COLLECTION AND CHARACTERIZATION OF LANDRACES OF CULINARY MELON (*Cucumis melo* L.) IN KERALA

By

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THESIS
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Dedicated

to my

Beloved Parents

DECLARATION

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

Vellayani,
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CERTIFICATE

Certified that this thesis entitled **"Collection and characterization of landraces of culinary melon (*Cucumis melo* L.) in Kerala"** is a record of research work done independently by **Mrs. Rakhi. R.** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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INTRODUCTION

1. INTRODUCTION

Melon (*Cucumis melo* L.) is one of the most important summer vegetable crops of India. It is grown traditionally in various river beds of India covering about 80 per cent of the area under melon cultivation in India (Nandpuri, 1989).

The species *Cucumis melo* is a polymorphic taxon encompassing a large number of botanical and horticultural varieties or groups. It includes dessert as well as cooking and salad types. (Naudin, 1859). They are good sources of Vitamin C, sugars and minerals (Ramayya and Azeemoddin, 1983). Melon plants also contain various bioactive principles including elaterin, stigmasterol, spinosterol and the antitumour principle cucurbitacin B (Duke and Ayensu, 1985).

There are several local varieties of melon grown in different regions of India (Nandpuri, 1989). The non dessert or culinary forms of *Cucumis melo* L. is a distinct group distributed and adapted well essentially under humid tropics of South India (Seshadri and More, 1996). Several non dessert types like 'Vellari' of Kerala (eaten both as salad cucumber and cooked cucumber) 'Vellarikkara' of Tamil Nadu (eaten like salad cucumber), 'Nakadosakai' and 'Budamkai' of Andhra Pradesh (eaten as cooked cucumber) 'Phoot' and 'Kachri' of Rajasthan and Bihar (eaten as dessert melon with sugar) are distributed in South (Seshadri and Chatterjee, 1996).

Vellari is a traditional as well as popular vegetable crop of Kerala. Truely analysing this is a non-dessert melon (*C. melo* L.) distributed throughout the humid tropical region of South India, with a variety of common names viz., Vellari, Melon, Pickling melon, Preserving melon, Oriental pickling melon, culinary melon etc.

Melons of Kerala have large variability in fruit shape and size, skin characters, flesh colour, cavity, keeping quality and reaction towards pest and disease incidence. However, no authentic reports are available on the characterization of these landraces.

Information on genetic variability and components of variation are basic for any crop improvement programme. Being a cross pollinated crop, tremendous variation exists in the melons (Davis *et al.*, 1967, Khanna *et al.*, 1969). Transfer of quantitatively inherited characters into commercially adopted cultivars from available germplasm can be an effective way to obtain greater genetic variation and response to selection (Bliss, 1981). No systematic work had been carried out in Kerala to characterize the genetic wealth on 'Vellari'. Many valuable genotypes may be lost forever if not saved. Hence, there is an urgent need to collect and conserve the genetic wealth in this crop.

The present study was attempted for collection and characterization of landraces of melon distributed in different parts of Kerala and also to assess the variability existing in the germplasm for morphological characters, yield and quality attributes. Also an attempt was made to assess the inter relationship between yield and other traits. Apart from this, path analysis and discriminant function analysis was also carried out to determine the extend of improvement that could be made in yield contributing characters.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

Cucumis melo L. commonly known as 'Vellari' is a traditional as well as popular vegetable crop of Kerala. The crop has its origin in tropical and subtropical Africa (Grubben, 1977) where many wild types occur. India has also a long history of cultivation of melon which was introduced by the Mughal rulers from Central Asia (Nandpuri, 1989). Melons of India have large variability in fruit shape, skin characters, flesh colour, thickness, sweetness, seed cavity diameter, seed size etc. (Seshadri and Chatterjee, 1996). Distinct forms in terms of fruit shape, colour and keeping quality can be seen even within Kerala. However, no authentic reports are available on the characterization of these local cultivars. The available literature on *Cucumis melo* L. relevant to the present study is reviewed under the following heads.

2.1. Variability

2.2. Reaction to biotic stresses

2.3. Heritability

2.4. Correlation

2.5. Path analysis

2.1. Variability

The success of any crop improvement programme depends to a great extend upon the magnitude of genetiv variability existing in the germplasm.

Naudin (1859) classified *C.melo* L. varieties into different horticultural groups based on the fruit characteristics and their uses. Robinson *et al.* (1976) opined that the word melon referred to the fruits of different botanical varieties of *Cucumis melo* L. According to them, the cultivated forms of *Cucumis melo* L. are varied in many characters and are difficult to classify clearly.

An extensive study conducted by Whitaker and Davis (1962) revealed that the crop exploded with variability after being introduced into India and the congenial environment which exists in India resulted in the existence of large number of species in a relatively short time.

Malinina, 1982 classified the Central Asian subspecies of *Cucumis melo* L. into four botanical varieties. With the aim of conserving the varietal diversity of melon in Central Asia, the Central Asian Branch of the Vavilov Institute in Tashkent made 1600 varietal collections (Kuchkarov and Shchukina, 1982).

According to Deol *et al.* (1981) the vine length ranged from 76.9 to 209.3 cm, with a mean of 130.2 cm. Swamy *et al.* (1985) reported that the main vine length ranged between 50.00 and 279.00 cm with a mean of 168.00.

Chhonkar *et al.* (1979) reported that in muskmelon the number of primary branches ranged from 10.75 to 15.00 with a mean of 12.11 at Varanasi. Swamy *et al.* (1985) reported that the number of primary branches per plant ranged between 2.3 and 8.3 with a mean of 5.7.

Nandpuri *et al.* (1976) studied the performance of three musk melon varieties under green house and field conditions in Ludhiana and observed significant varietal differences for number of days taken from sowing to both first male and female flower production and anthesis Deol *et al.* (1981) also observed highly significant differences between varieties for days taken to first female flower production. The range of variation for this triat was 32.7 to 53.1 days.

Swamy *et al.* (1985) observed considerable variation among 45 genotypes of musk melon for number of days to first harvest. They observed a range of 75 to 96.6 days with a mean of 84.6 days.

Nandpuri *et al.* (1975) reported that the yield per plant ranged from 672 to 4811 g with a general mean of 2821 g. Kalyanasundaram (1976) observed that variation among the varieties for yield per plant was non significant at Annamalai.

Regarding the number of fruits per plant, Nandpuri *et al.* (1975) reported a range of 11.6 to 7.3 with a mean of 3.6 whereas Deol *et al.* (1981) reported a low value ranging from 1.3 to 4.2 with a mean of 2.

Fruit weight varied widely in muskmelon. Ranges of 338g to 2064g (Nandpuri *et al.*, 1975), 200g to 1010g (Gurudeep *et al.*, 1977) and 314g to 1517g with a mean of 907g (Swamy *et al.*, 1985) have been recorded.

From Varanasi, Chhonkar *et al.* (1979) reported that thickness of the pulp ranged from 1.25 to 3.15 cm with a mean of 2.85 cm. More *et al.* (1987) reported a range of 0.34 to 1.57 for flesh cavity ratio.

In an attempt to study the varietal response to date of planting, Nandpuri and Lal, 1978, observed considerable variation among the varieties for the number of days taken from transplanting to fruit maturity irrespective of the planting date.

Solanki and Seth (1980) observed a wide range of variation among 24 genotypes of cucumber for plant height, leaves/plant, internode length, male flowers/plant, days to fruit maturity, female flowers/plant, fruits/ plant and yield/plant. Korneev (1980) observed significant variation for bitterness, yield/plant, female flowers/plant, earliness, disease resistance and pickling quality in cucumber.

Gopalakrishnan *et al.* (1983) conducted an evaluation trial of varietal collection from Western Ghats and coastal Kerala, the cultivar 'Mudikkode Local' produced the highest yield.

Elkner and Krysiak (1984) compared the physical and chemical characteristics of fruits of 14 melon varieties and found that differences in fruit characteristics were due to variety. The varieties 'Cristel' and 'Muskotaly' were identified as having the best biochemical and organoleptic qualities. Nakamura and Ishiuchi (1985) reported that pickling melons (*Cucumis melo* L.) were very similar to pickling cucumber in taste, flavour and processing suitability. In an evaluation of local varieties of *C. melo* var. *conomon* in Japan, the local variety, 'Ohama' was the best for yield and quality (Nakamura and Ishiuchi, 1985). 'Aurora' a melon cultivar with very large fruits surpassed other cultivar in yield, transporting quality and culinary quality (Norton *et al.*, 1985). Birdsnest type cultivars from Iran, which have a compact plant habit, reduced apical dominance, good fruit set and concentration of maturity are potentially valuable for once over harvesting (Mc Collum *et al.*, 1987).

In a study of 820 cucumber lines of diverse geographical origin, Neykov and Neikov (1988) reported a wide range of variation for yield/plant, harvesting period, disease resistance and growth period. Nerson *et al.* (1988) reported on the development of 'melofon', a genotype of *Cucumis melo* suitable for pickle production. Mariappan and Pappiah (1990) studied 45 diverse cucumber genotypes and reported a wide range of variation for all the traits except for leaves per plant.

Knavel (1991) found considerable genotypic differences among the muskmelon cultivars tested with respect of canopy architecture. According to him, the genotype 'Main Dwarf' provided a greater percentage of plant leaf area exposed to sunlight whereas genotype Ky-P reported less secondary stem branching with few potential fruiting sites on the stem.

A wide range of variability among 22 cucumber accessions was observed by Satyanarayana (1991) for all the characters excepting branches / vine and flesh thickness.

Chacko (1992) observed significant difference among the genotypes of muskmelon for percentage of germination, number of days to first male / female flower production, days to first harvest, yield/vine, volume of fruits, length of vine, number of branches and reaction towards pests and diseases.

In an experiment conducted with four cultivars of muskmelon in Spain, Artes *et al.*, 1993 reported that the cultivar 'Piel de Sapo' were highest in weight, caliber, edible portion and were the most oval shaped.

A wild melon *C. melo* var. *callosus* was characterised by earliness and multiple fruiting habit (Rana, 1993).

Considerable variation in respect of yield and earliness was reported among six slicing cucumber cultivars from an observational trial in Kerala. Among the cultivars tested EC 179394 and 'Sheetal' were found promising for yield and local preference (KAU, 1996).

Wehner and Cramer (1996) reported genetic variance for total, early and marketable fruits per plot, fruit shape and fruit weight in three slicing cucumber populations.

2.2. Reaction to biotic stresses

Cucurbits suffer from numerous bacterial, viral, mycoplasmal and fungal infections (Blancard *et al.*, 1994; Zittler *et al.*, 1996). Insects are also a major obstacle to the successful production of cucurbits (York, 1992). Varieties or lines with resistance to these biotic stresses get priority in the integrated pests and disease management.

According to Leppik (1970) the gene centers of cultivated plants and wild progenitor are the main source of resistance to insect pests and diseases. Various non dessert types of India are the sources of resistance to mildews and viruses (Seshadri and Chatterjee, 1996). Several wild and semi wild types of *Cucumis* sp. have been in cultivation in India long before the large scale introduction of dessert melons (Sujatha, 1987).

2.2.1. Mosaic virus disease

Middleton and Whitaker (1942) reported a lethal virus disease of cantaloup occurring in Imperial Valley, California and it was found that the disease reduced the yield to the extend of 75 per cent.

There are large number of viruses which cause much damage to different cucurbits all over India. Identified strains may be several, occurring singly or in mixtures especially in river beds (Seshadri and Chatterjee, 1996).

Studies at IARI have identified different strains like Cucumber mosaic virus, Watermelon mosaic virus, Tobacco virus group, Yellow vein mosaic virus and Kakri mosaic virus (Vasudeva and Lal, 1943; Capoor and Varma, 1948; Vasudeva *et al.*, 1949; Shankar *et al.*, 1972, Dubey and Nariani, 1975).

In the histological studies of infected leaves of cucumber with CMV, Cook (1938) found that the mosaic affected parts of leaves were thinner than normal parts.

Cohen and Nitzamy (1960)) described a virus causing typical yellow vein mosaic in cucumber (*Cucumis sativus* cv. Beit Alfa) from Israel transmitted by *Bemisia tabaci* and it could easily be transmitted mechanically from its known hosts.

Hills *et al.* (1961) while studying the effect of cucumber mosaic virus on contaloup, observed that the plant inoculated at the sixth leaf stage caused 40 per cent reduction in yield. Nelson (1961) also conducted studies on the effect of mosaic virus on cantaloups and reported that when runners of 2-4 feet length were inoculated with CMV, there was a reduction in fresh plant weight upto 75 per cent. Kazda *et al.* (1975) reported decrease in yield of green house cucumber infected with CMV. Yield loss was estimated to be 89 per cent in summer months and 96 per cent in winter.

Sharma and Sharma (1982) tested 31 genotypes of summer squash in field against natural infection of a strain of *Cucumis virus* 1 and found that 12 were moderately resistant but none was immune.

Collection of oriental pickling melon from South India made in Japan were resistant to CMV (Thakada, 1982).

According to Jagannathan and Ramakrishnan (1971), the diseased vines infected with melon mosaic produced only a few fruits of abnormal appearance. Internodes are shorter with smaller and malformed leaves. Nagarajan and Ramakrishnan (1975) carried out investigations on the transmission of melon mosaic virus and found that it was transmitted to some extend through seeds.

Lecoq *et al.* (1981) described that muskmelon yellow stunt virus could produce severe yellowing, deformation and enation of leaves and stunting in melon plants.

Resistance to various virus diseases has been reported in several semi dessert or culinary forms of *C. melo*. Oriental pickling melon (*C. melo* var *conomon*) introduced in USA from South India was reported to be resistant to cucumber virus 1. (Enzie, 1943).

CGMMV, a strain of TMV caused mottling independent of the season, but the leaf distorting was more severe during the slow growth in winter (Vasudeva and Nariani, 1952). Verma *et al.* (1970) recorded virus diseases of some cucurbits and found that CGMMV produced characteristic mosaic symptom on snakegourd and a mosaic mottling and blistering of the leaves with stunting on bottlegourd. Komura *et al.* (1971) reported the incidence of CGMMV in watermelon which produced mosaic symptom on young leaves and mosaic like dark green elevated areas on the surface of fruits.

According to Raychoudhuri and Varma (1978) CGMMV is the common and dangerous among different viruses identified in cucurbits. They also reported that CGMMV causing mosaic symptom on muskmelon has its host range restricted to the family Cucurbitaceae. When cucumber plants were inoculated with CGMMV at an early stage, the yield loss was 15 per cent (Fletcher *et al.*, 1969).

CGMMV resistance was reported in *Cucumis myriocarpus* by Esquinas - Alcazar and Gulick (1983). In India, CGMMV resistance has been located both in wild species of *Cucumis viz., C. africanus, C. figarei, C. ficifolius, C. meeusii, C. zeyheri* (Rajamony *et al.*, 1990) and in culinary melon like 'Phoot' and 'Kachri' (Rajamony, 1996).

Sowell and Demski (1981) described that inoculation of muskmelon with WMV-2 produced significantly fewer infected seedlings in PI 403994 than in 'Hales Best Jumbo'. Provvidenti and Robinson (1974) could prove that two lines of *Cucumis metuliferus* viz., PI 20268 and PI 292140 were highly resistant to watermelon mosaic virus 1.

2.2.2. Downy mildew

Downy mildew is prevalent in areas of high humidity especially when summer rain occurs regularly. Temperatures between 20 and 22°C along with extended rainy periods are ideal for infection and spread (Bains and Jhooty, 1978).

Of the numerous muskmelon varieties 'Buduma type 1,2,3' 'Phoontee', 'Goomuk', 'Nakkadosa', 'Ex-2', 'Annamalai', 'Edisto' and 'Harvest Queen' were found resistant to downy mildew (Sambandam *et al.*, 1979; Amin *et al.*, 1985).

2.2.3. Powdery mildew

Powdery mildew is severe in warm and rainfree region. This disease is dependent on age of host plant, relative humidity and temperature. Infection occurs in very dry as well as wet atmosphere, but it becomes severe when atmospheric humidity is high. Powdery mildew is an important disease affecting muskmelon and it reduces photosynthetic efficiency of crop drastically (Munjal *et al.*, 1963).

Choudhury and Sivakami (1972) screened 74 lines of muskmelon for breeding resistance against powdery mildew. 'Campo', 'Jacumba', 'Perlita', 'PMR-5' and 'PMR-6' expressed high degree of resistance. Among the indigenous collection, 'Pusa Sharbati' was moderately resistant. 'Lucknow Safeda' was the most susceptible.

Waraitch *et al.* (1977) screened 69 genotypes of muskmelon under field condition and cultivars *viz.,* 'Arka Rajhans', 'Jacumba', 'Dulce', 'PMR-5' and 'Gulfstream' were found to be resistant.

Ivanova (1986) investigated sources of resistance to powdery mildew among melons in Uzbekistan and USSR and noticed highest resistance in 'Super Market', 'Perlita', 'Kurume' and ''Jokneam".

2.2.4. Red pumpkin beetle

The red pumpkin beetle, *Raphidopalpa foveicollis* Lucas is the most common beetle on cucurbits and is widely distributed all over India (Dutt and Dalapati (1977).

Cucurbitacins, a class of tetracyclic triterpenoids naturally occurring in cucurbits act as specific feeding attractants for *R. foveicollis* (Sinha and Krishna, 1970).

Shinde and Purohit (1978) observed peak population of beetles during summer months in Madhya Pradesh.

Vashistha and Choudhury (1972) reported melon cultivar 'Casaba' showed a high degree of tolerance to red pumpkin beetle.

2.2.5. Fruit fly

Fruit fly is reported to be one of the dangerous pests of melons causing great economic loss in the field. Several species of fruit fly have been identified (Kapoor, 1970). According to Bhatia and Mahto (1970) melon fruitfly, *Dacus cucurbitae* is the most common species attacking cucurbits in India.

