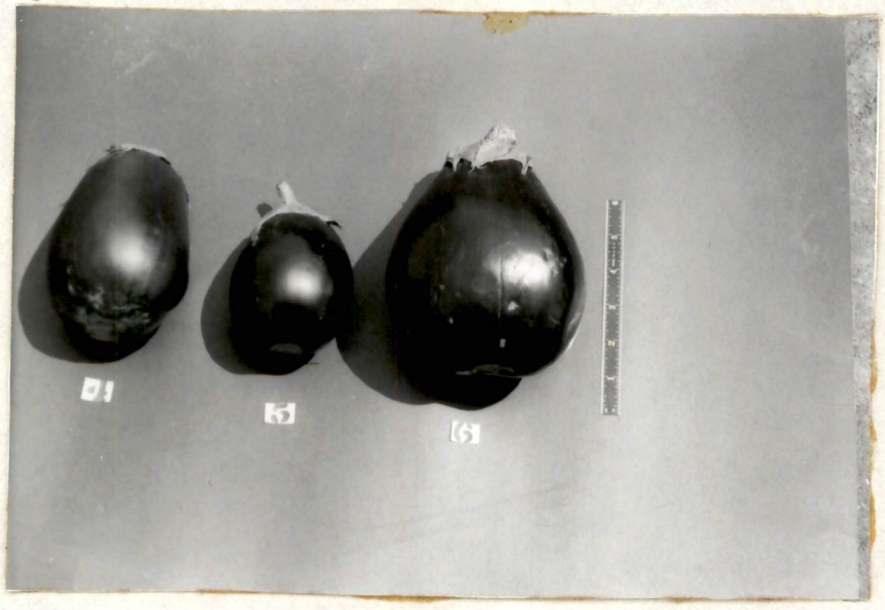

PLATE 2

4. Mission Bell Hybrid; 5. New Hampshire; 6. Vaughan Hybrid

and that they differed only in the chroma. Black Beauty, Black Magic Hybrid, and Vaughan Hybrid produced very dark colored fruits; Florida High Bush produced comparatively light purple fruits while Mission Bell Hybrid and New Hampshire produced fruits of intermediate color intensity.

The data for the mature fruit color show that when ripe the fruits tend to attain more or less uniform coloration of yellow red to yellow.

Fruit Abnormalities

During the study of fruit characteristics certain abnormalities were observed.

The most frequent abnormality was the development of double fruits from a single flower. These were observed in all varieties and Plate 3 shows twin fruits from Florida High Bush. It can be seen that even the pedicel is double though fused throughout the length. This seems to indicate that doubleness might have originated even in the floral primordium.

Another abnormality was the occurrence of protrusions on fruits. Not more than one protrusion per fruit was observed in any case. The size was variable. In cases where the protrusion was big, a few seeds were contained in them. This fact indicates that the protrusions are not just bulges in the pericarp but are actually complete branches (if this term could be used in the case of fruits) of fruits with placentae and seeds. In contrast to the double fruits, the pedicel of fruits with a protrusion was always single. This fact appears to indicate that the teratological development possibly had its origin in the ovary

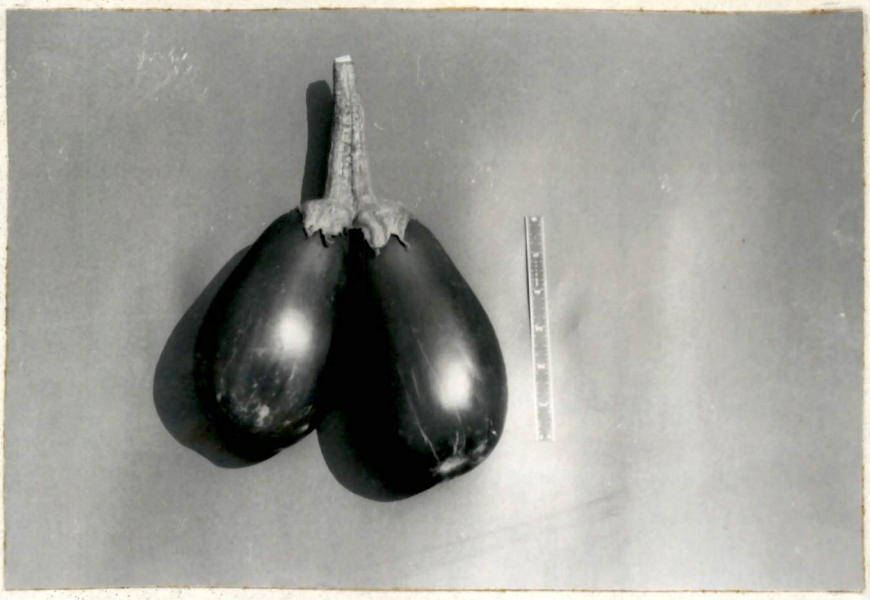

PLATE 3

Double Fruit from Florida High Bush

rather than in the floral primordium. Plate 4 illustrates this abnormality in Mission Bell Hybrid. Black Beauty and Vaughan Hybrid also had such cases.