Chelliah (1970) found that melon was the most preferred host for melon fly.

Resistance to fruit fly was reported in *Cucumis callosus* a cross compatible species to *Cucumis melo* by Sambandam and Chelliah, 1972. Gupta and Verma (1978) tested eleven cucurbits for its relative susceptibility to fruit fly attack. They reported that snapmelon had maximum damage.

2.3. Heritability

Deol *et al.* (1981) reported high heritability for main vine length in muskmelon (70.64 %) but genetic gain was low (36.24 %). Number of primary branches per plant showed moderate heritability (50.59 %) and low genetic gain (19.79 %). Days to first harvest also showed moderate heritability (42.7 %) and very low genetic gain (7.4 %). High heritability (85.23 %) and high genetic gain (77.39 %) was recorded for number of fruits / plant. Average fruit weight recorded high heritability and moderate genetic gain (66.29 %).

Kalloo *et al.* (1981) reported high heritability and high genetic advance for yield per plant under North Indian conditions. However, Lippert and Hall (1982) reported a low heritability value of less than 13 per cent for this character under glass house condition in Europe.

In Cucumber, Mariappan and Pappiah (1990) observed high heritability associated with genetic advance for fruit girth, days for first staminate flowering, number and weight of seeds per fruit indicating the action of additive genes for the expression of these characters.

Lal and Singh (1997) reported highest heritability in characters like node at which first female flower appeared and days from transplanting to first fruit harvest in melons. Node at which first female flower appeared, showed the highest expected genetic advance.

In a genetic study of 13 varieties of cucumbers, it was reported that yield had the lowest heritability and lateral number had the highest among the characters investigated (Sheng and Staub, 1999).

2.4. Correlation

Guardeep *et al.* (1977) reported significant positive correlation of flesh thickness with fruit weight in muskmelon. Similarly, fruit length, fruit diameter and seed cavity diameter were found to be correlated in cucumber (Imam *et al.*, 1977).

Singh and Nandpuri (1978) reported that days to first fruit maturity was positively correlated phenotypically as well as genotypically with days to opening of first female flower, TSS, fruit weight and total yield per vine. Flesh thickness was positively correlated both phenotypically and genotypically with total yield.

Parthasarathy and Kalyanasundaram (1978) reported correlation of flesh thickness with weight of fruit and TSS.

Chhonkar *et al.* (1979) reported that in muskmelon, the length of the main creeper had a positive association both phenotypically and genotypically with fruit weight and yield and the number of primary branches was very strongly and positively associated with the number of nodes on the main creeper.

Deol *et al.* (1981) found a positive and highly significant correlation for vine length with the number of branches per plant. They also observed a positive and significant correlation of the number of days to produce the first female or bisexual flower with the number of days to fruit picking which showed that the cultivar early in producing female flowers was early in picking too. Flesh thickness did not exhibit significant correlation with any of the traits *viz.*, TSS, vine length and number of branches. Yield per plant showed a highly significant positive correlation with weight per fruit but negative correlation with number of days to first female flower.

Correlation studies on some character associated with yield conducted by Salk (1982) in melons found that the total fruit yield per plant was positively correlated with number of fruits per plant. Fruit number was negatively correlated with fruit weight. Positive correlations were found between flesh thickness, fruit weight and fruit diameter.

Cerne, 1984 reported that in cucumber, yield components were in positive correlation with number of main roots, vine length and leaf area. Choudhary *et al.* (1985) found the female flowers/vine, fruit length, fruit diameter and weight were positively associated with yield. They also observed the negative association of days to first female flower opening with fruits/vine and yield per vine. Haribabu (1985) observed fruit yield to be positively correlated with fruit weight, fruits/vine and vine length. Vine length was correlated with branches/vine and branches/vine with fruits/vine. Significant correlations between yield and its four components were noticed in five monoecious lines and their hybrids.

Swamy *et al.* (1985) observed in muskmelon that yield per plant was positively correlated with number of fruits, average fruit weight, number of nodes on the main stem, stem length, internode length, number of primary branches and fruit shape index.

Studies conducted by Choudhary and Mandal (1987) revealed significant genotypic and phenotypic correlation of yield with fruits/plant, female flowers/plant, fruit length, fruit weight and fruit diameter in cucumber. More *et al.* (1987) reported negative correlation of shape index with flesh to cavity ratio in oblong fruits in muskmelon. They also found flesh area production to be directly influenced by shape index. Vijay (1987) reported that fruits/vine and fruit weight were positively correlated with yield per vine in muskmelon.

Abusaleha and Dutta (1988) reported positive and significant associations between yield and fruit length, fruits per vine, fruit girth and flesh thickness in cucumber. Days to male and female flowering exhibited negative association with yield.

According to Kuo *et al.* (1988), there exists some correlation between flower type and fruit shape but varietal differences were present in muskmelon.

Among nine germplasm lines of water melon evaluated for 14 characters, fruit yield was correlated with vine length and vine girth (Lalta prasad *et al.*, 1988).

Singh and Singh (1988) evaluated eleven diverse genotypes of water melon at Sabour and found that yield was positively correlated with number of fruits/vine and negatively with fruit weight and number of days for the appearance of first female flower.

Cerne, 1989 found that total fruit weight was positively correlated with parameters of vegetative development in cucumber. Prasunna and Rao (1989) observed positive correlation of fruit yield with node to first female flower, days to first female flower opening, female flowers/vine, sex ratio, fruits/vine, average fruit weight and primary branches per vine.

A study conducted by Rastogi and Deep (1990a) with 25 cucumber cultivars also revealed positive correlation of total yield per plant with fruit per plant, fruit weight and fruit length.

Satyanarayana (1991) reported a positive correlation of yield with vine length, nodes/vine, fruits/vine and marketable yield per vine in cucumber. Significant positive correlation was observed in muskmelon between percentage of germination and yield per vine and also with number of fruits/vine (Chacko, 1992). He also reported high heritability in conjunction with high genetic advance for percentage of germination, yield/vine and vine length.

Prasad and Singh (1992) conducted correlation studied in cucumber and observed a significant and positive correlation of yield per plant with vine length, fruit length, fruit weight, fruit breadth and flesh thickness.

Rajendran and Thamburaj (1993) reported the interassociation of various yield components in watemelon. The average fruit weight had significant positive association with number of fruits/vine, flesh seed ratio and number of seeds/fruit. The number of fruits/vine had significant negative relationship with days to first female flower production.

Studies on correlation carried out in eight genotypes of cucumber by Saikia *et al.* (1995) showed that yield per plant had strong positive association with main vine length, number of secondary branches, leaf area, fruits/plant, fruit weight and fruit length.

In watermelon, yield/plant exhibited significant positive correlation with number of branches/plant, number of fruits/plant, weight of individual fruits. Earliness was positively correlated with node and days to first female flower production, length of vine, node at which first fruit produced and 100 seed weight (Shibukumar, 1995).

Total fruit yield per vine possessed highly significant positive correlations with flesh thickness, marketable fruit yield per vine, seed cavity size and weight per fruit in melon (Lal and Singh, 1997).

2.5. Path analysis

Vijay (1987) reported that number of fruits/vine and weight of individual fruit in muskmelon had strong direct positive effects on yield and recommended them as selection criteria.

Fruit number, female flower per plant, fruit length, fruit weight and fruit diameter as the important characters determining yield in cucumber (Choudhury and Mandal, 1987). Abusaleha and Dutta (1988) also reported highest direct effect for fruit per vine and fruit length. They also found direct negative effect of days to female flowering and percentage of unmarketable yield on total fruit yield. Indirect positive and significant effect of vine length branches per vine, fruit girth and flesh thickness on yield was also reported. Prasunna and Rao (1989) conducted path coefficient analysis and observed fruits/vine and average fruit weight as the most important yield contributing factors. A significant positive effect was found between fruits/vine and yield and branches per vine and yield (Rajput *et al.*, 1991).

Path analysis of yield and its components in 23 genotypes of cucumber by Prasad and Singh (1992) revealed the positive direct effect of vine length, days to female flower appearance, fruit weight and fruit length on yield. Internodal length, number of female flowers and days to maturity have positive and highly significant direct effect on fruit yield (Solanki and Shah, 1992).

Chen *et al.* (1994) compared seven moneocious cucumber cultivars for four parthenocarpic yield components. There were significant positive direct effects of fruits/vine, female flowers/vine and average fruit weight on yield per plant.Saikia *et al.* (1995) also revealed fruits per plant to have maximum direct effect on yield followed by fruit weight.

In Kerala, fruit girth exhibited maximum positive effect on fruit yield followed by average fruit weight (Gayathri, 1997). Meng *et al.*, 1999 reported that the longest direct positive action on early yield were average fruit weight, number of harvested fruits per plant and average fruit length.

Number of node to the first female flower production had high direct as well as indirect effect on yield in watermelon (Sidhu and Brar, 1981). Singh and Singh (1988) reported that number of fruits per vine and TSS had the highest direct as well as indirect effect on yield.

Among the various yield components, the average fruit weight had exerted maximum direct influence on the yield of fruits/vine (Rajendran and Thamburaj, 1989) whereas the number of fruits and early yield/plant had the highest direct positive effect on yield per plant (Pandita *et al.*, 1990).

Gopalakrishnan *et al.* (1980) conducted path coefficient analysis in pumpkin and reported that length of vine had maximum direct effect on fruit yield/vine.

MATERIALS AND METHODS

3. MATERIALS AND METHODS

The present study entitled "Collection and characterization of landraces of culinary melon (*Cucumis melo* L.) in Kerala" was carried out at the Department of Olericulture, College of Agriculture, Vellayani during the year 1998-2000.

3.1. Survey and collection of landraces

A survey was carried out in different melon growing tracts of Kerala for collecting landraces of melon. Special emphasis was given to include locally adapted types of Kerala from the traditionally melon growing areas.

Effective collection was made through the extension personnel in the Department of Agriculture, Kerala Horticultural Development Programme and krishi vigyan kendras. The survey was conducted during the period of March to September 1998 so as to cover the crops raised both during summer and rainy seasons. Seed samples of various landraces were collected by conducting field visit. The details of the accession of the landraces with their sources are presented in Table 3.1.

Table 3.1. List of landraces of culinary melons used for the study

Sl. No.	Accession	Source
1.	CM 2	Kakamoola, Thiruvananthapuram
2.	CM 3	Nemom, Thiruvananthapuram
3.	CM 4	Balaramapuram, Thiruvananthapuram
4.	CM 5	Kattakada, Thiruvananthapuram
5.	CM 6	Aryanad, Thiruvananthapuram
6.	CM 7	Nedumangad, Thiruvananthapuram
7.	CM 8	Nedumangad, Thiruvananthapuram
8.	CM 9	Nedumangad, Thiruvananthapuram
9.	CM 10	Vembayam
10.	CM 11	Palapoor, Thiruvananthapuram
11.	CM 13	Ochira, Kollam
12.	CM 14	Kottarakkar, Kollam
13.	CM 16	Chengannur
14.	CM 17	Kalavoor, Kottayam
15.	CM 18	Manimala, Pathanamthitta
16.	CM 19	Thiruvalla, Pathanamthitta
17.	CM 22	Madapalli, Kottayam
18.	CM 23	Neezhoor, Kottayam
19.	CM 24	Ettumanoor, Kottayam
20.	CM 25	Vakathanam, Kottayam
21.	CM 26	Vakathanam, Kottayam
22.	CM 28	Kuravilangad, Kottayam
23.	CM 31	Vakathanam, Kottayam
24.	CM 32	Pambadi, Kottayam
25.	CM 33	Velloor, Kottayam
26.	CM 34	Ikkattoor, Kottayam
27.	CM 35	Thrikkodithanam, Kottayam
28.	CM 36	Kattappana, Idukki
29.	CM 37	Kattappana, Idukki
30.	CM 38	Kattappana, Idukki
31.	CM 39	Kunnukara, Ernakulam
32.	CM 40	Moovattupuzha, Ernakulam
33.	CM 41	Manjapra, Ernakulam
34.	CM 42	Chalakudi, Thrissur
35.	CM 43	Aalathur, Palakkad
36.	CM 44	Nenmara, Palakkad
37.	CM 45	Anakkayam, Malappuram
38.	CM 46	Perithalmanna, Malappuram
39.	CM 47	Vadakara, Kozhikode
40.	CM 48	Periya, Wayanad
41.	CM 49	Edakkad, Kannur
42.	CM 50	Kanhangad, Kasaragod

3.2. Characterization of landraces

The basic materials for the study include seeds of 42 accessions of various landraces. They were grown in the experiment field of the Instructional Farm, College of Agriculture, Vellayani (Figure 1). It is situated at 8.5°N latitude, 76.9° E longitude at an altitude of 29m above MSL. The experimental site was summer rice fallow with clayey loam soil.

The experiment was laid out in Randomised Block Design with two replications. Pits of 60 cm diameter and 30 cm depth were taken at a spacing of 2 x 1.5 m. In each pit four seeds were sown. Sowing was done in such a way that in each replication there was a single row of four plants per accession (micro plots). The cultural and management practices were adopted according to the Package of practices recommendation of Kerala Agricultural University (KAU, 1996).

3.3. Observations recorded

Two middle plants out of the four in each plot were tagged for the purpose of recording the biometrical observations. The details of the experimental observations are given below :

3.3.1. Plant characters

3.3.1.1. Vine length

Vine length from the collar region to the tip of the main vine was measured at the time of harvest and expressed in centimeters.

3.3.1.2. Number of branches per plant

The number of primary and secondary branches per plant was counted at the full maturity of the plant.

3.3.1.3. Internodal length

Distance between two adjacent nodes were taken from the bottom portion, middle and top of the vine and average was calculated and expressed in centimeters.

3.3.1.4. Leaf area index

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

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

(Watson, 1952)

3.3.1.5. Leaf thickness

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

3.3.1.6. Leaf petiole length

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

3.3.2. Flowering characters

3.3.2.1. Days to first male flower

The number of days were counted from the sowing of seeds to the opening of the first male flower and recorded.

3.3.2.2. Branch and node of first male flower

Branch and node of the first male flower was noted counting from the soil surface.

3.3.2.3. Days to first female flower

The number of days taken from sowing to the bloom of the first female flower was recorded.

3.3.2.4. Branch and node of the first female flower

Branch and nodes were counted from the lowest to the one at which first female flower produced.

3.3.2.5. Sex ratio

Number of male and female flowers were counted starting from the commencement of flowering till its completion and expressed as male to female sex ratio.

$$\text{Sex ratio} = \frac{\text{Number of male flower}}{\text{Number of female flowers}}$$

3.3.2.6. Pollen viability

Pollens were taken from staminate flowers selected randomly and observed under light microscope (40 x) using the stain acetocarmine and glycerine. Fertile pollen per microscopic field was counted and mean was computed. Ratio of fertile pollen to total number of pollen was taken and expressed as percentage.

3.3.3. Fruit and yield characters

3.3.3.1. Days to first harvest

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

3.3.3.2. Total number of fruits per plant

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

3.3.3.3. Average fruit weight

Weight of two randomly selected fruits from each observational plants were taken and the average worked out and expressed in gram.

3.3.3.4. Yield per plant

Weight of fruits from observational plants at each harvest was taken using a top loading balance and added to get the total and the average recorded in kilogram.

3.3.3.5. Fruit length

The length of the fruits was recorded, average worked out and expressed in centimeters.

3.3.3.6. Fruit girth

The girth at the middle portion of the fruits were measured and the mean girth expressed in centimeter.

3.3.3.7. Flesh cavity ratio

The flesh cavity ratio was calculated using the following formula proposed by (Davis *et al.*, 1964).

$$\frac{\text{Flesh thickness}}{\text{½ cavity diameter}}$$

3.3.3.8. Colour and shape of fruits

Colour and shape of fruits in each accessions were noted.

3.3.3.9. Keeping quality of fruits

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

3.3.3.10. Organoleptic quality

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

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

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

Table 3.2. Score card for the organoleptic evaluation of culinary melons

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

The fruits were washed thoroughly in water and cut into pieces. 100 g of cut fruits were boiled with 50 ml water and one gram salt for ten minutes.

The prepared samples was used for organoleptic quality scoring.

The panel members were selected from a group of healthy adults in age group of 23-40. They were requested to taste one sample and score it. Each quality was assessed by the panel members after tasting the same sample several times if needed.

3.3.3.11. Seed per fruit

One well ripened fruit from each plant was selected at random and seeds with the mucilage were extracted carefully, keeping them under fermentation for 36 hours. It was washed, cleaned and dried under shade for three days and number of seeds were counted and recorded.

3.3.3.12. 1000 seed weight

A random sample of 1000 fully developed seeds per fruit from each collection was weighed using a top loading balance (sartorius) and weight recorded in gram.

3.3.4. Reaction towards pests and diseases

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

3.3.4.1. Incidence of fruit fly

Characterization of fruit fly incidence was done as suggested by Nath (1966).

The incidence of *Dacus cucurbita* and *Dacus dorsalis* on fruits was assessed by calculating percentage of infested fruits over total number of healthy fruits at different pickings. Pest rating was done as per the following scale.

% of fruit infestation	Score
0 - 20	1
21 - 40	2
41 - 60	3
61 - 80	4
81 - 100	5

3.3.4.2. Incidence of Red pumpkin beetles

Reaction to the incidence of red pumpkin beetle (*Aulocophora* sp.) on leaves was studied as suggested by Vashistha and Choudhury (1972).

3.3.4.3. Reaction towards the incidence of mosaic virus

Screening for virus incidence was done based on the symptoms of the individual plant. Scoring was done 60 days after sowing with a resistance susceptibility scale ranging from 0-5 as suggested by Rajamony *et al.*, 1990.

Score	Rating
0 and 1	resistant
2	medium resistant
3	medium susceptible
4	susceptible
5	highly susceptible

3.3.5. Weather parameters

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

1. Maximum and minimum temperature
2. Relative humidity
3. Rainfall

3.4. Statistical analysis

Data recorded from the 42 accessions were subjected to the following statistical analysis.

3.4.1. Analysis of variance and covariance

Analysis of variance and covariance were done.

a) to test the significant difference among the genotypes

b) to estimate the variance components and other genetic parameters like correlation coefficients, heritability, genetic advance etc. as per Singh and Choudhary (1979). Table 3.3 represents the analysis of variance / covariance. From this table other genetic parameters were estimated as follows :

3.4.1.1. Variance

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

3.4.2. Coefficient of variation

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

$$GCV = \frac{\sigma_g(x)}{x} \times 100$$

$$PCV = \frac{\sigma_p(x)}{x} \times 100$$

where, $\sigma_g(x)$ = genotypic standard deviation
$\sigma_p(x)$ = Phenotypic standard deviation
x = mean of the character under study

Table 3.3. Analysis of variance / covariance

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

Hence we have the following estimates

$\sigma^2_g(x) = (G_{xx} - E_{xx}) / r$ $\qquad$ $\sigma^2_e(x) = E_{xx}$

$\sigma^2_g(y) = (G_{yy} - E_{yy}) / r$ $\qquad$ $\sigma^2_e(y) = E_{yy}$

$\sigma^2_g(xy) = (G_{xy} - E_{xy}) / r$ $\qquad$ $\sigma^2_e(xy) = E_{xy}$

3.4.3. Heritability (Broad sense)

$$H^2 = \frac{\sigma^2{}_g\,(x)}{\sigma^2{}_p(x)} \times 100$$

where,

H^2 = heritability expressed in percentage

$\sigma^2{}_g(x)$ = genotypic variance

$\sigma^2{}_p(x)$ = phenotypic variance (Jain, 1982)

3.4.4. Genetic advance as percentage of mean

$$GA = \frac{KH^2\sigma_p}{\bar{x}} \times 100$$

where,

K = standard selection differential ie., 2.06 at 5 per cent selection

$\bar{x}$ = mean of the character (Miller *et al.*, 1958)

3.4.5. Correlation

Genotypic correlation coefficient $\gamma_g(xy) = \dfrac{\sigma_g(xy)}{\sigma_g(x) \times \sigma_g(y)}$

Phenotypic correlation coefficient $\gamma_p(xy) = \dfrac{\sigma_p(xy)}{\sigma_p(x) \times \sigma_p(y)}$

Environmental correlation coefficient $\gamma_e(xy) = \dfrac{\sigma_e(xy)}{\sigma_e(x) \times \sigma_e(y)}$

3.4.5. Path coefficient analysis

The path coefficients were worked out by the method suggested by Wright (1921) using the character which showed high correlation with yield. The simultaneous equations which give the estimates of path co-efficients are as follows.

$$\begin{vmatrix} r_{1y} \\ r_{2y} \\ \\ r_{iy} \\ r_{ky} \end{vmatrix} = \begin{vmatrix} 1 & r_{12} & r_{13} & \cdots & r_{1j} & \cdots & r_{1k} \\ & 1 & r_{23} & \cdots & \cdots & \cdots & r_{2k} \\ & & & & & & \\ & . & & & r_{ij} & \cdots & r_{ik} \\ & & & & & & 1 \end{vmatrix} \times \begin{vmatrix} p_1 \\ p_2 \\ \\ p_i \\ p_k \end{vmatrix}$$

where

r_{ij} is the genotypic correlation between the variables x_i and x_j

$i,j = 1,2,....k$

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

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

$$R = \left(1-\sum_{i=1}^{k} P_i r_{ij}\right)^{1/2}$$

Indirect effect of ith character *via* jth character on yield is estimated as $P_i.\gamma_{ij}$

3.4.6. Selection index

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

The selection index was described by the function.

$$I = b_1x_1 + b_2x_2 + \ldots\ldots b_kx_k$$

and the merit of the plant was described by the function :

$$H = a_1G_1 + a_2G_2 + \ldots.a_kG_k$$

where x_1, x_2 ... x_k are the phenotypic values and G_1, G_2... G_k are the genotypic values of the plant with respect to character, x_1, x_2 .... x_k and H is the genetic worth of plant. It is assumed that the economic weight assigned to each character is equal to unit ie., a_1, a_2 ... a_k = 1. The b coefficients were determined such that the correlation between H and I is maximum.

RESULTS

4. RESULTS

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

4.1 Characterization of the landraces

4.2 Variability analysis

4.3 Heritability and genetic advance

4.4 Correlation studies

4.5 Path analysis

4.6 Selection index

4.1 Characterization of the landraces

The mean data on morphological and yield attributes were subjected to analysis of variance for testing the significance of the difference among accessions. The results (Appendix II) revealed that genotypes exhibited wide and significant difference among themselves for all the characters except number of primary branches, branch of first male and female flower produced.

4.1.1 Plant characters

The mean performance of each of the 42 accessions for various plant characters under study are furnished in Table 4.1.

Vine length varied from 112.5 cm in CM 41 to 307.0 cm in CM 3. Accessions CM 48, CM 36, CM 50, CM 46, CM 10, CM 40 were on par with C 3. Accessions CM 26, CM 43, CM 42, CM 32, CM 24, CM 28 were on par with C 41.

CM 11 recorded maximum primary branches (3.75) and the lowest (2.5) was seen in accession CM 43. The mean value of secondary branches ranged from two in CM 10 to five in CM 48. Accessions *viz.*, CM 36, CM 40, CM 7, CM 14, CM 35, CM 38, CM 48 and CM 50 were found on par with CM 10 (4.25, 4.25, 4, 3.75, 3.75, 3.75, 3.75, 3.75).

The longest internode was recorded by CM 40 (12.4 cm) followed by CM 48 (11.85). Lowest was in CM 6 (7.8 cm). CM 5, CM 8, CM 11, CM 23, CM 46, CM 14, CM 39, CM 49, CM 32 and CM 47 were on par with CM 40. (11.85, 11.6, 11.3, 10.95, 10.95, 10.75, 10.75, 10.75, 10.7, 10.55 respectively).

Table 4.1. Plant characters of the landraces of culinary melons

Accession	Vine length (cm)	No. of primary branches	No. of secondary branches	Internodal length (cm)
CM 2	215.50	3.00	3.00	10.25
CM 3	307.00	3.50	3.25	10.50
CM 4	215.00	3.00	3.00	9.39
CM 5	230.75	2.50	3.50	11.85
CM 6	228.25	3.00	2.75	7.80
CM 7	236.75	3.25	4.00	10.25
CM 8	213.00	3.50	3.00	11.60
CM 9	203.25	3.00	3.00	8.80
CM 10	245.25	3.50	2.00	9.00
CM 11	213.75	3.75	2.55	11.30
CM 13	191.25	3.00	3.25	9.25
CM 14	211.25	3.00	3.75	10.75
CM 16	187.00	3.25	2.50	9.00
CM 17	220.50	3.50	3.50	9.30
CM 18	216.25	3.25	3.25	10.50
CM 19	225.25	3.75	3.00	9.75
CM 22	212.75	2.50	3.00	9.50
CM 23	218.28	3.00	3.00	10.95
CM 24	118.50	2.75	3.00	8.39
CM 25	197.50	2.75	3.00	8.95
CM 26	166.00	3.50	2.50	10.00
CM 28	117.75	2.50	2.25	8.50
CM 31	205.25	2.75	2.75	10.50
CM 32	123.50	2.25	2.25	10.70
CM 33	213.25	3.25	3.25	9.50
CM 34	197.75	3.75	2.75	9.15
CM 35	232.25	3.00	3.75	10.05
CM 36	261.00	3.00	4.25	9.95
CM 37	230.75	3.00	3.50	9.80
CM 38	228.75	3.25	3.75	8.39
CM 39	232.50	3.00	2.75	10.75
CM 40	239.25	3.00	4.25	12.40
CM 41	112.50	3.00	3.00	8.80
CM 42	135.50	4.00	3.75	9.45
CM 43	150.00	3.50	2.25	10.30
CM 44	212.50	3.75	3.00	10.15
CM 45	230.00	2.50	2.25	10.25
CM 46	245.50	3.50	3.50	10.95
CM 47	182.75	3.00	3.00	10.55
CM 48	278.25	3.00	5.00	9.50
CM 49	190.25	3.50	2.25	10.75
CM 50	248.00	3.75	3.75	8.25
CD(0.05)	67.79	0.876	1.304	1.91
Mean	208.10	3.16	3.12	9.898

4.1.2 Leaf characters

The accessions CM 7, CM 36, CM 5, CM 4 and CM 50 were superior in leaf area index (Table 4.2). (0.89, 0.875, 0.8, 0.79, 0.775 respectively). Accessions CM 16, CM 9, CM 10, CM 38, CM 47, CM 24, CM 23, CM 3, CM 22, CM 42, CM 19 and CM 28 recorded low leaf area index. (0.41, 0.4, 0.38, 0.375, 0.375, 0.35, 0.35, 0.345, 0.34, 0.34, 0.315, 0.305 respectively).

Leaf thickness was highest (397.25 μ) CM 49 followed by CM 4 (395.5 μ). Lowest value was recorded in CM 28 (232.5 μ) CM 5, CM 33, CM 7, CM 48, CM 47 were on par with CM 49 (383.25, 382.5, 378.75, 374.5, 372.5 μ respectively).

Leaf petiole length ranged from 7.5 cm in CM 28 to 11.5cm in CM 43 and CM 50 followed by CM 24 (11.25 cm). Accessions *viz.*, CM 17, CM 14, CM 36, CM 37, CM 40, CM 4, CM 35 and CM 44 (11 cm, 10.75 cm, 10.75 cm, 10.75 cm, 10.75 cm. 10.5 cm, 10.5 cm, 10.5 cm) were on par with CM 43 and CM 50.

4.1.3 Flowering characters

Characterization of the landraces in terms of staminale flower production is presented in Table 4.3.

Table 4.2. Leaf characters of the landraces of culinary melons

Accession	Leaf area index	Leaf thickness (μ)	Leaf petiole length (cm)
CM 2	0.555	306.25	9.50
CM 3	0.345	302.75	9.25
CM 4	0.780	395.50	10.50
CM 5	0.800	383.25	9.50
CM 6	0.615	323.50	9.00
CM 7	0.890	378.75	8.25
CM 8	0.555	335.25	9.75
CM 9	0.400	335.50	8.50
CM 10	0.380	367.00	8.88
CM 11	0.625	371.00	9.50
CM 13	0.640	336.25	10.25
CM 14	0.595	266.25	10.75
CM 16	0.405	346.25	9.25
CM 17	0.720	282.50	11.00
CM 18	0.675	310.00	9.00
CM 19	0.315	298.75	8.75
CM 22	0.340	285.00	9.75
CM 23	0.350	265.00	10.00
CM 24	0.350	252.50	11.25
CM 25	0.740	342.50	7.75
CM 26	0.420	357.50	9.25
CM 28	0.305	232.50	7.50
CM 31	0.415	362.50	10.25
CM 32	0.465	268.75	8.75
CM 33	0.665	382.50	8.25
CM 34	0.580	306.25	10.13
CM 35	0.690	347.50	10.50
CM 36	0.875	330.00	10.75
CM 37	0.660	293.25	10.75
CM 38	0.375	334.75	10.25
CM 39	0.480	268.25	10.25
CM 40	0.675	268.00	10.75
CM 41	0.580	347.00	8.75
CM 42	0.340	367.25	9.50
CM 43	0.450	356.50	11.50
CM 44	0.630	294.25	10.50
CM 45	0.585	330.00	0.00
CM 46	0.685	293.25	9.50
CM 47	0.375	372.50	9.50
CM 48	0.735	374.50	8.75
CM 49	0.480	397.25	8.75
CM 50	0.775	267.75	11.50
CD(0.05)	0.120	25.93	2.19
Mean	0.565	333.47	9.67

Table 4.3. Characterization of the landraces of culinary melons in terms of staminate flower production

Accession	Days to produce first male flower	Branch of first male flower	Node of first male flower
CM 2	29.50	2.00	3.50
CM 3	23.00	2.50	2.25
CM 4	29.50	2.00	4.25
CM 5	28.75	2.25	4.00
CM 6	29.50	1.75	4.50
CM 7	29.00	2.00	4.50
CM 8	28.75	2.00	2.25
CM 9	25.75	2.00	4.25
CM 10	29.00	2.00	5.00
CM 11	28.75	1.75	3.50
CM 13	29.25	1.50	4.50
CM 14	28.50	1.50	4.50
CM 16	32.00	1.25	4.00
CM 17	29.25	1.75	4.00
CM 18	29.25	2.50	4.50
CM 19	30.25	2.25	5.00
CM 22	29.25	2.00	5.25
CM 23	29.25	2.75	4.75
CM 24	29.75	2.25	4.25
CM 25	29.75	1.50	4.25
CM 26	29.75	1.00	4.75
CM 28	35.75	3.00	5.00
CM 31	30.00	1.50	4.00
CM 32	30.00	1.50	4.75
CM 33	29.50	2.00	4.75
CM 34	29.50	3.00	4.00
CM 35	27.75	1.50	2.50
CM 36	29.00	1.75	4.50
CM 37	29.00	2.00	5.25
CM 38	29.75	2.25	4.50
CM 39	29.75	2.75	4.75
CM 40	35.00	2.75	6.75
CM 41	29.75	2.50	5.00
CM 42	29.50	2.75	4.75
CM 43	29.25	1.50	5.00
CM 44	29.50	1.75	4.75
CM 45	30.00	1.25	4.75
CM 46	29.75	1.50	4.75
CM 47	35.50	2.75	6.75
CM 48	28.25	1.50	5.00
CM 49	29.50	1.75	4.75
CM 50	27.75	1.50	4.50
CD(0.05)	1.29	0.78	0.89
Mean	29.35	1.98	4.49

The days to produce first male flower ranged between 23 (CM 3) and 35.75 (CM 28). CM 47 (35.5) CM 40 (35) was on par with CM 28.

For first male flower production, highest value of three was observed in CM 28 and CM 34. CM 23, CM 39, CM 40, CM 42, CM 47 (2.75), CM 18, CM 26, CM 41 (2.5) and CM 19, CM 24, CM 38, CM 5 (2.25) were on par with CM 28 and CM 34.

CM 26 produced first male flower in the first branch itself and accession CM 16 and CM 45 recorded a slight higher value of 1.25.

A higher value of 6.75 was recorded by CM 40 and CM 47 for the node of first male flower production. Lowest value of 2.25 was recorded by CM 3 and CM 8.

Characterization of landraces of culinary melons in terms of pistillate flower production was given in Table 4.4.

The number of days for blooming of first female flower ranged between 32 (CM 9) and 42.25 (CM 40). CM 47 (40.5) was on par with CM 40. CM 41, CM 42, CM 39, CM 50, CM 43, CM 37, CM 44, CM 13 and CM 3 were also early in producing female flowers (33, 33, 33, 33, 32.75, 32.75, 32.75, 32.25, 32.25 respectively).

Table 4.4. Characterization of the landraces of culinary melons in terms of pistillate flower production

Accession	Days to produce first female flower	Branch of first female flower	Node of first female flower
CM 2	35.50	2.00	8.00
CM 3	32.25	2.50	6.25
CM 4	34.75	2.00	8.50
CM 5	33.50	2.25	8.50
CM 6	34.50	1.75	9.25
CM 7	34.50	2.00	8.50
CM 8	33.75	2.00	6.50
CM 9	32.00	2.00	10.25
CM 10	34.00	2.00	10.00
CM 11	33.50	1.75	7.50
CM 13	32.25	1.50	8.75
CM 14	35.25	1.75	9.00
CM 16	36.50	1.50	9.25
CM 17	34.75	2.00	8.00
CM 18	33.25	2.00	8.50
CM 19	35.00	2.00	9.75
CM 22	34.00	2.00	11.25
CM 23	34.00	2.50	9.25
CM 24	38.00	2.00	9.00
CM 25	33.50	2.00	9.00
CM 26	34.00	1.50	10.25
CM 28	39.00	2.50	10.00
CM 31	36.50	1.75	8.75
CM 32	34.75	2.00	9.75
CM 33	33.25	2.00	10.25
CM 34	34.00	2.00	8.30
CM 35	34.00	1.75	6.25
CM 36	33.25	1.75	9.00
CM 37	32.75	2.00	11.00
CM 38	33.50	2.25	9.00
CM 39	33.00	2.75	10.25
CM 40	42.25	2.75	12.25
CM 41	33.00	2.50	10.75
CM 42	33.00	2.75	9.50
CM 43	32.75	1.50	9.25
CM 44	32.75	1.75	9.50
CM 45	35.25	1.25	8.50
CM 46	33.75	1.50	9.25
CM 47	40.50	2.75	12.25
CM 48	34.65	1.50	9.50
CM 49	34.25	1.75	9.00
CM 50	33.00	2.50	9.00
CD(0.05)	1.81	0.76	1.46
Mean	34.56	2.006	9.204

Regarding the branch of first female flower production, maximum value of 2.75 was recorded in CM 39, CM 40, CM 42, CM 47 and minimum in CM 45 (1.25).

Highest value of 12.25 was recorded for node of first female flower production by CM 40 and CM 47. CM 22 (11.25) and CM 37 (11) were on par with CM 40 and CM 47. Lowest value of 6.25 was recorded in CM 35 and CM 3.

4.1.4 Sex ratio and pollen viability

Details on various landraces for sex ratio and pollen viability are presented in Table 4.5.

CM 40, CM 41, CM 5, CM 50, CM 46, CM 48, CM 44, CM 33, CM 38, CM 36, CM 37, CM 7, CM 17, CM 32 and CM 25 had high values for sex ratio (38.15, 37.85, 37.4, 35.8, 35.55, 35.1, 34.5, 33.45, 33.35, 33.0, 33.0, 32.2, 32.0, 31.9, 31.8). Lowest sex ratio was observed in CM 28 (9.89) followed by CM 10 (12.45) and CM 42 (16.05).