Another abnormality not morphological but perhaps physiological was observed more commonly in Florida High Bush than in others. It was the vertical cracking of fruits, following rains. The cracking was possibly due to the inability of the epicarp to keep pace in growth with rate of swelling of the fruit resulting from large intake of water. Plate 5 illustrates this abnormality in Florida High Bush.

Yield Data

With the object of comparing the productivity of the varieties, the yields were recorded in pounds per plot. The yield data are presented in Table XVI. The yield data were subjected to analysis of variance. Separate analyses were conducted for yields in terms of number of fruits and in terms of pounds. The results are summarized in Tables XVII and XVIII. The analyses of variance indicate that there was no significant difference between the six varieties with regard to the number of fruits produced but with regard to yields in terms of pounds, New Hampshire yielded significantly less than the other five varieties. There was no significant yield differences between the five varieties, Black Beauty, Black Magic Hybrid, Florida High Bush, Mission Bell Hybrid and Vaughan Hybrid.

The average acre yields by grades of the six varieties are presented in Table XIX along with their percentage of total yields.

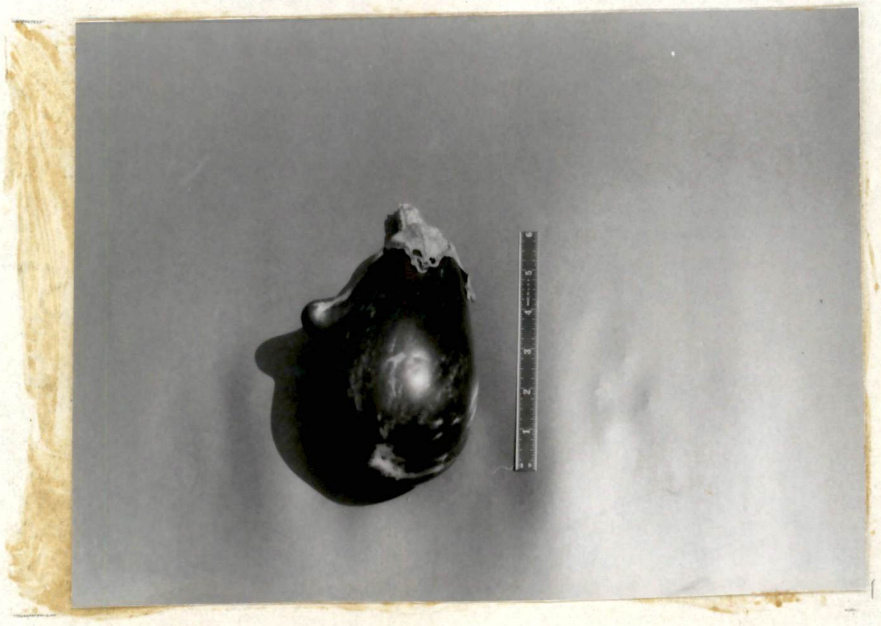

PLATE 4

Protrusion on a Mission Bell Fruit

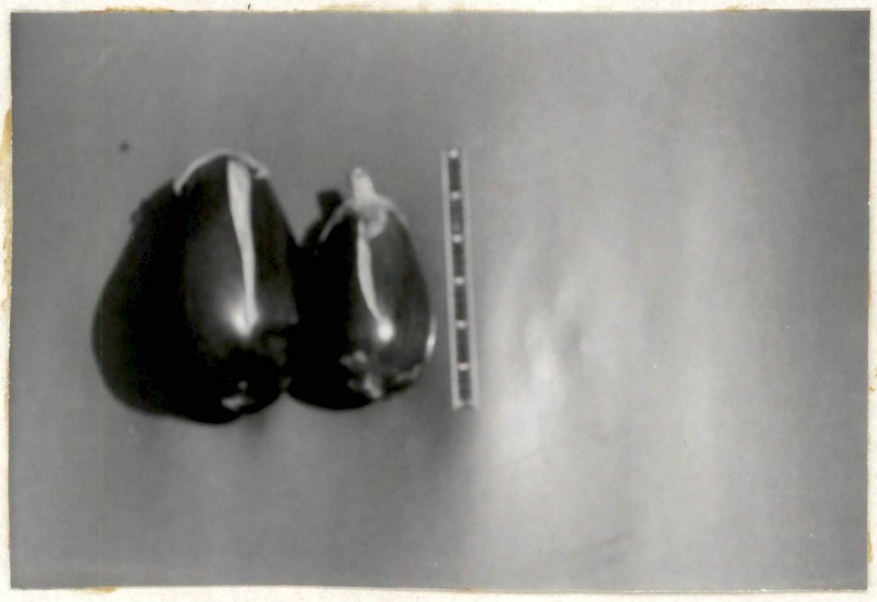

PLATE 5

Vertical Cracking of Fruits in Florida High Bush

TABLE XVI

YIELDS OF SIX AMERICAN VARIETIES OF EGGPLANTS
(Per Plot of 6 Plants)

Sl. No.	Variety and Replication		Yields in Number and Pounds							
			No. 1		No. 2		Cull		Total	
			No.	Lbs.	No.	Lbs.	No.	Lbs.	No.	Lbs.
1	Black Beauty	I	64	74.20	30	23.31			94	97.51
		II	43	52.40	22	16.94			65	69.34
		III	52	54.98	22	16.11			74	71.09
		IV	49	55.76	31	23.79	1	0.81	81	80.36
	Total		208	237.34	105	80.15	1	0.81	314	318.30