CM 17 (77.74 per cent) and CM 40 (77.74 per cent) recorded the highest value for pollen viability. CM 46, CM 5, CM 36, CM 7, CM 49, CM 50, CM 45 and CM 48 (75.84, 75.21, 75.21, 73.03, 73.03, 73.03, 72.02, 71.07) were on par with CM 17 and CM 40. CM 24 (58.35) recorded the lowest value for pollen viability.

Table 4.5. Sex ratio and pollen viability in landraces of culinary melons

Accession	Sex ratio	Pollen viability (%)
CM 2	24.95	88.50
CM 3	28.25	88.50
CM 4	19.90	89.00
CM 5	37.40	93.50
CM 6	27.20	85.50
CM 7	32.20	91.50
CM 8	22.20	82.50
CM 9	28.05	79.00
CM 10	12.45	78.00
CM 11	17.45	73.50
CM 13	17.00	80.50
CM 14	28.65	77.00
CM 16	18.00	78.50
CM 17	32.00	95.50
CM 18	24.65	78.00
CM 19	25.40	86.00
CM 22	26.30	82.50
CM 23	26.25	86.50
CM 24	16.50	72.50
CM 25	31.80	83.00
CM 26	30.35	76.50
CM 28	9.89	73.50
CM 31	28.15	82.50
CM 32	31.90	82.00
CM 33	33.45	86.50
CM 34	18.05	83.00
CM 35	31.30	82.50
CM 36	33.00	93.50
CM 37	33.00	84.50
CM 38	33.35	81.00
CM 39	29.80	84.50
CM 40	38.15	95.50
CM 41	37.85	82.00
CM 42	16.05	85.50
CM 43	20.25	84.00
CM 44	34.50	86.00
CM 45	28.85	90.50
CM 46	35.55	94.00
CM 47	16.95	85.50
CM 48	35.10	89.50
CM 49	24.95	91.50
CM 50	35.80	91.50
CD(0.05)	6.497	7.64
Mean	26.97	84.64

4.1.5 Yield and yield characters

Performance of various accessions for yield and yield characters were presented in Table 4.6.

CM 47 took maximum days to harvest (60.5) whereas accession CM 3 took minimum days (50.25). CM 40, CM 28 and CM 24 (60.25, 59.0, 58.0 days) were found to be on par with CM 47 whereas CM 35, CM 50, CM 5, CM 26, CM 23 and CM 9 (51.75, 51.75, 51.5, 51.5, 51.5, 50.75) were found to be on par with CM 3.

Fruits per plant ranged from 2.25 to 16.5 in CM 28 and CM 48 respectively. Accession viz., CM 47 (4), CM 32 (3.75), CM 23 (3.5), CM 19 (3.25) and CM 24 (2.25) were found on par with CM 28. Next to CM 48, accessions CM 36, CM 7 and CM 50 (12, 11.25, 10.75) had the highest number of fruits respectively.

CM 5 was superior for yield (13.89 kg) followed by CM 6 (10.74 kg) and CM 18 (8.08). Lowest yield was recorded by the accession CM 41 (1.01 kg) followed by CM 24 and CM 28 (1.40 and 1.49).

4.1.6 Fruit characters

Details of various landraces in terms of fruit characters are furnished in Table 4.7 and Plate 2.

Table 4.6. Harvest and yield characters of the landraces of culinary melons

Accession	Days to first harvest	Fruits per plant	Yield per plant (kg)
CM 2	55.25	8.00	6.023
CM 3	50.25	7.75	7.925
CM 4	54.00	8.25	7.105
CM 5	51.50	9.50	13.890
CM 6	53.75	9.50	10.740
CM 7	53.25	11.25	4.960
CM 8	53.25	8.50	7.948
CM 9	50.75	7.50	3.663
CM 10	54.00	7.75	4.898
CM 11	53.50	9.25	7.535
CM 13	52.25	6.25	3.908
CM 14	54.25	8.50	2.328
CM 16	56.50	6.00	3.903
CM 17	53.25	7.25	7.905
CM 18	52.75	7.50	8.083
CM 19	55.00	3.25	1.510
CM 22	54.00	5.75	2.975
CM 23	51.50	3.50	2.493
CM 24	58.00	2.75	1.400
CM 25	53.50	4.75	2.775
CM 26	51.50	7.50	4.690
CM 28	59.00	2.25	1.485
CM 31	56.50	6.00	3.888
CM 32	54.75	3.75	2.060
CM 33	53.25	7.00	6.115
CM 34	54.00	6.50	5.400
CM 35	51.75	5.75	7.100
CM 36	53.75	12.00	5.613
CM 37	52.75	6.25	2.595
CM 38	53.50	4.75	2.758
CM 39	53.00	5.75	2.560
CM 40	60.25	9.25	2.085
CM 41	53.00	7.75	1.018
CM 42	53.00	4.75	1.975
CM 43	52.75	7.25	3.188
CM 44	52.75	4.50	5.410
CM 45	55.25	5.00	2.610
CM 46	53.75	9.00	5.105
CM 47	60.50	4.00	2.690
CM 48	52.00	16.50	7.310
CM 49	55.50	6.25	5.088
CM 50	51.75	10.75	4.295
CD(0.05)	1.58	2.03	1.58
Mean	53.92	7.03	4.69

Table 4.7. Fruit characters of the landraces of culinary melons

Accession	Average fruit weight (kg)	Length of fruit (cm)	Girth of fruit (cm)	Flesh cavity ratio
CM 2	1.000	33.75	24.350	0.893
CM 3	1.038	31.10	26.175	0.985
CM 4	0.903	24.38	24.800	0.875
CM 5	1.523	39.63	28.675	1.148
CM 6	1.160	29.50	31.500	1.063
CM 7	0.463	21.25	21.425	0.940
CM 8	0.963	31.50	24.075	1.183
CM 9	0.478	22.25	20.775	0.790
CM 10	0.748	22.20	26.600	1.098
CM 11	0.718	28.85	20.700	0.948
CM 13	0.638	23.45	23.900	1.270
CM 14	0.453	19.93	20.350	1.340
CM 16	0.780	23.83	27.880	0.893
CM 17	1.323	34.93	28.250	1.108
CM 18	1.000	25.30	28.825	1.133
CM 19	0.388	19.20	20.425	0.898
CM 22	0.580	21.18	23.500	1.375
CM 23	0.678	23.30	23.400	1.155
CM 24	0.550	18.53	25.325	1.163
CM 25	0.655	24.10	23.500	1.165
CM 26	0.663	23.78	25.100	1.163
CM 28	0.663	21.97	20.100	0.793
CM 31	0.758	24.93	24.125	1.573
CM 32	0.560	22.14	23.100	1.088
CM 33	0.988	26.10	27.775	0.985
CM 34	0.900	22.15	31.700	1.055
CM 35	0.990	28.18	25.950	1.095
CM 36	0.463	17.80	22.050	1.283
CM 37	0.335	19.28	19.850	1.350
CM 38	0.653	19.73	24.650	1.513
CM 39	0.478	25.03	20.775	1.095
CM 40	0.285	15.63	18.625	1.053
CM 41	0.273	15.68	14.900	1.170
CM 42	0.468	19.93	21.775	0.995
CM 43	0.473	21.90	20.350	1.440
CM 44	1.453	40.68	27.550	1.093
CM 45	0.375	18.75	20.475	1.025
CM 46	0.613	19.88	24.750	0.940
CM 47	0.780	34.63	22.475	1.018
CM 48	0.538	20.43	24.200	1.250
CM 49	0.755	28.40	23.375	1.093
CM 50	0.385	14.60	22.900	0.780
CD(0.05)	8.740	0.63	0.881	0.104
Mean	0.712	24.28	23.83	1.102

Highest value for fruit weight (1.523 kg) was recorded by CM 5 followed by CM 44 (1.453 kg). Lowest value of 0.273 kg was recorded by CM 41.

Longest fruit (40.675 cm) was produced by CM 44 (followed by CM 5 (39.63 cm) CM 50 (Plate 4) had shortest fruit (14.6 cm) followed by CM 40 (15.625cm).

Average fruit girth ranged from 14.9 in CM 41 to 31.7 cm in CM 34. CM 6 (31.5) was found on par with CM 34.

Maximum flesh cavity ratio (1.573) was in CM 31 followed by CM 38 (1.51) whereas minimum flesh cavity ratio (0.78) was noted for CM 50. CM 43 was found to be on par with CM 38.

4.1.7 Quality characters

Keeping quality of fruits under ordinary room temperature ranged from 3 to 12.25 days (Table 4.8). CM 50 (12.25 days) had good keeping quality followed by CM 48 (10 days). CM 40 had poor keeping quality (3 days). The accession viz., CM 43, CM 39, CM 28, CM 2, CM 42, CM 17, CM 31 and CM 16 (3.75, 3.75, 3.75, 3.75, 3.5, 3.5, 3.5, 3.25, 3 days) were found on par with CM 40.

CM 48, CM 40, CM 16, CM 5, CM 7, CM 37, CM 36 and CM 50 obtained high scores (19.0, 18.5, 17.5, 16.5, 16.5, 16.5, 16.0 and 16.0

Table 4.8. Characterization of the landraces of culinary melons in terms of fruit shape and quality

Accession	Fruit shape	Stripes of fruit colour	Keeping quality of fruits (days)	Organoleptic quality (score)
CM 2	Cylindrical	White in green	3.75	12.00
CM 3	Slender	Green in white	4.25	12.50
CM 4	Cylindrical	Yellow in green	5.25	9.50
CM 5	Cylindrical	White in green	4.50	16.50
CM 6	Cylindrical	White in green	4.00	8.00
CM 7	Cylindrical	Green in white	4.25	16.50
CM 8	Cylindrical	White in green	4.75	12.00
CM 9	Cylindrical	Green in yellow	5.00	15.50
CM 10	Cylindrical	Yellow in green	5.25	13.00
CM 11	Slender	White in green	4.75	8.50
CM 13	Cylindrical	Yellow in green	5.00	13.50
CM 14	Oblong	Yellow in green	4.25	13.00
CM 16	Cylindrical	White in green	3.25	17.50
CM 17	Oblong	White in green	3.50	15.00
CM 18	Cylindrical	Dark green with ridges	4.00	8.50
CM 19	Cylindrical	Greenish yellow	9.00	14.50
CM 22	Oblong	Yellow in green	4.25	10.50
CM 23	Oblong	Yellow in green	4.50	7.50
CM 24	Oblong	Yellow in green	4.75	10.50
CM 25	Oblong	Yellow in green	4.50	7.50
CM 26	Cylindrical	White in green	4.00	12.50
CM 28	Cylindrical	White in green	3.75	7.00
CM 31	Oblong	White in green	3.50	14.50
CM 32	Oblong	Green in yellow	4.50	14.50
CM 33	Cylindrical	Yellow in green	4.50	10.50
CM 34	Oblong	Yellow in green	4.25	12.00
CM 35	Cylindrical	Yellow in green	6.00	8.50
CM 36	Oblong	Green in yellow	4.50	16.00
CM 37	Oblong	Yellow in green	5.00	16.50
CM 38	Cylindrical	Green in yellow	5.75	15.00
CM 39	Slender	Yellow in green	3.75	13.50
CM 40	Oblong	White in green	3.00	18.50
CM 41	Slender	Yellow in green	4.50	9.50
CM 42	Cylindrical	Green in yellow	3.50	9.50
CM 43	Oblong	White in green	3.75	12.50
CM 44	Slender	Yellow in green	4.00	14.00
CM 45	Oblong	Light green in dark green	4.50	13.50
CM 46	Oblong	Yellow in green	5.75	15.50
CM 47	Slender	Dark green in light green	4.75	15.00
CM 48	Oblong	Yellow	10.00	19.00
CM 49	Slender	White in green	4.50	15.50
CM 50	Round	Yellow in green	12.25	16.00
CD(0.05)			0.88	3.49
Mean			4.82	12.88

respectively) for organoleptic qualities. Lowest score of seven was obtained in CM 28.

4.1.8 Seed characters

Characterization of landraces of culinary melons in terms of seed yield is given in Table 4.9.

Highest seeds per fruit (1103) was obtained in CM 37 followed by CM 17, CM 11 and CM 46 (980, 916, 893 respectively). CM 5 (791.25) was found to be on par with CM 46. CM 41, CM 39 and CM 28 (408.75, 403.75, 387.5 respectively) had lower seeds per fruit.

Maximum seed weight (expressed in terms of 1000 seed weight) was for the accession CM 50 (16.75) followed by CM 17 and CM 31 (11.4). CM 2 (11.225) was found to be on par with CM 17 and CM 31. Lowest 1000 seed weight was recorded by the accession CM 11 (4.9). Accession CM 6, CM 7, CM 9, CM 8 and CM 28 (5.45, 5.35, 5.25, 5.225, 5.225) were found to be on par with CM 11.

4.1.9 Characterization in terms of the reaction towards various biotic stress

There was no major pest attack during the course of the experimentation.

Table 4.9. Characterization of landraces of culinary melons in terms of seed yield

Accession	No. of seeds per fruit	1000 seed weight (g)
CM 2	593.00	11.225
CM 3	513.00	6.225
CM 4	589.25	6.950
CM 5	791.25	5.875
CM 6	470.25	5.450
CM 7	550.25	5.350
CM 8	557.25	5.225
CM 9	540.75	5.250
CM 10	580.00	6.650
CM 11	916.00	4.900
CM 13	507.75	7.475
CM 14	437.75	6.550
CM 16	441.75	9.850
CM 17	980.00	11.400
CM 18	510.50	8.300
CM 19	526.25	8.830
CM 22	470.00	5.850
CM 23	595.50	6.075
CM 24	549.00	6.125
CM 25	696.50	7.250
CM 26	534.75	6.275
CM 28	387.50	5.225
CM 31	557.75	11.400
CM 32	470.50	6.525
CM 33	501.50	6.200
CM 34	530.50	5.575
CM 35	558.00	8.700
CM 36	594.25	5.600
CM 37	110.30	6.125
CM 38	704.25	6.625
CM 39	403.75	7.425
CM 40	552.25	5.950
CM 41	408.75	8.775
CM 42	442.25	8.450
CM 43	499.00	6.930
CM 44	729.75	6.175
CM 45	456.50	6.100
CM 46	893.00	10.750
CM 47	532.25	6.575
CM 48	548.75	7.450
CM 49	648.75	9.200
CM 50	504.00	16.750
CD(0.05)	117.35	0.65
Mean	580.39	7.37

Among the diseases, mosaic virus disease was found to be the serious one.

4.1.9.1 Mosaic virus disease incidence

Reaction of 42 landraces to virus disease is given in Table 4.10.

CM 10, CM 14, CM 19, CM 24, CM 28, CM 32, CM 42 and CM 47 were highly susceptible to mosaic virus incidence (Plates 5 and 6). Resistance with a score of 0 was noted in accessions CM 5 (Plate 7), CM 17 and CM 18. However, CM 3 (Plate 8), CM 33, CM 36 were also found as resistant with a score eighter '0' or '1'.

4.2 Variability studies

The phenotypic variance, genotypic variance and coefficient of variation for the biometric characters are presented in Table 4.11 to 4.19.

Seeds per fruit showed the highest genotypic variance (48895.9) followed by leaf thickness (3809.37) and vine length (3555.13). Lowest value (0.055) was recorded for leaf area index (LAI) followed by flesh cavity ratio (0.069) and average fruit weight (0.18).

The phenotypic variance was also maximum for seeds per fruit (52264.88) followed by vine length (4681.19). Lowest phenotypic variance was noticed for LAI (0.059) followed by flesh cavity ratio (0.072).

Plate 1. Experimental plants in the field

Plate 2. A comprehensive representation of fruits of the landraces used in the study

Plate 3. CM 44 - Landrace with longest fruit

Plate 4. CM 50 - Landrace with shortest fruit

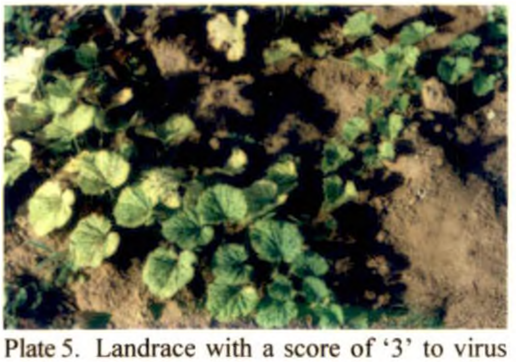

Plate 5. Landrace with a score of '3' to virus incidence

Plate 6. Landrace with a score of '4' to virus incidence

Plate 7. CM 5 - Landrace with a score of '0' to virus incidence

Plate 8. CM 3 - Landrace with a score of '1' to virus incidence

Table 4.10. Reaction of different landraces of culinary melons to the incidence of virus disease

Accession	Score / range of score	Rating
CM 2	3-4	MS or S
CM 3	1	R
CM 4	3-4	MS or S
CM 5	0	R
CM 6	0-2	R or MR
CM 7	3	MS
CM 8	0-3	R or MS
CM 9	1-4	R or S
CM 10	4	S
CM 11	3-4	MS or S
CM 13	2-4	MR or S
CM 14	4	S
CM 16	2-4	MR or S
CM 17	0	R
CM 18	0	R
CM 19	4	S
CM 22	0-4	R or S
CM 23	2-4	MR or S
CM 24	4	S
CM 25	1-2	R or MR
CM 26	2-4	MR or S
CM 28	4	S
CM 31	2-4	MR or S
CM 32	4	S
CM 33	0-1	R
CM 34	1-4	R or S
CM 35	2-4	MR or S
CM 36	1	R
CM 37	2-4	MR or S
CM 38	3-4	MS or S
CM 39	2-4	MR or S
CM 40	0-4	R or S
CM 41	2	MR
CM 42	4	S
CM 43	2-4	MR or S
CM 44	1-4	R or S
CM 45	1-4	R or S
CM 46	2	MR
CM 47	4	S
CM 48	2-4	MR or S
CM 49	1-4	R or S
CM 50	2-4	MR or S

R - Resistant MR - Medium Resistant MS - Medium Susceptible
S - Susceptible HS - Highly Susceptible

Maximum GCV in per cent was observed for yield per plant (57.04) followed by fruit weight (42.24), fruit per plant (37.41), keeping quality of fruits (35.45), 1000 seed weight (31.26), leaf area index (29.05) and sex ratio (26.12). Lowest GCV in per cent was noted for the days to first harvest (4.12) followed by the days to produce first female flowers (5.88) and pollen viability (6.38).

The highest PCV in percentage was observed for yield per plant (59.42) followed by average fruit weight (42.68), fruit per plant (40.03), keeping quality of fruits (36.58), 1000 seed weight (31.57), leaf area index (30.85) and sex ratio (28.72). Lowest PCV was observed for days to first harvest (4.37 per cent) followed by days to produce first female flower (6.43 per cent) and pollen viability (7.79 per cent) (Fig. 4.1).

4.3 Heritability and genetic advance

The estimates of heritability and genetic advance are presented in Tables 4.11 to 4.19.

High values of heritability in per cent were recorded for length of fruit (99.74), girth of fruit (98.42), 1000 seed weight (98.09), average fruit weight (97.9), keeping quality of fruit (93.89), flesh cavity ratio (92.58), yield per plant (92.13), leaf thickness (91.72). Leaf petiole length, number of primary branches, number of secondary branches recorded low heritability percentages (24.8, 28.16, 32.49 respectively).

X1	Length of fruit
X2	Girth of fruit
X3	1000 seed weight
X4	Average fruit weight
X5	Keeping quality of fruits
X6	Flesh cavity ratio
X7	Yield per plant
X8	Leaf thickness
X9	Fruits per plant
X10	Leaf area index

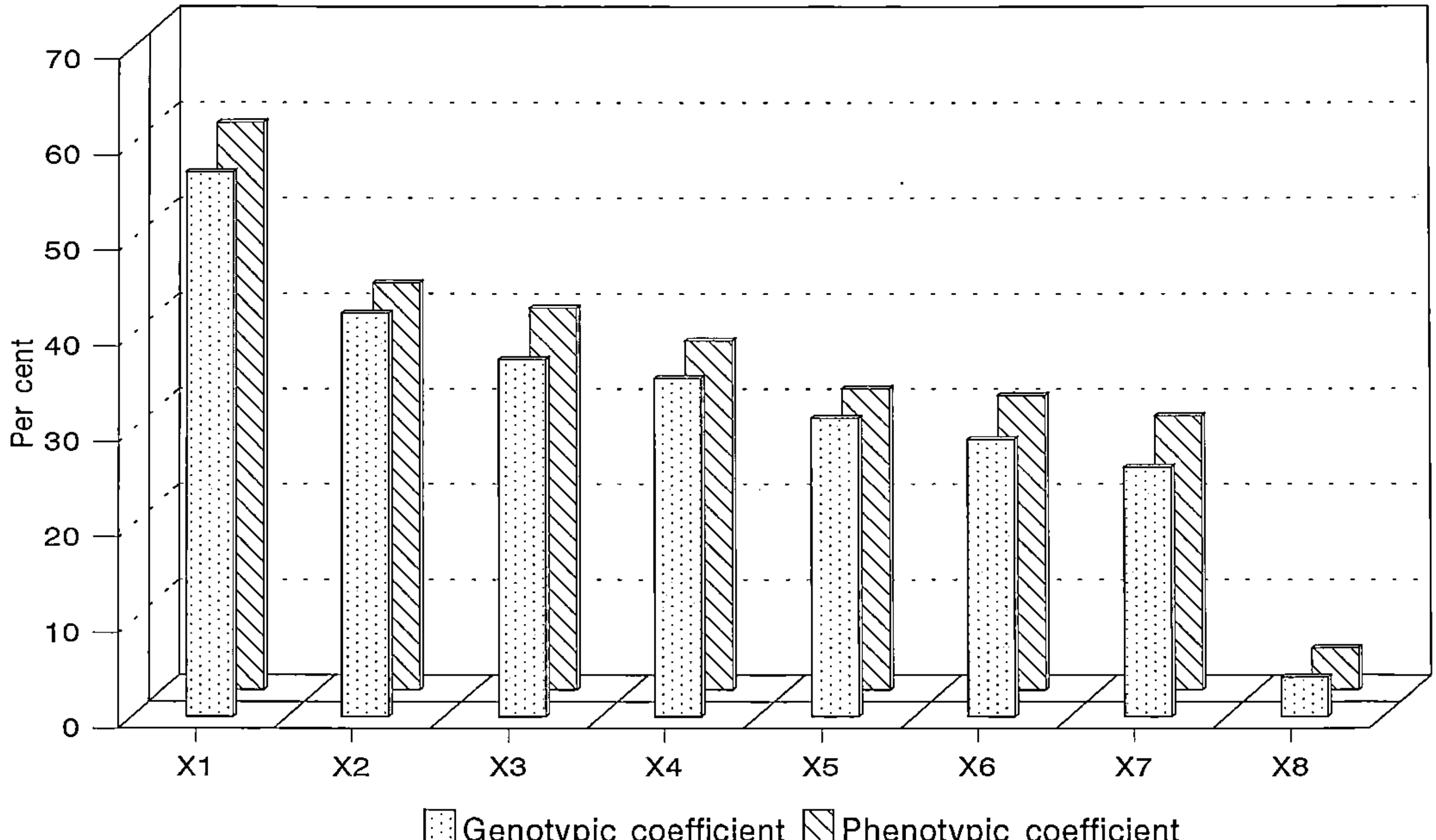

Fig. 4.1. Coefficient of variation for various characters in landraces of *Cucumis melo L.*

Table 4.11. Estimates of genetic parameters of plant characters in the landraces of culinary melons

Sl. No.	Characters	σ^2g	σ^2e	σ^2p	PCV (%)	GCV (%)	H (%)	GA	GA as % of mean
1	Vine length	3555.13	1126.06	4681.19	23.25	16.75	51.89	51.71	40.24
2	No. of primary branches	0.3351	0.1878	0.5230	16.2100	8.6000	28.1600	0.2970	9.3900
3	No. of secondary branches	0.8183	0.4170	1.2350	25.2500	14.3900	32.4900	0.5260	16.8600
4	Internodal length	2.0921	0.8901	2.9820	12.3400	7.8300	40.3100	1.0140	10.2400

Table 4.12. Estimates of genetic parameters of leaf characters in the landraces of culinary melons

Sl. No.	Characters	σ^2g	σ^2e	σ^2p	PCV (%)	GCV (%)	H (%)	GA	GA as % of mean
1	Leaf area index	0.0554	0.0033	0.059	30.85	29.05	88.70	0.313	55.39
2	Leaf thickness	3809.37	164.44	3973.81	13.73	13.15	91.72	84.22	25.26
3	Leaf petiole length	1.939	1.168	3.107	12.89	6.42	24.80	0.637	6.59

Table 4.13. Estimates of genetic parameters of staminate flowers in the landraces of culinary melons

Sl. No.	Characters	σ^2g	σ^2e	σ^2p	PCV (%)	GCV (%)	H (%)	GA	GA as % of mean
1	Days to produce first male flower	8.840	0.402	9.240	7.270	6.950	91.300	4.043	13.780
2	Branch of first male flower	0.527	0.149	0.676	29.330	21.920	55.830	0.669	33.790
3	Node of first male flower	1.521	0.195	1.717	20.620	18.120	77.250	1.474	32.830

Table 4.14. Estimates of genetic parameters of pistillate flowers in the landraces of culinary melons

Sl. No.	Characters	σ^2g	σ^2e	σ^2p	PCV (%)	GCV (%)	H (%)	GA	GA as % of mean
1	Days to produce first female flower	9.027	0.804	9.831	6.430	5.880	83.650	3.82	11.050
2	Branch of first female flower	0.302	0.143	0.445	23.499	14.060	35.810	0.348	17.350
3	Node of first female flower	3.371	0.521	3.893	15.150	12.960	73.220	2.104	22.860

Table 4.15. Estimates of genetic parameters of sex ratio and pollen viability in the land races of culinary melons

Sl. No.	Characters	σ^2g	σ^2e	σ^2p	PCV (%)	GCV (%)	H (%)	GA	GA as % of mean
1	Sex ratio	109.632	10.344	119.98	28.72	26.12	82.76	13.204	48.96
2	Pollen viability	72.569	14.313	86.88	7.79	6.38	67.05	9.104	10.76

Table 4.16. Estimates of genetic parameters of harvest and yield characters in landraces of culinary melons

Sl. No.	Characters	$\sigma^2 g$	$\sigma^2 e$	$\sigma^2 p$	PCV (%)	GCV (%)	H (%)	GA	GA as % of mean
1	Days to first harvest	10.467	0.612	11.08	4.37	4.12	88.96	4.313	7.99
2	Fruits per plant	14.837	1.0035	15.84	40.03	37.41	87.33	5.063	72.02
3	Yield per plant	14.9243	0.6117	15.54	59.42	57.04	92.13	5.289	11.28

Table 4.17. Estimates of genetic parameters of fruit biometrics in the landraces of culinary melons

Sl. No.	Characters	$\sigma^2 g$	$\sigma^2 e$	$\sigma^2 p$	PCV (%)	GCV (%)	H (%)	GA	GA as % of mean
1	Average fruit weight	0.1825	0.0019	0.184	42.68	42.24	97.97	0.613	86.09
2	Length of fruit	75.131	0.096	75.23	25.26	25.23	99.74	12.602	51.90
3	Girth of fruit	23.789	0.1895	23.98	14.53	14.42	98.42	7.020	29.46
4	Flrsh cavity ratio	0.0693	0.0027	0.072	17.22	16.57	92.58	0.362	32.85

Table 4.18. Estimates of genetic parameters of fruit quality in the landraces of culinary melons

Sl. No.	Characters	σ^2g	σ^2e	σ^2p	PCV (%)	GCV (%)	H (%)	GA	GA as % of mean
1	Keeping quality of fruits	6.046	0.1902	6.24	36.58	35.45	93.89	3.416	70.87
2	Organoleptic quality	20.556	2.986	23.546	26.64	23.01	74.63	5.28	40.99

Table 4.19. Estimates of genetic parameters of seed yield in the landraces of culinary melons

Sl. No.	Characters	σ^2g	σ^2e	σ^2p	PCV (%)	GCV (%)	H (%)	GA	GA as % of mean
1	Seeds per fruit	48895.9	3368.98	52264.88	27.85	25.99	87.11	290.08	49.98
2	1000 seed weight	10.723	0.1031	10.83	31.57	31.26	98.09	4.701	63.79

X1	Length of fruit
X2	Girth of fruit
X3	1000 seed weight
X4	Average fruit weight
X5	Keeping quality of fruits
X6	Flesh cavity ratio
X7	Yield per plant
X8	Leaf thickness
X9	Fruits per plant
X10	Leaf area index

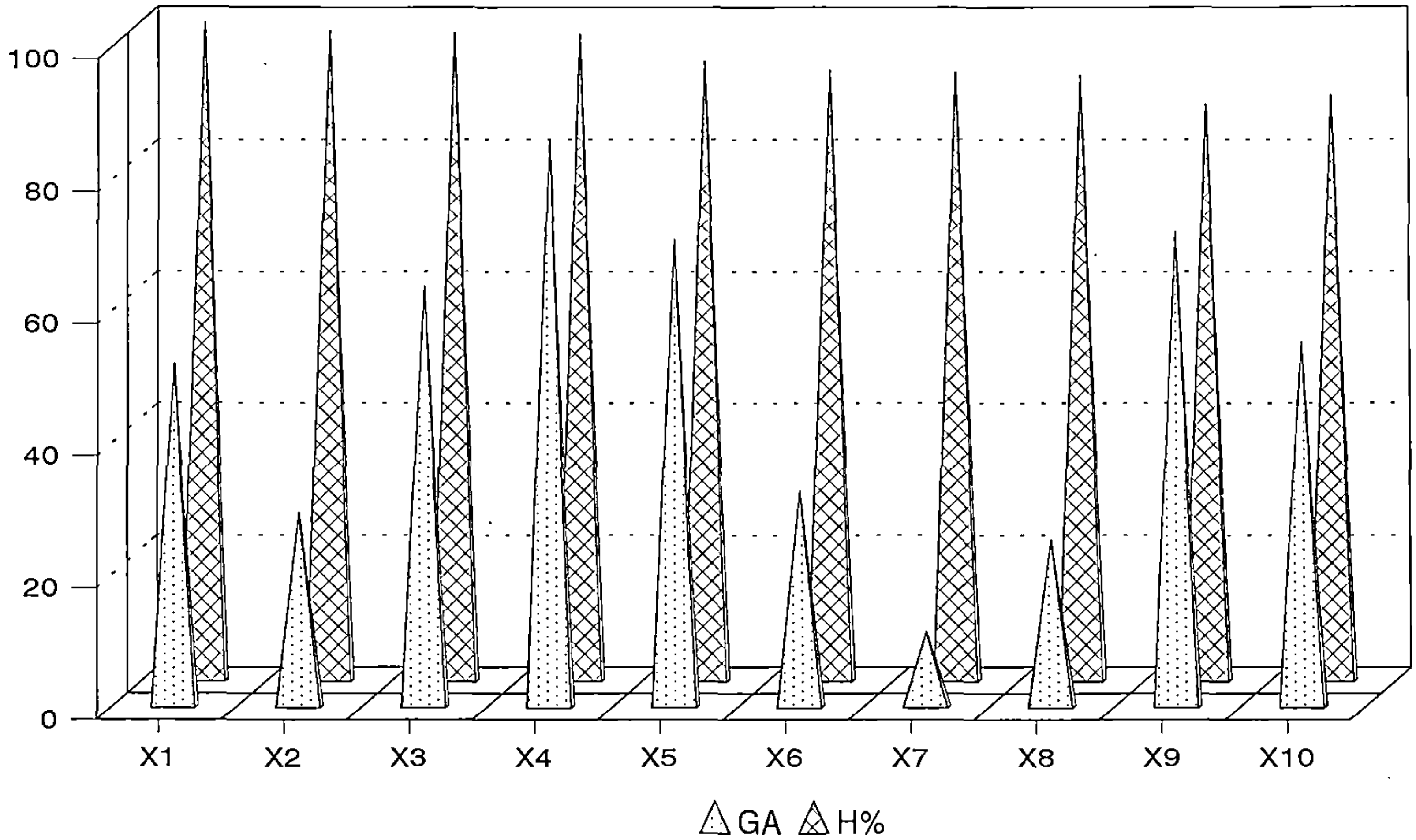

Fig. 4.2. Heritability and genetic advances as percentage of mean for various characters in the landraces of culinary melons

Expected genetic advance as percentage of mean was maximum for average fruit weight (86.09) followed by fruits per plant (72.02) keeping quality of fruits (70.87), 1000 seed weight (63.79), leaf area index (55.39), length of fruit (51.9). These traits also possessed high heritability values (Fig. 4.2).

Lowest genetic advance as percentage of mean was for the character leaf petiole length (6.59) followed by days to first harvest (7.99) and number of primary branches (9.39) Fig. 4.2

4.4 Correlation studies

The phenotypic, genotypic and environmental correlations among 27 characters were worked out and presented in Tables 4.20, 4.21 and 4.22.