	Average		52	59.33	26.25	20.04	0.25	0.20	78.50	79.57
2	Black Magic Hybrid	I	47	55.76	14	8.43			61	64.19
		II	65	70.56	15	12.26			80	82.82
		III	52	60.71	22	24.81			74	85.52
		IV	35	39.12	23	19.94			58	59.06
	Total		199	226.15	74	65.44			273	291.59
	Average		49.75	56.54	18.50	16.36			69.25	72.89
3	Florida High Bush	I	45	57.63	17	13.88			62	71.51
		II	30	38.13	27	20.56	1	0.75	58	59.44
		III	43	46.94	12	8.62			55	55.56
		IV	46	49.94	16	14.56	2	1.12	64	65.62
	Total		164	192.64	72	57.67	3	1.87	239	252.13
	Average		41	48.16	18	14.40	0.75	0.47	59.75	63.03

TABLE XVI (Continued)

Sl. No.	Variety and Replication		Yields in Number and Pounds							
			No. 1		No. 2		Cull		Total	
			No.	Lbs.	No.	Lbs.	No.	Lbs.	No.	Lbs.
4	Mission Bell Hybrid	I	46	52.95	24	20.57			70	73.52
		II	64	65.96	12	8.94	1	1.13	77	76.03
		III	48	51.39	20	14.50			68	65.89
		IV	52	53.58	34	27.97			86	81.55
	Total		210	223.88	90	71.98	1	1.13	301	296.99
	Average		52.50	55.97	22.50	17.99	0.25	0.28	75.25	74.25
2	New Hampshire	I	51	24.44	9	3.63	2	0.56	62	28.63
		II	36	17.66	13	4.88			49	36.93
		III	66	29.30	19	7.63			85	36.93
		IV	46	20.93	7	2.81			53	23.74
	Total		199	92.33	48	18.95	2	0.56	249	111.84
	Average		49.75	23.08	12	4.74	0.50	0.14	62.25	27.96
3	Vaughan Hybrid	I	48	77.90	13	13.50			61	91.40
		II	51	71.79	18	20.69			69	92.48
		III	39	52.69	27	26.81			66	79.50
		IV	28	42.37	11	12.19	1	1.19	40	55.75
	Total		166	244.75	69	73.19	1	1.19	236	319.13
	Average		41.5	61.19	17.25	18.29	0.25	0.29	59.0	79.78

TABLE XVII

TOTAL NUMBER OF FRUITS PRODUCED BY SIX VARIETIES OF EGGPLANTS
(Per Plot of 6 Plants)
(Analysis of Variance)

Replication	Black Beauty A	Black Magic Hybrid B	Florida High Bush C	Mission Bell Hybrid D	New Hampshire E	Vaughan Hybrid F	Replication Total
I	94	61	62	70	62	61	410
II	65	80	58	77	49	69	398
III	74	74	55	68	85	66	422
IV	81	58	64	86	53	40	382
Variety Total	314	273	239	301	249	236	1612
Mean	78.50	68.25	59.75	75.25	62.25	59.0	

A=B=C=D=E=F.