4.4.1 Phenotypic correlation coefficients

Total yield per plant was positively and highly correlated with leaf area index (0.459), fruits per plant (0.510), average fruit weight (0.751), length of fruit (0.6238) and girth of fruit (0.6419). A positive association with yield was also noted for vine length (0.3974), leaf thickness (0.3650) and seeds per fruit (0.2896). However a negative association was found for characters like leaf petiole length (-0.028) days to produce first male flower (-0.376), branch of first male flower

1. Vine length
2. Number of primary branches
3. Number of secondary branches
4. Internodal length (cm)
5. Leaf area index
6. Leaf thickness (μ)
7. Leaf petiole length (cm)
8. Days to produce first male flower
9. Branch of first male flower
10. Node of first male flower
11. Days to produce first female flower
12. Branch of first female flower
13. Node of first female flower
14. Sex ratio
15. Pollen viability (%)
16. Days to first harvest
17. Fruits per plant
18. Average fruit weight (kg)
19. Yield per plant (kg)
20. Length of fruit (cm)
21. Girth of fruit (cm)
22. Flesh-cavity ratio
23. Keeping quality of fruits (days)
24. Number of seeds per fruit
25. 1000 seed weight
26. Organoleptic quality of fruits
27. Mosaic virus incidence

Table 4.20. Phenotypic correlation matrix of various characters in the landraces of culinary melon

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	1.000																										
2	0.067	1.000																									
3	0.310	0.055	1.000																								
4	0.207	-0.012	-0.049	1.000																							
5	0.340	-0.010	0.439	0.104	1.000																						
6	0.092	0.145	-0.027	0.036	0.201	1.000																					
7	0.126	0.124	0.228	0.140	0.098	-0.221	1.000																				
8	-0.369	-0.214	-0.104	0.035	-0.131	-0.131	-0.073	1.000																			
9	-0.125	-0.052	0.038	0.006	-0.239	-0.224	-0.114	0.230	1.000																		
10	-0.189	-0.091	0.037	-0.038	-0.089	-0.089	-0.003	0.588	0.175	1.000																	
11	-0.196	-0.091	-0.042	0.153	-0.184	-0.203	0.012	0.735	0.247	0.423	1.000																
12	-0.103	-0.031	0.081	0.021	-0.172	-0.225	-0.034	0.176	0.824	0.170	0.236	1.000															
13	-0.229	-0.111	-0.050	-0.082	-0.225	-0.117	-0.070	0.507	0.148	0.884	0.351	0.174	1.000														
14	0.317	-0.074	0.453	0.165	0.485	-0.049	0.065	-0.217	-0.212	0.044	-0.198	0.005	0.059	1.000													
15	0.422	0.018	0.409	0.190	0.468	0.117	0.146	-0.072	0.017	0.108	-0.003	0.084	-0.039	0.470	1.000												
16	-0.310	-0.194	-0.134	0.035	-0.247	-0.166	-0.005	0.807	0.216	0.460	0.883	0.162	0.384	-0.300	-0.070	1.000											
17	0.516	0.141	0.399	0.149	0.615	0.315	0.065	-0.305	-0.252	-0.114	-0.181	-0.175	-0.129	0.363	0.349	-0.318	1.000										
18	0.164	0.067	-0.091	0.084	0.153	0.172	-0.019	-0.148	-0.006	-0.391	-0.118	-0.863	-0.405	-0.031	0.111	-0.176	-0.008	1.000									
19	0.397	0.101	0.085	0.167	0.459	0.365	-0.028	-0.376	-0.135	-0.437	-0.254	-0.173	-0.475	0.135	0.261	-0.384	0.510	0.751	1.000								
20	0.119	0.060	-0.151	0.246	0.059	0.223	-0.065	-0.084	0.004	-0.313	-0.067	-0.020	-0.312	-0.046	0.106	-0.103	-0.070	0.881	0.624	1.000							
21	0.202	0.127	-0.037	-0.147	0.112	0.107	-0.012	-0.196	-0.071	-0.331	-0.143	-0.197	-0.340	-0.097	0.032	-0.187	0.053	0.778	0.642	0.513	1.000						
22	0.006	-0.155	0.138	0.074	-0.045	0.067	0.281	-0.083	-0.156	0.065	-0.124	-0.175	0.059	0.168	-0.103	-0.080	0.008	-0.076	-0.099	-0.082	-0.033	1.000					
23	0.295	0.116	0.275	-0.224	0.184	-0.012	0.017	-0.223	-0.181	-0.002	-0.182	-0.046	-0.053	0.210	0.137	-0.243	0.310	-0.238	0.006	-0.298	-0.077	-0.172	1.000				
24	0.255	0.203	0.106	0.164	0.335	0.061	0.196	-0.122	-0.190	-0.053	-0.172	-0.195	-0.080	0.234	0.229	-0.159	0.134	0.261	0.290	0.287	0.117	0.125	0.011	1.000			
25	0.046	0.203	0.110	-0.126	0.110	-0.083	0.200	-0.059	-0.243	-0.079	-0.048	0.005	-0.119	0.191	0.265	-0.038	0.090	-0.027	-0.036	-0.088	0.038	-0.147	0.435	0.050	1.0000		
26	0.320	0.058	0.320	0.174	0.196	0.059	0.202	0.022	-0.205	0.228	0.130	-0.083	0.196	0.361	0.428	0.098	0.379	-0.163	0.004	-0.079	-0.080	0.069	0.218	0.213	0.1886	1.0000	
27	-0.257	0.076	-0.176	-0.139	-0.357	-0.030	0.087	0.161	-0.047	0.178	0.195	0.007	0.194	-0.247	-0.202	0.247	-0.213	-0.440	-0.484	-0.297	-0.353	-0.057	0.151	-0.167	0.0837	0.0742	1.0000

1. Vine length
2. Number of primary branches
3. Number of secondary branches
4. Internodal length (cm)
5. Leaf area index
6. Leaf thickness (μ)
7. Leaf petiole length (cm)
8. Days to produce first male flower
9. Branch of first male flower
10. Node of first male flower
11. Days to produce first female flower
12. Branch of first female flower
13. Node of first female flower
14. Sex ratio
15. Pollen viability (%)
16. Days to first harvest
17. Fruits per plant
18. Average fruit weight (kg)
19. Yield per plant (kg)
20. Length of fruit (cm)
21. Girth of fruit (cm)
22. Flesh-cavity ratio
23. Keeping quality of fruits (days)
24. Number of seeds per fruit
25. 1000 seed weight.
26. Organoleptic quality of fruits
27. Mosaic virus incidence

Table 4.21. Genotypic correlation matrix of various characters in the landraces of culinary melon

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	1.000																										
2	0.477	1.000																									
3	0.843	0.024	1.000																								
4	0.282	-0.051	0.393	1.000																							
5	0.503	-0.031	0.706	0.217	1.000																						
6	0.068	0.296	-0.004	0.091	0.238	1.000																					
7	0.163	0.224	0.181	0.066	0.279	-0.398	1.000																				
8	-0.534	-0.328	-0.251	0.113	-0.169	-0.150	-0.179	1.000																			
9	-0.107	0.281	0.105	0.176	-0.369	-0.310	-0.146	0.337	1.000																		
10	-0.265	-0.265	0.147	0.032	-0.107	-0.110	-0.099	0.722	0.294	1.000																	
11	-0.235	-0.506	0.094	0.186	-0.194	-0.239	0.016	0.856	0.270	0.483	1.000																
12	-0.075	0.153	0.378	0.157	-0.342	-0.376	-0.091	0.328	0.796	0.406	0.289	1.000															
13	-0.372	-0.459	0.080	-0.105	-0.231	-0.147	-0.215	0.666	0.378	0.967	0.435	0.576	1.000														
14	0.519	-0.274	0.741	0.322	0.557	-0.068	0.182	-0.290	-0.300	0.088	-0.212	-0.018	0.111	1.000													
15	0.690	0.241	0.623	0.545	0.587	0.109	0.280	-0.062	-0.075	0.169	-0.004	0.128	0.016	0.693	1.000												
16	0.404	-0.484	-0.282	0.141	-0.262	-0.204	-0.050	0.882	0.304	0.521	0.951	0.245	0.488	-0.380	-0.102	1.000											
17	0.625	0.197	0.894	0.107	0.697	0.350	0.010	-0.364	-0.329	-0.113	-0.205	-0.332	-0.187	0.435	0.496	-0.355	1.000										
18	0.229	0.173	-0.140	0.098	0.168	0.180	-0.092	-0.157	0.016	-0.461	-0.137	-0.101	-0.486	-0.010	0.126	-0.196	-0.007	1.000									
19	0.613	0.164	0.281	0.222	0.515	0.392	-0.069	-0.384	-0.168	-0.564	-0.306	-0.304	-0.601	0.182	0.342	-0.421	-0.549	0.787	1.000								
20	0.169	0.117	-0.255	0.376	0.065	0.232	-0.102	-0.086	0.013	-0.357	-0.071	-0.016	-0.371	-0.052	0.132	-0.108	0.071	0.892	0.651	1.000							
21	0.322	0.252	-0.078	-0.242	0.115	0.118	0.014	-0.204	-0.120	-0.368	-0.149	-0.348	-0.398	-0.096	0.044	-0.193	0.053	0.792	0.667	0.517	1.000						
22	-0.030	-0.363	0.150	0.163	-0.060	0.069	0.602	-0.082	-0.234	0.030	-0.143	-0.327	0.039	0.193	-0.133	-0.100	0.007	-0.075	-0.078	-0.081	-0.028	1.000					
23	0.389	0.412	0.536	-0.346	0.187	-0.013	0.196	-0.253	-0.226	0.016	-0.172	-0.012	-0.051	0.236	0.205	-0.256	0.360	-0.248	0.028	-0.311	-0.078	-0.191	1.000				
24	0.357	0.184	0.239	0.273	0.367	0.064	0.271	-0.155	-0.117	-0.114	-0.193	-0.112	-0.188	0.296	0.302	-0.191	0.099	0.278	0.319	0.306	0.133	0.131	0.028	1.000			
25	0.116	0.394	0.172	-0.244	0.122	-0.084	0.369	-0.071	-0.310	-0.080	-0.049	0.043	-0.130	0.195	0.332	-0.034	0.104	-0.029	-0.038	-0.090	0.034	-0.147	0.452	0.058	1.000		
26	0.447	0.057	0.538	0.351	0.218	0.109	0.262	0.018	-0.297	0.304	0.148	-0.225	0.285	0.451	0.548	0.086	0.424	-0.186	0.001	-0.090	-0.102	0.097	0.304	0.221	0.231	1.000	
27	-0.609	-0.082	-0.362	-0.227	-0.589	-0.122	0.103	0.320	-0.228	0.380	0.267	-0.138	0.340	-0.731	-0.871	0.371	0.431	-0.800	-1.002	-0.571	-0.625	-0.058	0.420	-0.400	0.150	-0.012	1.000

1. Vine length
2. Number of primary branches
3. Number of secondary branches
4. Internodal length (cm)
5. Leaf area index
6. Leaf thickness (μ)
7. Leaf petiole length (cm)
8. Days to produce first male flower
9. Branch of first male flower
10. Node of first male flower
11. Days to produce first female flower
12. Branch of first female flower
13. Node of first female flower
14. Sex ratio
15. Pollen viability (%)
16. Days to first harvest
17. Fruits per plant
18. Average fruit weight (kg)
19. Yield per plant (kg)
20. Length of fruit (cm)
21. Girth of fruit (cm)
22. Flesh-cavity ratio
23. Keeping quality of fruits (days)
24. Number of seeds per fruit
25. 1000 seed weight
26. Organoleptic quality of fruits
27. Mosaic virus incidence

Table 4.22. Error correlation matrix of various characters in the landraces of culinary melon

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	1.000																										
2	-0.196	1.000																									
3	-0.064	0.069	1.000																								
4	0.145	0.009	-0.302	1.000																							
5	-0.004	0.020	0.218	-0.099	1.000																						
6	0.223	-0.022	-0.106	-0.088	-0.141	1.000																					
7	0.112	0.088	0.248	0.178	-0.113	-0.124	1.000																				
8	-0.010	-0.194	0.133	-0.148	0.210	0.074	0.049	1.000																			
9	-0.147	-0.290	-0.013	-0.151	0.095	-0.014	-0.104	-0.055	1.000																		
10	-0.065	0.081	-0.094	-0.152	-0.004	0.027	0.098	-0.134	-0.058	1.000																	
11	-0.147	0.011	-0.274	0.144	-0.127	0.052	0.013	-0.117	0.233	0.178	1.000																
12	-0.127	-0.117	-0.072	-0.063	0.078	-0.042	-0.010	-0.049	0.879	-0.113	0.240	1.000															
13	0.002	0.223	-0.209	-0.063	-0.223	0.022	0.048	-0.244	-0.273	0.633	0.052	-0.292	1.000														
14	-0.080	0.166	0.203	-0.064	0.059	0.084	-0.048	0.286	-0.030	-0.132	-0.128	0.045	-0.128	1.000													
15	0.037	-0.179	0.250	-0.212	0.077	0.187	0.065	-0.137	0.166	-0.050	0.002	0.046	-0.167	-0.194	1.000												
16	-0.152	0.172	0.067	-0.192	-0.127	0.196	0.065	0.125	0.007	0.175	0.465	0.092	-0.058	0.186	0.047	1.000											
17	0.385	0.145	-0.266	0.310	0.018	0.016	0.197	0.191	-0.096	-0.121	-0.042	0.036	0.114	-0.047	-0.149	-0.050	1.000										
18	0.010	-0.197	-0.106	0.207	-0.069	0.020	0.211	0.008	-0.188	0.150	0.108	-0.233	0.091	-0.385	0.114	0.142	0.017	1.000									
19	-0.136	0.074	-0.297	0.147	-0.064	0.055	0.021	-0.291	-0.076	0.288	0.128	0.007	0.129	-0.213	-0.047	-0.031	0.177	0.083	1.000								
20	-0.059	-0.049	-0.125	0.192	-0.139	0.097	-0.321	-0.129	-0.155	0.012	-0.067	-0.260	0.174	0.082	-0.065	-0.053	0.204	-0.010	-0.010	1.000							
21	-0.325	-0.053	0.071	0.060	0.124	-0.139	-0.174	-0.067	0.206	-0.161	-0.149	0.103	-0.039	-0.189	-0.052	-0.157	0.073	0.042	0.192	-0.024	1.000						
22	0.143	0.133	0.249	-0.124	0.098	0.038	-0.034	-0.096	0.068	0.304	0.021	0.060	0.193	-0.009	0.009	0.120	0.017	-0.115	-0.351	-0.277	-0.182	1.000					
23	0.134	-0.460	-0.101	-0.060	0.164	0.002	-0.364	0.155	-0.111	-0.132	-0.288	-0.197	-0.086	0.017	-0.182	-0.111	0.180	-0.001	-0.282	0.190	-0.050	0.094	1.000				
24	0.060	0.367	-0.072	0.009	0.107	0.039	0.223	0.150	-0.457	0.233	-0.047	-0.460	0.375	-0.113	-0.009	0.079	0.372	0.071	0.042	0.133	-0.133	0.078	-0.159	1.000			
25	-0.382	-0.036	0.118	0.261	-0.086	-0.091	0.149	0.204	-0.147	-0.143	-0.075	-0.184	-0.129	0.275	-0.058	-0.121	0.128	0.091	-0.008	0.102	0.273	-0.199	0.058	-0.073	1.000		
26	0.120	0.076	0.131	-0.049	0.115	-0.210	0.205	0.050	-0.039	-0.012	0.064	0.084	-0.057	0.031	0.138	0.168	0.205	-0.058	0.024	-0.054	0.128	-0.087	-0.296	0.195	-0.127	1.000	
27	-0.043	0.138	-0.096	-0.095	-0.224	0.131	0.081	-0.003	0.075	0.003	0.191	0.074	0.091	0.296	0.358	0.221	-0.002	-0.179	0.099	0.085	-0.238	-0.121	-0.303	0.098	0.046	0.187	1.000

(-0.135), node of first male flower (-0.437), days to produce first female flower (-0.254), branch of first female flower (-0.173), node of first female flower (-0.475) and days to first harvest (-0.384).

Leaf area index showed a high positive correlation with secondary branches (0.439), sex ratio (0.4852) and pollen viability (0.4675).

Days to produce first female flower was positively associated with days to produce first male flower (0.7345), node of first male flower (0.4225) and node of first female flower (0.8835).

Sex ratio had significant positive correlation with number of secondary branches (0.4534) and pollen viability (0.4701).

Days to first harvest was positively correlated with days to produce first male flowers (0.807), node of first male flower (0.4597), node of first female flower (0.8835).

Days to first harvest was positively correlated with days to produce first male flowers (0.807)), node of first male flower (0.4597), days to produce first female flower (0.8828), node of first female flower (0.3836) whereas it had negative correlation with vine length (-0.3097), primary branches (-0.1935), secondary branches (-0.1335), leaf area index (-0.247), leaf thickness (-0.1657), leaf petiole length (-0.0048) and sex ratio (-0.3003).

Fruits per plant had a positive correlation with vine length (0.5157), secondary branches (0.3938), leaf area index (0.6153), leaf thickness (0.3145), sex ratio (0.3625) and pollen viability (0.3491).

Average fruit weight was positively correlated to fruit length (0.8812), fruit girth (0.7784) and number of fruits (0.519). Fruit length had a negative correlation with fruits per plant (-0.0695).

Seed yield showed a positive correlation with average fruit weight (0.2605) and length of fruit (0.2873).

Mosaic disease incidence has high negative correlation with average fruit weight (-0.4398), yield per plant (-0.4843) and girth of fruit (-0.3529). Also, a negative correlation was seen with length of fruit (-0.2974), sex ratio (-0.2468) and pollen viability (-0.2021).

4.4.2 Genotypic correlation coefficients

High positive correlation was obtained between yield and vine length (0.6131), leaf area index (0.5145), fruits per plant (0.5488), average fruit weight (0.787), length of fruit (0.651) and girth of fruit (0.667). Positive association was also noted for characters *viz.*, leaf thickness (0.3922), pollen viability (0.3419), seeds per fruit (0.3186) and internodal length (0.2221) with yield.

Characters like days to produce first male flower (-0.3839), days to produce first female flower (-0.3036) days to first harvest (-0.4207) and node of appearance of first female flower (-0.601). Mosaic disease incidence (-1.0019) had a negative correlation with yield (Fig. 4.3).

Vine length and high positive correlation with number of primary branches (0.477) and number of secondary branches (0.843).

Leaf area index had a positive association with number of secondary branches (0.7056), sex ratio (0.5566), pollen viability (0.587), fruits per plant (0.6967) and seeds per fruit (0.3668).

Days to produce first female flower showed high significant positive correlation with days to produce first male. flower (0.8564), node of first male flower (0.4828) and node of first female flower (0.4351). Node of first female flower showed significant positive correlation with days to produce first male flower (0.666), node of first male flower (0.9669) and branch of first female flower (0.5760).

Sex ratio had a positive correlation with vine length (0.5194), number of secondary branches (0.7407), pollen viability (0.6932) and fruits per plant (0.4345).

Days to first harvest showed a positive association with days to produce male flower (0.8819), node of first male flower (0.5211), days to produce first female flower (0.9509) and node of first female flower (0.4876).

X1	Vine length
X2	Leaf area index
X3	Leaf thickness
X4	Leaf petiole length
X5	Days to produce first male flowers
X6	Days to produce first female flowers
X7	Pollen viability
X8	Fruits / plant
X9	Average fruit weight
X10	Length of fruit
X11	Girth of fruit
X12	Flesh cavity ratio
X13	Seeds / fruit
X14	Mosaic disease

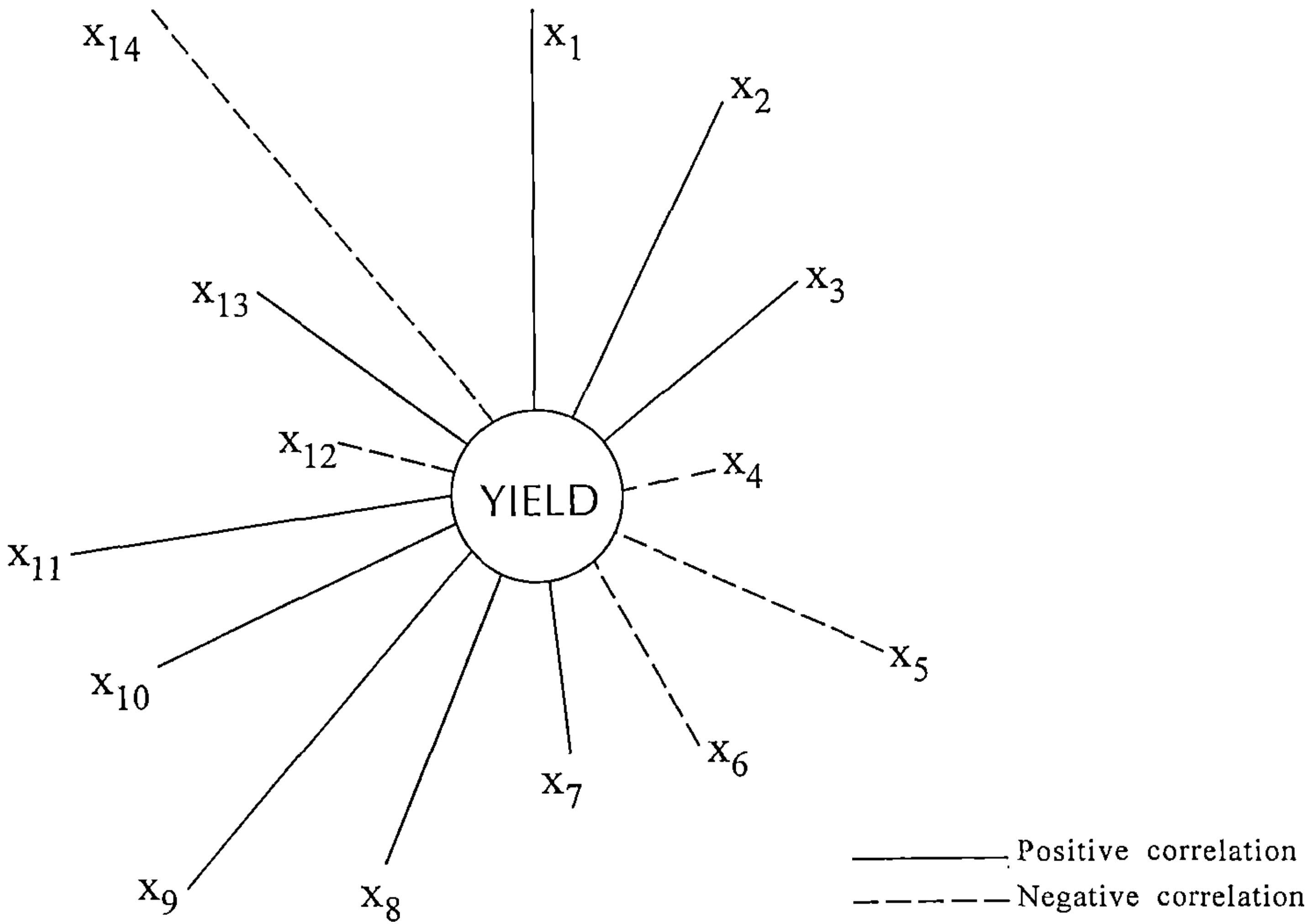

Fig. 4.3. Genotypic correlation coefficient between yield and other characters

Fruits per plant exhibited a high significant positive correlation with vine length (0.6248), number of secondary branches (0.8944), pollen viability (0.496) and a negative correlation with length of fruit (-0.0706) and days to first harvest (-0.3545).

Average fruit weight exhibited significant positive correlation with girth of fruit (0.7919) vine length (0.229) and seeds/fruit (0.2781) whereas it had a negative correlation with days to first harvest (-0.1959), days to first male flower (-0.1573), days to first female flower (-0.1370) and node of first female flower (-0.4860).

Seeds per plant showed a positive correlation with pollen viability (0.3024), length of fruit (0.3057) and negative correlation with days to first female flower production (-0.1931). Incidence of mosaic disease was highly and negatively correlated with vine length (-0.6086), leaf area index (-0.5885), sex ratio (-0.7308), pollen viability (-0.8707), average fruit weight (-0.8000) and length of fruit (-0.5708).

4.4.3 Error correlation coefficient

Most of the error correlation coefficients were very low indicating that the effect of environment on the expression of the association between the characters was not so strong as to alter it markedly. Error correlation between yield and fruits per plant (0.1772) average fruit weight (0.0833), length of fruit (-0.0166) and seeds per fruit (0.0417) were very low.

4.5 Path coefficient analysis

The characters *viz*., vine length, internodal length, sex ratio, fruits per plant, length of fruit and girth of fruit were selected in the present study for path coefficient analysis. The results are furnished in Table 4.23 and Fig. 4.4.

The direct effect of vine length on yield was positive but low (0.0867) and the total correlation was 0.3974. It had high positive indirect effect *via* length of fruits (0.3224).

Internodal length had low positive direct effect on yield (0.1083) and total correlation was 0.1673. It had a negative indirect effect through sex ratio (-0.0193) and girth of fruit (-0.1014).

Sex ratio exhibited positive correlation with yield (0.1345), but on partitioning, it was observed that the direct effect on yield was negative (-0.0599). But it had a positive indirect effect through fruits per plant (0.2242).

The direct effect of fruits per plant on yield was high and positive (0.5159) and the total correlation was 0.5100.

The positive and negative indirect effects through other traits got nullified.

Table 4.23. Direct and indirect effects of the component characters on yield in landraces of culinary melons

Sl. No.	Characters	Vine length	Internodal length	Sex ratio	Fruits / plant	Length of fruit	Girth of fruit	Total correlation
1.	Vine length	<u>0.0867</u>	0.0306	-0.0311	0.3224	0.0696	0.1349	0.3974
2.	Internodal length	0.0245	<u>0.1083</u>	-0.0193	0.0549	0.1550	-0.1014	0.1673
3.	Sex ratio	0.0451	0.0348	<u>-0.0599</u>	0.2242	-0.0214	-0.0403	0.1345
4.	Fruits / ratio	0.0542	0.0115	-0.0260	<u>0.5159</u>	-0.0291	0.0223	0.5100
5.	Length of fruit	0.0146	0.0407	0.0031	-0.0364	<u>0.4123</u>	0.2166	0.6238
6.	Girth of fruit	0.0280	-0.0262	0.0058	0.0274	0.2133	<u>0.4187</u>	0.6419

Residual effect = 0.1029

(Underlined, diagonal values indicate direct effects)

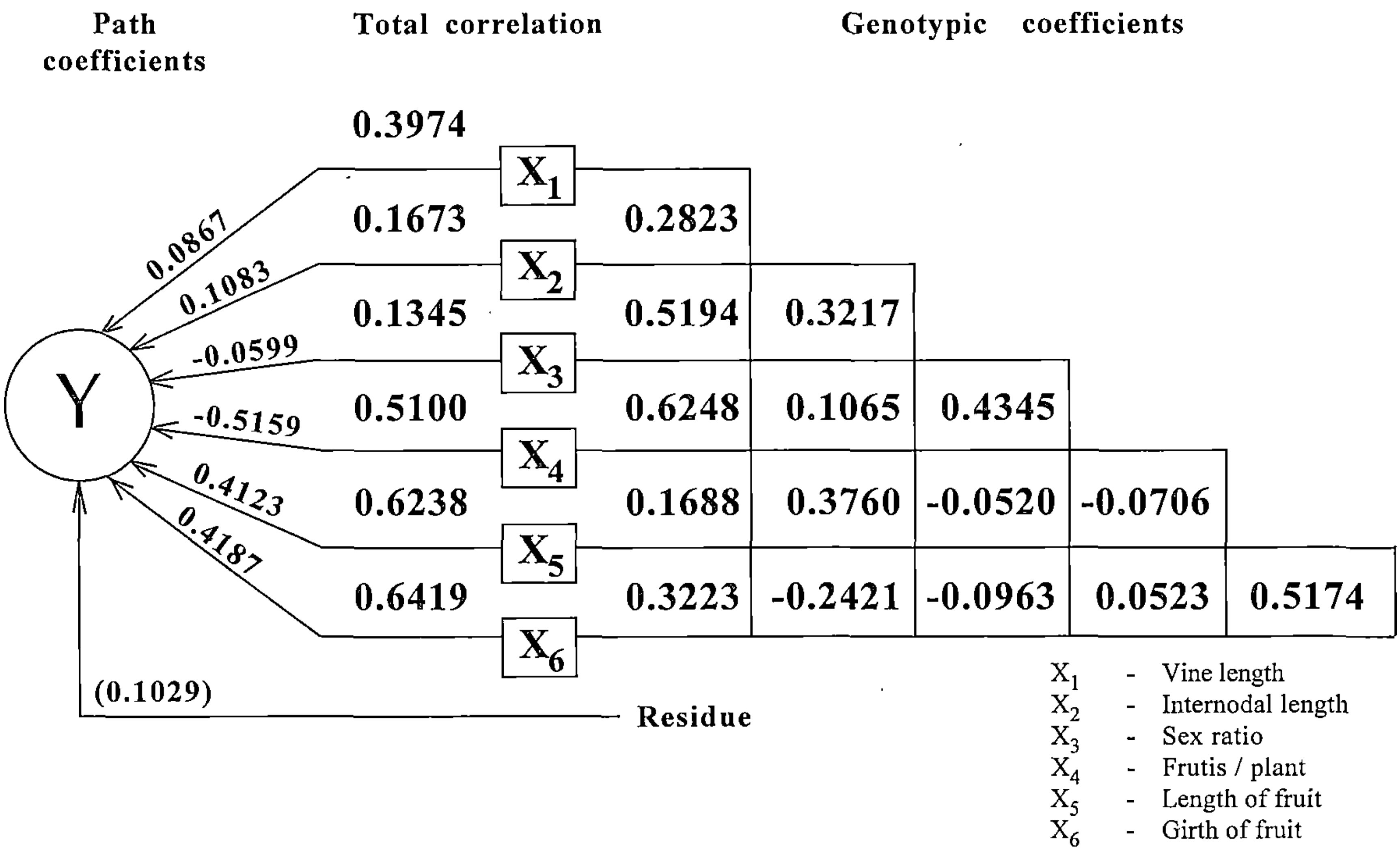

Fig. 4.4. Path diagram showing direct effects and interrelationships in landraces of culinary melons

The direct effect of length of fruit on yield was also high and positive (0.4123) which had a total correlation of 0.6238. It exerted a positive indirect effect (0.2166) through girth of fruit.

The direct effect of girth of fruit on yield was 0.4187 and the total correlation 0.6419. It had a positive indirect effect especially through length of fruit (0.2133).

The residue obtained was low (0.1029) indicating that the component characters taken for path analysis well explained the cause and effect system.

4.6 Selection index

Discriminant function technique was adopted for the construction of selection index for yield using total fruit yield per plant (X_6) and the component characters *viz.*, vine length (X_1), LAI (X_2) sex ratio (X_3), fruits per plant (X_4), fruit weight (X_5), length of fruit (X_7) and girth of fruit (X_8). These component characters showed relatively stronger association with yield and could form a valuable selection index for yield in this crop.

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

$$I = 0.339\ X_1 + 9.841\ X_2 + 2.097\ X_3 + -0.431\ X_4 + -97.13\ X_5 + 9.007\ X_6 + 2.604\ X_7 + 4.6133\ X_8.$$

Table 4.24. Selection indices for the landraces of culinary melon

Accession	Selection index	Rank
CM 5	746.12	1
CM 48	692.85	2
CM 6	684.91	3
CM 3	671.23	4
CM 36	629.78	5
CM 46	625.96	6
CM 17	619.53	7
CM 35	618.97	8
CM 50	614.03	9
CM 7	611.04	10
CM 18	604.74	11
CM 33	602.32	12
CM 8	583.36	13
CM 44	578.49	14
CM 2	569.31	15
CM 37	567.51	16
CM 40	562.79	17
CM 39	562.33	18
CM 11	559.89	19
CM 26	552.74	20
CM 38	551.19	21
CM 49	546.13	22
CM 34	545.74	23
CM 45	544.73	24
CM 4	543.19	25
CM 25	542.71	26
CM 9	537.51	27
CM 31	535.37	28
CM 22	524.19	29
CM 10	523.18	30
CM 14	513.19	31
CM 23	512.24	32
CM 16	505.01	33
CM 19	502.88	34
CM 13	497.24	35
CM 47	483.44	36
CM 32	480.13	37
CM 43	456.59	38
CM 41	424.21	39
CM 2	411.14	40
CM 24	402.51	41
CM 28	323.29	42

The index value for each accession were determined and the accessions ranked accordingly. The selection indices are presented in Table 4.24 along with the ranking of each genotypes. Accessions *viz.*, CM 5 (746.12), CM 48 (692.85), CM 6 (684.91), CM 3 (671.23), CM 36 (629.48). CM 46 (625.96), CM 17 (619.53), CM 35 (618.97), CM 50 (614.03) and CM 7 (611.04) recorded top ten superior index values.

DISCUSSION

5. DISCUSSION

Culinary melon (*Cucumis melo* L) is one of the most popular and traditional vegetable crops of South India. This has been in cultivation throughout the humid tropics with various common names *viz.*, vellari, melon, pickling melon, preserving melon, oriental pickling melon etc.

Fruit yield and resistance are the two major pathways in the development of superior genotypes and achievement of the goal of self sustenance. The information usually needed for developing high yielding varieties in a particular species pertains to the extent of genetic variability for desirable traits in the available germplasm. In *Cucumis melo*, a large variability is present in the landraces with respect to all the characters (Kalloo *et al.*, 1983). Variability parameters like coefficient of variation, heritability and predicted genetic advance, besides degree of association between the various characters and direct effects of yield contributing characters on total fruit yield are of paramount significance in formulating an appropriate breeding strategy.

The present study was hence contemplated to collect and characterise melon landraces of Kerala and to investigate the genetic variability, heritability, genetic advance and correlation among yield and yield contributing characters. Also, an attempt was made to estimate direct and indirect effects of different yield components and to construct a selection index so as to identify superior genotypes.

In the present investigation, analysis of variance revealed significance difference among the landraces of *C. melo* for all the characters except primary and secondary branches, leaf petiole length and branch and node of first male and female flower production. The existence of considerable variation indicated enough scope for improving the population.

The ultimate aim in the improvement of a crop is its yield. In the present study, a landrace collected from Kattakada, Thiruvananthapuram CM 5, was found significantly superior in yield (Plate 9). Vine length, fruits per plant and average fruit weight were also found more in this accession with high organoleptic properties. Lowest yield was recorded by CM 41. This accession had low fruit weight with poor organoleptic qualities also. Similar differential response of yield and yield attributes in melon was reported by Nandpuri *et al.* (1975), Chhonkar *et al.* (1979), Deol *et al.* (1981) and Swamy *et al.* (1985) in many of the local germplasms.

5.1 Variability studies

Large variability ensures better chances of producing new desirable forms. Selection is the fundamental process in the development of superior varieties and it depends on the variability available in the crop. Only the genetic proportion of the total variability contributes to gain under selection. So, knowledge of the genetic variation governing the inheritance of quantitative characters like yield and its components is essential in any of the crop plant (Allard, 1960).

In general, estimates of phenotypic coefficient of variation in the present study were higher than the corresponding estimates of genotypic coefficient of variation. Similar results were reported by Kalloo *et al.* (1981) and Vijay (1987) in muskmelon.

High values of PCV with corresponding high values of GCV was obtained for yield per plant, average fruit weight, fruits per plants, keeping quality of fruits, 1000 seed weight, leaf area index and sex ratio. Since the magnitude of PCV and GCV were closer in the present study, genotype had more contribution than environment. So the selection can be very well done based on phenotypic values. This observation was in confirmation with the findings of Rastogi and Deep (1990) in cucumber. Comparatively wide differences between the estimates of PCV and GCV for vine length, number of primary and secondary branches and leaf petiole length indicated greater effect of environment on the expression of these traits.

Lowest GCV was noted for the days to first harvest. This was in accordance with the findings of Deol *et al.* (1981) and Swamy *et al.* (1985).

In the light of above results, it is clear that while selecting for high yielding types of culinary melons, major emphasis should be given to average fruit weight and fruits per plant with due consideration to keeping quality.

5.2 Heritability and genetic advance

The heritability is a measure of efficiency of selection system in separating genotypes and indicates the effectiveness with which selection of genotypes could be done. Allard (1960) suggested that gain from selection for a particular character depends largely on the heritability of the character. High heritability of characters indicate that the characters are least influenced by environmental effects and there could be greater correspondence between phenotypes and breeding value while selecting individuals (Johnson *et al.*, 1955).

In the present investigation, heritability was found to be high for traits such as fruit length, fruit girth, 1000 seed weight, average fruit weight, keeping quality of fruit, flesh cavity ratio, yield per plant and leaf thickness. This can be attributed to the fact that these characters are least influenced by environmental effects and there could be greater correspondence between phenotypes and breeding value while selecting individuals (Johnson *et al.*, 1955). High heritability of fruit length is in agreement with the findings of Choudhary *et al.* (1985) and Abusaleha and Dutta (1990) in cucumber. High heritability for average fruit weight by Kalloo and Dixit (1983) and Swamy *et al.* (1985) in melons and for fruit girth and 1000 seed weight was recorded by Mariappan and Pappiah (1990) in cucumber. High heritability for flesh cavity ratio was in accordance with the finding of Chhonkar *et al.* (1979) and for yield per plant by Kalloo *et al.* (1981)and Chacko (1992).