TABLE XVIII

TOTAL YIELD OF SIX VARIETIES OF EGGPLANT
(Analysis of Variance)

Replication	Black Beauty A	Black Magic Hybrid B	Florida High Bush C	Mission Bell Hybrid D	New Hampshire E	Vaughan Hybrid F	Replication Total
I	97.51	64.19	71.51	73.52	28.63	91.40	426.76
II	69.34	82.82	59.44	76.03	22.54	92.48	402.65
III	71.09	85.52	55.56	65.09	36.93	79.50	393.69
IV	80.36	59.06	65.62	81.55	23.74	55.75	366.08
Variety Total	318.30	291.59	252.13	296.19	111.84	319.13	1589.18
Mean	79.57	72.89	63.03	74.05	27.96	79.78	

Least significant difference at 0.05 level -17.39.

Least significant difference at 0.01 level -24.06.

A=B=C=D=F > E.

TABLE XIX

COMPARISON OF ACRE YIELDS AND GRADE COMPOSITION OF SIX AMERICAN VARIETIES OF EGGPLANTS

Sl. No.	Variety	Acre Yields										
		Total		No. 1			No. 2			Cull		
		Bushels	Tons	Bushels	Tons	Per Cent of Total	Bushels	Tons	Per Cent of Total	Bushels	Tons	Per Cent of Total
1	Black Beauty	1750.54	24.55	1305.26	18.31	74.58	440.88	6.18	25.18	4.40	0.06	0.24
2	Black Magic Hybrid	1603.58	22.49	1243.88	17.45	77.59	359.70	5.04	22.41	--	--	--
3	Florida High Bush	1386.66	19.45	1059.52	14.86	76.40	316.80	4.44	22.83	10.34	0.15	0.77
4	Mission Bell Hybrid	1629.10	22.85	1231.34	17.27	75.57	391.60	5.49	24.04	6.16	0.09	0.39
5	New Hampshire	615.12	8.62	507.76	7.12	82.29	104.28	1.46	17.25	3.08	0.04	0.46
6	Vaughan Hybrid	1755.16	24.62	1346.18	18.88	76.68	402.38	5.65	22.95	6.60	0.09	0.37

1 bushel = 33 lbs.

It is seen from Table XIX that all varieties except New Hampshire were heavy yielders on acre yield basis. The varieties do not appear to differ greatly in the percentage of the No. 1, No. 2 and cull fruits. The maximum percentage of No. 1 fruits, viz., 82.29 per cent, was from New Hampshire, while the minimum of 74.58 was from Black Beauty. In the case of No. 2 fruits, the maximum of 25.18 per cent was from Black Beauty, while the minimum of 17.25 per cent was from New Hampshire. In all the varieties, the percentage of culled fruits was very low, the maximum being only 0.77 per cent in Florida High Bush and the minimum being 0 per cent in Black Magic Hybrid.

Plant Growth Habit

In order to compare plant growth habit, the height, spread, general appearance and branching of the six varieties were recorded. The results are presented in Table XX.

It is seen from the table that Florida High Bush and New Hampshire are very distinct in their growth habit from the other four varieties which are bushy, spreading, densely branching and much more different from one another in height and spread. But Florida High Bush is tall and erect, with its spread less than proportionate to its height and with its branches springing far apart from one another. On the other hand, New Hampshire is a dwarf variety with almost all its branches lying on the ground. For its height, it is a good spreader. New Hampshire, Mission Bell Hybrid and Vaughan Hybrid which were earliest to bloom, were also earliest to mature fruits. Black Beauty and Black Magic Hybrid

TABLE XX

COMPARISON OF PLANT GROWTH HABIT OF SIX AMERICAN VARIETIES OF EGGPLANTS

Sl. No.	Variety	Plant Height in Inches[a]		Plant Spread in Inches[a]		Growth Habit
		Range	Average	Range	Average	
1	Black Beauty	22.8-33.7	27.7	44.1-67.2	53.5	Bushy, spreading, densely branching
2	Black Magic Hybrid	17.5-30.9	24.13	44.3-69.2	56.26	Bushy, spreading, densely branching
3	Florida High Bush	26.1-42.1	32.9	38.2-58.5	47.6	Erect, not much spreading, sparsely branching
4	Mission Bell Hybrid	17.2-32.8	25.43	40.5-64.2	51.5	Bushy, spreading, and densely branching
5	New Hampshire	11.2-24.9	16.4	36.9-55.7	44.1	Decumbent
6	Vaughan Hybrid	22.3-37.8	30.8	42.6-66.7	52.5	Bushy, spreading, densely branching

[a]Measurements were taken on 24 plants per variety.

followed them and Florida High Bush was the latest of all. New Hampshire was also the first to cease yielding, followed by Mission Bell Hybrid. Black Beauty, Black Magic Hybrid and Vaughan Hybrid had a longer bearing period. Florida High Bush was the last to cease production.

CHAPTER V

DISCUSSION OF RESULTS

I. FLORAL STUDIES

Earliness of Flowering

It was found in this study that Mission Bell Hybrid, New Hampshire and Vaughan Hybrid were early blooming, Black Beauty and Black Magic Hybrid were midseason blooming, while Florida High Bush were late blooming. These findings are in agreement to the claims of the seed companies only with regards Black Beauty, Florida High Bush, Mission Bell Hybrid and New Hampshire. Black Magic Hybrid was not early as claimed but was midseason blooming. Vaughan Hybrid was not late but was early blooming.*

It is likely that the early varieties, namely Mission Bell Hybrid, New Hampshire and Vaughan Hybrid would be particularly suitable to northern sections where the growing season is short. Southern sections can grow any of the varieties because of the long growing season.

Number of Flowers Per Inflorescence

It was found that the inflorescences of the varieties under study were invariably extra axillary irrespective of the number of flowers carried. Never was found a case where it was axillary as stated by Magtang (44).

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*Descriptions of the varieties as given by the seed companies are given on pages 19 and 20.

In Black Magic Hybrid, Mission Bell Hybrid and New Hampshire, single flowers were more common than multiple flowered inflorescences. In Black Beauty, Florida High Bush and Vaughan Hybrid multiple flowered inflorescences were more common. It appears that the number of flowers per inflorescence is a varietal characteristic. This finding is in agreement with that of Smith (71).

Types of Flowers in the Inflorescence

In the present study long styled flowers and short styled flowers described by Smith (71) and Pal and Singh (55) and medium styled flowers described by Krishnamurthi and Subramaniam (41) were found in all the six varieties. It was observed that the solitary flowers and basal flowers were normally long styled while the styles of the second and third flowers had short styles in most cases. This finding is in agreement with that of Smith (71). Magtang (44) stated that flowers produced early and late in the season were short styled. In the present studies, it was found that Magtang's observation was correct only with regard to the late season flowers; solitary flowers and basal flowers of multiple flowered inflorescences were invariably long styled early in the season.

Floral Composition

According to Porter (59) flowers in Solanaceae are 5-merous, the stamens being normally 5, rarely 4 or 2 and the pistil composed of 2 united carpels and the stigma single or slightly 2-lobed. In the present study it was seen that flowers that conformed to the above standards were exceptions rather than the norm in the varieties in question.

Pleiomery of different degrees was observed. Pleiomery was reported by Singh (68) also.

From the point of view of the plant breeder, eggplant varieties that exhibit pleiomery are of material advantage since a stigma with 7 or 8 lobes offers greater surface area than one with just two lobes and this makes hand pollination easy. It also enables the application of large quantities of pollen so as to ensure the fertilization of the maximum number of ovules, which in turn will result in a higher number of seeds per fruit.

II. STUDIES IN FRUIT SET

Position of the Flower on the Inflorescence and Fruit Set

In this study it was estimated that fruit set occurred in the basal or first flower from 92-100 per cent, in the second flower from 0-16 per cent, in addition to the setting on the first flower, while there was no fruit set in the third flowers. It was also found that fruit set was related to the style length: the long styled and medium and styled flowers set fruit while short styled flowers did not set. These findings are in agreement with those of Smith (71), Pal and Singh (55) and Krishnamurthi and Subramanian (41). It was also observed the fruit that developed occasionally on the second flower never grew to be as big as that developing from the first flower.

It is to be inferred from the above findings that the plant breeder who aims at a high set in the crossed blossoms and who desires to secure a large number of seeds per crossed fruit, should perform his crosses on

long styled flowers which are basal in position in multiple flowered inflorescences or is solitary.