Characters like number of primary branches and number of secondary branches recorded low heritability similar to the findings of Swamy *et al.* (1985).

Value of expected genetic advance indicates the expected genetic progress for a particular trait under a suitable selection system. In the present study, the genetic gain that could be expected by selection for a character provides the estimates of genetic advance and expressed as per cent of mean. Higher values of genetic advance as per cent of mean was recorded in the present study for average fruit weight, fruits per plant and keeping quality of fruits. Such a high value of genetic advance was also recorded by Kalloo and Dixit 1983 for average fruit weight and fruits per plant.

Knowledge of heritability coupled with expected genetic advance of a trait is necessary for assessing the scope of its improvement through selection (Johnson *et al.*, 1955). In the present study, high values of heritability associated with high genetic advance were observed for 1000 seed weight, average fruit weight and keeping quality of fruits. Kalloo and Dixit (1983) reported high heritability in melons with high genetic gain for average fruit weight. High heritability values accompanied by high genetic gain for 1000 seed weight was reported by Mariappan and Pappiah (1990) in cucumber. It shows that variation for these characters to be due to high additive gene effect and consequently the scope for improving yield through selection.

Though heritability was high for length of fruit, girth of fruit and yield per plant, genetic advance was of moderate to low magnitude, indicating the action of non additive genes for expression of these characters suggesting selection based on this characters to be less effective. Thus it implies that high heritability is not always an indication of high genetic advance (Johnson *et al.*, 1955).

5.3 Correlation studies

Selection based on yield alone is not very efficient, but that based on its components also could be more efficient (Evans, 1978). Correlation provides information of the nature and extend of relationship between characters and a knowledge of relationship of yield and its component character is essential for the simultaneous improvement of yield components, and in turn yield. Analysis of genotypic, phenotypic and error correlation coefficient of component characters leads to the understanding of characters that can form the basis of selection. The genotypic correlation provides a reliable measure of genetic association between the characters and help to differentiate the vital association useful in breeding from non vital ones (Falconer, 1981).

The higher magnitude of genotypic correlation co-efficients compared to the corresponding pheotypic correlations in the present study indicated that environment had small and similar effects on these characters. Genotypic correlation was also reported to be higher than the phenotypic correlation by Solanki and Seth (1980) and Rastogi and Deep (1990a) in cucumber.

In the present investigation, vine length, leaf area index, fruits per plant, fruit weight, length of fruit and girth of fruit exerted the highest positive and significant association with yield per plant. The association of length of vines was positive and highly significant with yield. Secondary and tertiary branches also had a positive association with yield. Therefore it can be concluded that the longer the vine, more will be the number of branches and higher will be the yield, as reported early by Kalloo *et al.* (1981) and Swamy *et al.* (1985).

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

In the present investigation, fruits per plant was seen highly and positively correlated with yield. This is in line with the findings of Swamy *et al.* (1985), Vijay (1987), Lal and Singh (1997). Therefore, by applying selection pressure on fruits per plant, yield can be enhanced. Average fruit weight had a significant positive association with yield. These observations are in conformity with the findings of Kalloo *et al.* (1981), Swamy *et al.* (1985) and Chacko (1992).

Choudhary *et al.* (1985), Choudhary and Mandal (1987), Abusaleha and Dutta (1988) reported significant positive correlation of length of fruit and girth of fruit with yield in cucumber. The present study confirmed their findings. A positive association of internodal length with yield was found which was in confirmation with the findings of Swamy *et al.* (1985) in muskmelon. Positive association was also noted in the present study for leaf thickness, pollen viability, seeds per fruit with yield.

More leaf thickness is an indication of efficient storage of photosynthates which in turn resulted in more yield. Being a cross pollinated crop, viability of pollen is important for better fruit set and yield in *Cucumis melo* L.

Days to harvest and mode of appearance of first female flower were found to have a negative correlation with yield which was in confirmation with the findings of Singh and Singh (1988) in watermelon.

Similarily days to produce first male and female flower recorded a negative association with yield. This was in confirmity with the findings of Deol *et al.* (1981) in melons and Singh and Singh (1988) in watermelon. Flesh cavity ratio had a negative correlation with yield as early reported by Deol *et al.* (1981) Satyanarayana (1991) and Chacko (1992).

Mosaic disease incidence which is one of the serious limiting factors in melon cultivation had negative correlation with yield.

Leaf area index showed significant positive association with number of secondary branches, sex ratio, pollen viability, fruits per plant and seeds per fruit. At the same time, these characters showed positive interrelationships with each other also. This indicates that selection for these characters will also improve leaf area index and thereby yield. Association of yield with leaf area was reported early by Cerne (1984) and Saikia *et al.* (1995) in cucumber.

Days to first female flower production showed significant positive genotypic correlation with days to first harvest in support of Deol *et al.* (1981) and Chacko (1992). Therefore it can be concluded that cultivar early in female flower production will be early in relating to harvest also.

Days to first female flower production was positively correlated with node of first female flower production. This was in accordance with the findings of Gayathri, 1997 in cucumber. Significant positive correlation was also observed between the node at which first female flower appears and the days to first harvest as early reported by Chacko (1992). Association was also noticed in the present study on the node of first female flower with days to first male flower production, days to first female flower production and days to first harvest as reported by Gayathri (1997) in cucumber.

Days to first harvest showed a positive association with days to produce first male flower, days to produce first female flower and node of first female flower as reported early by Gayathri, 1997 in cucumber.

Association of fruits per plant with vine length was observed in the present study as reported by Chacko (1992). Fruits per plant also showed a positive association with number of secondary branches as reported by Chacko (1992). Thus, it can be inferred that longer the vine, more will be the number of branches and higher will be the number of fruits per plant.

Fruits per plant also exhibited a positive correlation with pollen viability. As viability of pollen increases, there will be more fruit set and obviously increased fruit number per plant. Salk (1982) reported a negative correlation for fruits per plant with average fruit weight. In the present investigation also, fruits per plant accorded a negative association with average fruit weight and fruit length. It shows that with increase in number of fruits per plant, there is a simultaneous decrease in fruit weight and fruit length. Therefore we have to make a compromise among fruits per plant, fruit weight and fruit length, while selecting for yield. The study also revealed a negative association of fruits per plant with days to harvest. Similar finding was also reported by Gayathri (1997) in cucumber.

The positive significant association of fruit girth and fruit weight, observed in the present investigation indicated that selection for greater fruit girth would result in isolating streams with higher fruit weight. This was in confirmity with the findings of Gayathri (1997) in cucumber.

Increased fruit length would lead to more seed production as length of fruit and seeds per plant were positively correlated in the present study.

A significant negative correlation was noted between mosaic disease incidence and vine length, LAI, sex ratio, pollen viability, average fruit weight and length of fruit. This might be due to the reduction in vegetative growth and flowering caused by virus.

5.4 Path analysis

Yield is dependent on a number of component characters and information on the association of characters with yield and among themselves is essential in any breeding programme. The study of association of characters with yield enables to fix up characters which have decisive contributing role in influencing the yield. Path analysis provides information on the association of attributes and their direct and indirect influences on yield depicting importance in selection (Singh and Singh, 1988).

In the present study, fruits per plant, length of fruit and girth of fruit exerted strong and positive direct effect on yield. Positive direct effect of fruits per plant and fruit length on yield was in accordance with the findings of Choudhary and Mandal (1987) and Zhang *et al.* (1999) in cucumber. Direct effect of fruits per plant on yield was also reported by Kalloo *et al.* (1982), Vijay (1987) and Lal and Singh (1997) in muskmelon. Direct positive effect of fruit girth on yield was also reported by Gayathri (1997) in cucumber.

Though the direct effect of vine length on yield was low in magnitude, it exerted high and positive indirect effect through fruit length. Positive direct effect of vine length on yield was reported by Prasad and Singh (1992) in cucumber. Similarly, internodal length also exerted a positive direct effect on yield. This was in accordance with the findings of Solanki and Shah (1992) in cucumber.

Sex ratio exerted a negative direct effect even though its total correlation with yield was positive. It's positive indirect effect through fruits per plant could be considered as the cause for this.

The residual effect noticed in the present study was of very low magnitude (0.1030) indicating that almost 90 per cent of the variation in fruit yield was attributable to factors considered in this study.

In the light of above results from path analysis, it might be concluded that while selecting for high yielding types, major emphasis should be given to fruits per plant, length of fruit and girth of fruit with due consideration to vine length and internodal length.

5.5 Selection index

Discriminent function analysis developed by Fisher (1936) is a method of selection of genotypes based on multiple observable characters. It gives information on the proportionate weightage to be given to a yield component. Thus selection index was formulated to increase the efficiency of selection by taking into account the important characters contributing to yield. According to Hazel (1943), selection based on suitable selection index is more efficient than selection based on individual characters.

Vine length, LAI, sex ratio, fruits/plant, fruit weight, length of fruit and girth of fruit together with yield per plant were used for constructing selection index. Based on the selection index values, top ranking landraces namely CM 5 (Plate 9) from Kattakada (Thiruvananthapuram), CM 48 from Periya (Wayanad), CM 6 from Aryanad

(Thiruvananthapuram), CM 3 from Nemom (Thiruvananthapuram), CM 36 (Plate 10) from Kattapana (Iddukki), CM 46 from Perithalmanna (Malappuram), CM 17 from Kalavoor (Kottayam), CM 35 from Thrikkodithanam (Kottayam), CM 50 from Kanhangad), CM 7 from Aryanad (Thiruvananthapuram) were identified as superior ones with high yield and yield attributes. These adapted landraces can be utilized in various future improvement programmes of culinary melons. A 'location specific evaluation' has to be carried out with these culinary melon lines in areas where diverse agroclimatic situations and consumer preference exist.

Plate 9. CM 5 - High yielding superior landrace

Plate 10. CM 36 - A high yielding superior landrace of culinary melon (Kanivellari type)

SUMMARY

SUMMARY

The present study "Collection and characterization of landraces of culinary melon (*Cucumis melo* L.) in Kerala" was conducted at the Department of Olericulture, College of Agriculture, Vellayani during the period 1998-2000. The programme envisaged assessing the variability on the landraces of culinary melons in Kerala for morphology, yield, yield attributes and reaction to pest and diseases so as to identify suitable line for further improvement. Forty two diverse landraces collected from different parts of Kerala were evaluated in the rice fallow during the summer season of 1999-2000. The salient results of the study are summarised.

The results revealed significant difference among the landraces for all the characters studied except number of primary branches and branch of first male and female flower production. CM 5 a landrace from Kattakada (Thiruvananthapuram) was the top yielder.

Virus diseases was found to be the serious one and the landraces viz., CM 5 from Kattakada (Thiruvananthapuram), CM 17 from Kalavoor (Kottayam), CM 3 from Nemom (Thiruvananthapuram), CM 36 from Kattapana (Idukki) were found to be superior in yield and free from the

symptoms of any virus diseases. Landraces like CM 18 from Manimala (Pathanamthitta) and CM 33 from Velloor (Kottayam) were also resistant.

High PCV coupled with high GCV was recorded for yield per plant, fruit weight, fruits per plant, keeping quality of fruits and seed weight.

Very high heritability was observed for fruit length, fruit girth, 1000 seed weight, average fruit weight, keeping quality of fruit, flesh cavity ratio, yield per plant and leaf thickness.

Expected genetic advance as percentage was maximum for average fruit weight, fruit per plant, keeping quality of fruits, 1000 seed weight, leaf area index and length of fruit. All these characters possessed moderate to high heritability values also.

At genotypic level, yield per plant was positively correlated to vine length, leaf area index, fruits per plant, average fruit weight, fruit length and fruit girth. Characters like days to produce first male flower, days to produce first female flower, days to first harvest and node of appearance of first female flower, had a negative correlation with yield.

Virus disease incidence was negatively correlated with vine length, leaf area index, sex ratio, pollen viability and average fruit weight.

Fruits per plant, length of fruit and girth of fruit had high positive direct effect on yield.

A selection index was formulated using eight characters having high correlation with yield. Landraces *viz.*, CM 5 (Kattakada, Thiruvananthapuram), CM 48 (Periya, Wayanad), CM 6 (Aryanad, Thiruvananthapuram), CM 3 (Nemom, Thiruvananthapuram), CM 36 (Kattapana, Idukki), CM 46 (Perinthalmanna, Malappuram), CM 17 (Kalavoor, Kottayam), CM 35 (Thrikkodithanam, Kottayam), CM 50 (Kanhangad, Kasaragod) and CM 7 (Aryanad, Thiruvananthapuram) were identified as superior ones with yield and field resistance against virus diseases.

APPENDICES

Appendix I. Weather data for the crop period - weekly averages

Period	Max. temp. (°C)	Min. temp. (°C)	Relative humidity (%)	Rainfall (mm)
Dec.6-Dec.12	31.70	21.59	78.85	—
Dec.13-Dec.19	30.26	22.93	78.86	—
Dec.20-Dec.26	30.66	20.87	77.29	0.40
Dec.27-Jan.2	30.79	20.32	77.50	—
Jan.3-Jan.9	31.00	30.20	77.50	2.14
Jan.10-Jan.16	30.66	29.50	74.43	3.40
Jan.17-Jan.23	30.63	21.30	78.00	—
Jan.24-Jan.30	31.46	20.69	76.07	—
Jan.31-Feb.6	30.59	21.90	78.36	10.06
Feb.7-Feb.13	31.00	22.96	79.26	4.34
Feb.14-Feb.20	30.81	22.30	76.86	—
Feb.21-Feb.22	31.00	22.80	74.50	—

Appendix II. Analysis of variance of 27 characters in 42 accessions of culinary melons (Mean squares are given)

Source	df	Vine length 1	No. of primary 2	No. of secondary branches 3	Internodal length 4	Leaf area index 5	Leaf thickness 6	Leaf petiole length 7
Replication	1	295.75	4.76	2.679	3.988	0.138	522.0	7.741
Genotype	41	3555.13**	0.335*	0.818*	2.092**	5.537**	3809.37**	1.939*
Error	41	1126.22	0.188	0.417	0.892	3.395	164.76	1.72

Source	df	Days to produce first male flower 8	Branch of first male flower 9	Node of first male flower 10	Days to produce first female flower 11	Branch of first female flower 12	Node of first female flower 13
Replication	1	12.969	2.960	0.360	1.00	2.676	2.929
Genotype	41	8.840**	0.527**	1.521**	9.027**	0.302**	3.371**
Error	41	0.409	0.149	0.195	0.804	0.143	0.521

(Appendix II. Contd...)

Source	df	Sex ratio 14	Pollen viability 15	Days to first harvest 16	Fruit per plant 17	Average fruit weight 18	Yield / plant 19	Length of fruit 20
Replication	1	1.188	0.406	2.50	3.646	4.723	0.294	2.734
Genotype	41	109.632**	50.136	10.467**	14.837**	0.182**	14.924**	15.131**
Error	41	10.345	8.594	0.613	1.006	1.871	0.612	9.613

Source	df	Girth of fruit 21	Flesh cavity ratio 22	Keeping quality of fruits 23	Seeds per fruit 24	1000 seed weight 25	Organoleptic quality 26	Mosaic virus disease 27
Replication	1	1.016	3.685	0.075	10676.0	0.226	9.333	4.298
Genotype	41	23.789**	6.930**	6.046**	48895.9**	10.723**	20.56**	2.720
Error	4	0.190	2.672	0.190	3375.17	0.103	2.992	1.663

* Significant at 5 per cent level ** Significant at 1 per cent level

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COLLECTION AND CHARACTERIZATION OF LANDRACES OF CULINARY MELON (*Cucumis melo* L.) IN KERALA

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ABSTRACT OF THE THESIS
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ABSTRACT

A study was carried out to characterize the landraces of culinary melons *Cucumis melo* L. in Kerala at the Department of Olericulture, College of Agriculture, Vellayani. Forty two collections were evaluated for morphology, yield, yield attributes and reaction to the incidence of virus disease. The genetic parameters, correlation and path coefficients were studied and a selection index was formulated to identify superior genotypes.

Landraces showed significant difference for all the characters except number of primary branches, branch of first male and female flower production. CM 5, collected from Kattakada, (Thiruvananthapuram) was the top yielder.

Landraces *viz.*, CM 5 (Kattakada, Thiruvananthapuram), CM 17 (Kalavoor, Kottayam), CM 3 (Nemom, Thiruvananthapuram), CM 36 (Kattapana, Idukki) were superior in mosaic virus resistance and yield. CM 18 (Manimala, Pathanamthitta) and CM 33 (Velloor, Kottayam) were found resistant with medium yield.

GCV and PCV were highest for yield per plant followed by fruit weight, fruit per plant, keeping quality of fruits and 1000 seed weight. High heritability coupled with high genetic advance was noted for fruit length, 1000 seed weight, average fruit weight and keeping quality of fruit indicating scope for the improvement through selection.

Vine length, leaf area index, fruits per plant, average fruit weight, fruit length and fruit girth had high positive correlation with yield whereas days to produce first male flower, days to produce first female flower, days to first harvest and node of appearance of first female flower had a negative correlation with yield.

Path analysis revealed fruits per plant, length of fruit and girth of fruit as primary contributions to yield.

A selection index was constructed based on the yield per plant and eight yield contributing characters. The landraces CM 5 (Kattakkada, Thiruvananthapuram), CM 48 (Periya, Wayanad), CM 6 (Aryanad, Thiruvananthapuram), CM 3 (Nemom, Thiruvananthapuram), CM 36 (Kattapana, Idukki), CM 46 (Perinthalmanna, Malappuram), CM 17 (Kalavoor, Kottayam), CM 35 (Thrikkodithanam, Kottayam), CM 50 (Kanhangad, Kasaragod), CM 7 (Aryanad, Thiruvananthapuram) were identified as elite in terms of yield, field attributes and resistance against mosaic virus disease incidence.