Fruit Set by Selfing

It was found in the selfing studies that selfing did occur in four out of the six varieties when the flower buds were bagged the day previous to opening. The varieties were Black Beauty, Black Magic Hybrid, Mission Bell Hybrid and Vaughan Hybrid. This finding is contradictory to that of Kakizaki (35) who noted that insect pollination was indispensable for fruit set in eggplants and that eggplants grown in a screened house excluding insects did not set fruit. In view of the contradictory findings, it is inferred that capacity to set fruit by selfing might be a varietal character or perhaps be influenced by other factors.

In the present studies, the success of selfing did not exceed 20 per cent in any variety. Although it might be possible to secure greater success under more optimum ecological conditions, it will be advisable for the plant breeder to bag a large number of buds to obtain adequate quantities of selfed seed.

Fruit Set by Intervarietal Crossing

The intervarietal crosses in this study involved three pureline varieties, Black Beauty, Florida High Bush and New Hampshire and three hybrids, Black Magic Hybrid, Mission Bell Hybrid and Vaughan Hybrid. It was found that the varieties could cross freely regardless of whether they were purelines or hybrids. Kakizaki (35) estimated that natural

crossing could take place in eggplants to an extent of 46.8 per cent. To the plant breeder the above findings have significance in the following aspects:

1. In order to maintain purity of strains, cultivation under isolated conditions will be necessary; the minimum distance between the isolation fields will have to be ascertained by experiments.

2. Since crossing takes places readily in eggplants, since hybridization technique is easy in this vegetable and since commercial exploitation of heterosis has been reported to be a practical proposition by several authors (especially 10, 16, 17, 37, 38, 51, 57), there seems to be a great potential for breeding hybrid eggplants in countries like India where it is a popular vegetable.

Set of Parthenocarpic Fruits

Munson (47) found that parthenocarpic fruits occasionally developed from emasculated flowers of hybrid eggplants. Although the present studies included three hybrids, parthenocarpy did not occur in any of them. Further experiments are necessary with greater number of flowers and under more optimum conditions before the possibility of parthenocarpy is ruled out in these varieties.

III. FRUIT CHARACTERS

Studies on the fruit size indicate that all the varieties except New Hampshire were large sized. Comparing with the oriental varieties even New Hampshire is big fruited. It would be interesting to investigate

the possible correlation between pleiomery of the pistil and the large size of the fruit.

From the results regarding the seediness of the varieties, it appears that the percentage of seed weight of fruit weight tends to be more or less uniform for all the varieties since they ranged from 12.15 to 17.05 per cent. However, the actual weight of seeds per fruit varied materially. For example, it was 5.7 g. per fruit in New Hampshire and 10.9 g. in Black Beauty. From these results it is apparent that in the production of hybrid seeds, greater quantities could be secured by employing a variety producing many seeds as the pistillate parent than would be possible with a variety producing few seeds.

The data on the weight of seeds indicate considerable differences between varieties with regard to this characteristic. Since seeds are sold by weight, it will be an additional advantage to seedsmen if the plant breeder could produce eggplant varieties that combine heaviness of seeds with superior market qualities.

All the varieties under study produced table mature fruits of purple hue of value 2 (45). The color variation was only in the chroma. Ripe fruits in all the varieties were yellow red to yellow. Purple eggplants are popular in the American market. Previous reports have indicated that purple color is dominant over other colors (2,3,35,46,48,53,54). Therefore the plant breeder can readily employ white or other non-purple varieties as one of the parents if they have some desirable qualities in the production of hybrid eggplants. The hybrid fruits will still be purple if either parent is purple.

Fruit abnormalities, though are of teratological interest, have no economic value to the horticulturist or the breeder. They do not cause serious loss because they occur too infrequently. However, physiological abnormalities such as the cracking of the fruits might assume serious proportions under certain conditions. Some varieties might be more susceptible to cracking than others since in the present study more cracked fruits were found in Florida High Bush than in others. Pathogenic infection could easily occur through these cracks, rendering the seeds useless. While using varieties like Florida High Bush as the pistillate parent, the breeder may have to perform more crosses than with non-cracking varieties so as to allow adequate margin for loss of fruits through cracking and consequent infection.

IV. YIELDS

Comparison of the yields of the six varieties in terms of number of fruits shows that there was no significant difference between them. On the other hand, with regards yields in terms of weight, it was found that New Hampshire yielded significantly less than the other varieties and that there was no significant difference between the varieties other than New Hampshire. New Hampshire was as prolific as the other varieties with regard to the number of fruits produced but the yields in terms of weight was low because of the small size of the fruits. For areas where small fruits are preferred, New Hampshire appears to be best suited. It was observed in the U. T. Roadside Market that some customers, especially these with small families preferred small sized fruits. For sections

where large sized fruits are in demand, any of the other five varieties should be satisfactory.

In this study the average number of fruits produced per plant works out to be 8.6 for Black Beauty, 8.3 for Black Magic Hybrid, 6.8 for Florida High Bush, 8.7 for Mission Bell Hybrid, 8.3 for New Hampshire and 6.9 for Vaughan Hybrid. These figures are more than the range of 2 to 5 fruits given by Seymour (67) for eggplants cultivated on field scale. The difference is perhaps due to the fact that experimental plants receive more care and grow under more uniform conditions than the plants in the farmer's bulk production fields. Because of this reason, acre yields calculated in this study are also likely to be higher than would be harvested by the truck farmer.

V. PLANT GROWTH HABIT

The results on plant growth habit indicate differences between the varieties. New Hampshire plants were very short and decumbent with most of the branches lying on the soil. This habit of growth resulted in almost all the fruits coming on contact with the soil. It is evident that in such dwarf varieties hazards of damage to fruits through surface pests like field rats and tortoises and soil-borne diseases are more than in tall varieties.

The other extreme in plant growth habit was exhibited by Florida High Bush. The plants were tall, erect, the branches arising well apart and the spread being less than proportionate to its height. Hence

few fruits came in contact with the soil. Chances of damage to fruits are minimum in such varieties.

All the other four varieties were intermediate in height but were closely branching, well spreading and covered with profuse foliage. Fruits arising from the lower branches were in contact with the soil while those borne on the upper branches were not. Therefore the chances of damage through pests and soil-borne diseases in such varieties are not great though present to some extent. Because of the dense foliage, fruits in such varieties are well protected from sun's rays. Hence these varieties may be especially advantageous in hot southern sections.

CHAPTER VI

SUMMARY

Six American varieties of eggplants were studied with respect to characteristics that have particular bearing in breeding procedures. Marketing qualities and productivity were also studied and compared.

The earliness of blooming was studied and the varieties were classified as follows: Mission Bell Hybrid, New Hampshire and Vaughan Hybrid early blooming, Black Beauty and Black Magic Hybrid midseason blooming and Florida High Bush late blooming.

In all the varieties the position of the inflorescence was extra-axillary.

Solitary flowers were more common in Black Magic Hybrid, Mission Bell Hybrid and New Hampshire. Multiple flowered inflorescences were more frequent than solitary flowers in Black Beauty, Florida High Bush and Vaughan Hybrid.

In all the six varieties and throughout the flowering season except toward the end, the basal flower of the multiple flowered inflorescence and the solitary flower were long styled. The second flower of the multiple flowered inflorescence was occasionally long or medium styled but was usually short styled. The third and subsequent flowers were invariably short styled.

The floral composition in all the varieties exhibited pleiomery of different degrees. There was no case of reduction of floral parts.

The solitary flower and the basal flower of the inflorescence normally set fruit in all varieties. The second flower occasionally set fruit. Third and subsequent flowers invariably aborted.

Selfing was successful to a limited extent in Black Beauty, Black Magic Hybrid, Mission Bell Hybrid and Vaughan Hybrid, but was unsuccessful in the other three varieties.

Intervarietal crossing occurred freely among the six varieties in ten combinations out of the fifteen possible combinations other than the reciprocal crosses. More success might have been possible but for the extreme dry conditions.

Under the conditions of the experiment, parthenocarpy did not occur.

All the varieties except New Hampshire produced large sized, heavy fruits. Black Beauty and Vaughan Hybrid were similar in size and shape of fruits. Vaughan Hybrid produced heaviest fruits and New Hampshire the lightest, the others being intermediary.

Regarding the percentage of seeds out of the weight of fruits, all the varieties appeared to be uniform. But the actual weight of seeds per fruit was very low in New Hampshire and very high in Vaughan Hybrid, the others ranging in between. The varieties differed also in the weight of seeds, Mission Bell Hybrid producing the heaviest seeds and Black Beauty the lightest seeds.

All the varieties produced purple fruits. Black Beauty, Black Magic Hybrid and Vaughan Hybrid had very dark purple fruits, Florida High Bush produced light purple fruits, while the fruits of Mission

Bell Hybrid and New Hampshire were of medium intensity in color. Ripe fruits in all varieties were of yellow red to yellow color.

Fruit abnormalities observed were double fruits, protrusions from the fruits and vertical cracking. Double fruits were seen in all varieties. Protrusion on fruits was seen in Black Beauty, Mission Bell Hybrid and Vaughan Hybrid. Vertical cracking was more common in Florida High Bush than in other varieties.

Regarding yields in number of fruits, New Hampshire was as prolific as the other five varieties. But in terms of weight of the produce it was a poor yielder and there was no difference between the other five varieties.

The varieties differed in plant growth habit. New Hampshire was short, spreading well for its height and its branches decumbent. Florida High Bush was erect and tall, spreading inadequately for its height and the branches arising well apart on the main axis. The other four varieties were intermediate in height, spreading well, bushy and densely foliaged with closely arising branches. Although the earliest varieties to bloom were the earliest to mature fruits, differences were observed regarding when the plants became unproductive at the end of the season. New Hampshire closely followed by Mission Bell Hybrid was the first to quit yielding, but Vaughan Hybrid which was also early kept yielding as long as Black Beauty and Black Magic Hybrid. Florida High Bush was the latest with regard to blooming, maturing fruits, as well as to cease to yield.

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APPENDICES

APPENDIX I

FLORAL DESCRIPTION FOR SOLANACEAE

Flowers hypogynous, 5-merous, regular to somewhat irregular, perfect, the corolla of united petals, usually plicate in bud. Stamens 5, inserted on the tube of the corolla alternate with the lobes, rarely 4 or 2. Pistil 1, of 2 united carpels, the ovary not deeply lobed, usually 2-celled with an oblique placenta, but sometimes nearly 4-celled by the development of additional placental lobes, the style single or none, and the stigma single or slightly 2-lobed.

APPENDIX II

UNITED STATES STANDARDS FOR EGGPLANT

GRADES

U. S. No. 1 shall consist of eggplants of similar varietal characteristics which are firm, fairly smooth, of good characteristic color, fairly well shaped and which are free from damage caused by disease, insects, mechanical, or other means. If count is specified, the eggplants shall be reasonably uniform in size in the container.

In order to allow for variations incident to proper grading and handling, not more than a total of 10 per cent, by count, of the eggplants in any container* may be below the requirements of this grade but not more than one eggplant in any container may be affected by decay provided an average of not more than 1 per cent of the eggplants in any lot may be affected by decay.

U. S. No. 2 shall consist of eggplants which are firm and which are free from serious damage caused by disease, insects, mechanical, or other means.

In order to allow for variations incident to proper grading and handling, not more than a total of 10 per cent, by count, of the

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*Application of tolerances: The tolerances specified for these grades are placed on a container basis. However, any lot of eggplants shall be considered as meeting the requirements of a specified grade, if the entire lot averages within the tolerances specified, provided that the defects in any container based on sample inspection do not contain more than double the amount allowed.

eggplants in any container may be below the requirements of this grade but not more than one eggplant in any container may be affected by decay provided an average of not more than 1 per cent of the eggplants in any lot may be affected by decay.

Unclassified shall consist of eggplants which are not graded in conformity with the foregoing grades.

MARKING REQUIREMENTS FOR SIZE

The size of eggplants may be designated in terms of count or minimum diameter.

Where the size is specified, in order to allow for variations incident to proper packing, not more than 10 per cent, by count, of the eggplants in any container may be below the size specified.

DEFINITIONS OF TERMS

As used in these grades:

"Similar varietal characteristics" means that the eggplants are alike as to shape and general characteristics.

"Firm" means that the eggplants are not soft or flabby.

"Good characteristic color" means that the eggplants are uniformly colored a deep purple. Streaked color, light-purple, reddish, or yellowish color shall not be considered good characteristic color.

"Fairly well shaped" means that those of the long type such as Florida High Bush may be either cylindrical or slightly curved but that

they shall not be materially deformed; those of thick, chunky type such as New York Improved may show the characteristic scallops at the base and may be slightly curved, but they shall not be materially deformed.

"Fairly smooth" means that any scars present do not materially affect the appearance, shape, or color.

"Damage" means any injury which materially affects the appearance, edible or shipping quality.

"Serious damage" means any injury which seriously affects the appearance, edible or shipping quality.

"Diameter" means the greatest dimension at right angles to the longitudinal axis.