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Performance of selected F1 hybrids of sweet gourd

Mohammad Amdadul Hoque[1]*, Nizamul Haque Patwary[2], Shah Muhammad Shahidullah[2], Md. Riaz Ullah Bahadur[3], Labony Yeasmin[4]

[1]Upazila Agriculture Officer, Saturia, Manikgong, Bangladesh
[2]Department of Agriculture Extension, Ministry of Agriculture, Dhaka, Bangladesh
[3]Upazila Agriculture Officer, Rajapur, Jhalakati, Bangladesh
[4]Dhaka Cantt. Public Girls School & College, Dhaka Cantonment, Dhaka, Bangladesh

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***Corresponding Author:**

Mohammad Amdadul Hoque
Email:amdadulhoque28@gmail.com

ABSTRACT

The present investigation was undertaken at the field laboratory of "Collection, Evaluation, Conservation and Utilization of Landraces and Wild relatives of some Important Vegetables and Fruits of Bangladesh (CVFB)" Project, Department of Horticulture, Bangladesh Agricultural University, Mymensingh to study the field performance of 15 F1 hybrids along with 5 parents of sweet gourd. The analysis of variance for different characters showed high degree of variation among the 20 sweet gourd genotypes. Parental genotype CM099 produced the highest number of male flowers plant^{-1} (107.67) while the cross CM73 × CM 118 showed the highest number of female flowers plant^{-1} (15.44). The cross CM26 × CM73 showed the best performance in respect of yield plant^{-1} (29.40 kg). The highest average fruit weight (8.40 kg) was recorded in CM118 × CM122. The cross CM73 × CM 118 produced the maximum number of fruits plant^{-1} (9.32). In all cases, the phenotypic co-efficient of variation (PCV) was greater than the genotypic co-efficient of variation (GCV). High heritability, ranging from 81.27-99.26% was found for vine length, primary branches, number of nodes plant^{-1}, leaf length, leaf breadth, petiole length, male flowers plant^{-1}, female flowers plant^{-1}, days to first male flowering, nodal position for first female flowering, fruits plant^{-1}, yield plant^{-1}, fruit length, fruit diameter, cavity length, cavity breadth, peduncle length, flesh thickness and % TSS. Correlation co-efficient indicated that yield plant^{-1} had highly significant and positive correlation with vine length at final harvest, fruit diameter, fruit weight and number of fruits plant^{-1}.

INTRODUCTION

Sweet gourd *(Cucurbita moschata* Duch ex Poir) is an annual herb belonging to the family Cucurbitaceae. It is locally known as misty kumra or misty lau or misty kadu. It is a seed propagated, day neutral, annual and monoecious vine crop and originated from the region of Central America and Northern South America (Whitaker and Davis, 1962). The crop has been cultivated in Bangladesh from ancient time as a very popular and commercially important vegetable. Currently, it is grown and accepted as a popular vegetable through the entire tropical and subtropical region of the world and milder portions of the temperate zones of both the hemispheres. It is grown in all the districts of Bangladesh round the year but its production is concentrated during summer season. Sweet gourd occupied 1.17 thousand hectares of land with the total production of 11.9 thousand tons of fruits with an average yield of 8.8 t ha^{-1} in Bangladesh (BBS, 2004). The crop constitutes 8.38% and 6.44% of the total supply of vegetables in the market during the summer and winter season, respectively (BBS, 2002). Sweet gourd is appreciated by consumers as because its fruits, tender stems, leaves and even flowers can be used as vegetables. Further, fruits of sweet gourd are used as vegetables both at green and ripe stage. It is relatively richer source of energy, carbohydrates and vitamins, especially that of high carotenoids pigments and minerals (Bose and Som, 1986). Its leaves are also rich in various nutrients (Gopalan et al. 1982). This crop is, therefore, thought to have potentiality to solve malnutrition problem of Bangladesh to certain extent particularly of the vulnerable groups in respect of vitamin A requirement. There are several cultivars of sweet gourd, which are traditionally cultivated in Bangladesh. But the present yield (6.57 t ha^{-1}) is very low (BBS, 2002) compared to that of many other countries, where the yield is as high as 40 to 50 t ha^{-1} (Bolotskikh and Prikhodko, 1996). Lower yield of sweet gourd in Bangladesh is particularly due to lack of high yielding varieties. It may be mentioned that until to date there is no released variety of sweet gourd having high yield potential and better quality. Because of its high cross pollination, hardly any genetically pure strain is available to the growers. Lack of definite variety, therefore, is one of the main constraints towards its production. For improving the production as well as yield of sweet gourd, the CVFB Project has collected a number of sweet gourd accessions from different parts of the country which are being evaluated at the Bangladesh Agricultural University, Mymensingh.

In Bangladesh, the scope of horizontal increase in production of sweet gourd is limited due to shortage of land. On the contrary, in case of vertical increase, selection of high yielding varieties remains as the best opportunity for increased production of any crop. In this respect, there is a need to intensify research efforts in several areas, particularly the selection of superior genotype. The basic key to bring about the genetic upgrading to a plant is to utilize the available or created genetic variability. If the variability in the population is largely due to genetic cause with least environment effect, the probability of having a superior genotype is much higher for the expression of desired characters. The determination of correlation among the characters is a matter of considerable importance in selection of correlated response. The correlation analysis would

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provide a true picture of genetic association among different traits (Bhatt, 1973).

This experiment was conducted at the "CVFB" Project located at the BAU Horticultural Farm, where to be collection of some indigenous landraces and Wild relatives Vegetables and Fruits of Bangladesh and evaluation and documentation of collected landraces. Literature revealed that a few research works relating to the performance of sweet gourd genotypes have been conducted in Bangladesh. Therefore, the present study was conducted to assess the performance of 15 F_1 hybrids along with 5 parents of sweet gourd developed for yield and yield contributing characters.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at the field laboratory of "Collection, Evaluation, Conservation and Utilization of Landraces and Wild relatives of some Important Vegetables and Fruits of Bangladesh (CVFB)" Project site, Horticulture Farm, Bangladesh Agricultural University, Mymensingh, Bangladesh. The site of the experiment is situated between 24°75' N latitude and 90°50' E longitude at the elevation of 18 m above the sea level. The experiment was carried out in a medium high land belonging to the Old Bahmaputra Flood Plain Alluvial Tract (UNDP, 1988). The soil texture was silty loam with a pH 6.7. Soil sample of the experimental plot was collected from depth of 0 to 30 cm before conducting the experiment and analyzed in the Humboldt Soil Testing Laboratory, Department of Soil Science, Bangladesh Agricultural University, Mymensingh, Bangladesh. The experimental area was under the subtropical monsoon climate characterized by heavy rainfall during the Kharif season (April to September) and scanty rainfall in the Rabi season.

Planting materials

Fifteen F_1 hybrids (CM 20 × CM 44, CM 20 × CM 122, CM 73 × CM 118, CM 26 × CM 99, CM 44 × CM 122, CM 99 × CM 120, CM 73 × CM 99, CM 26 × CM 120, CM 118 × CM 122, CM 44 × CM 99, CM 20 × CM 99, CM 26 × CM 44, CM 26 × CM 73, CM 118 × CM 120 and CM 99 × CM 122) along with 5 parents (CM 020, CM 026, CM 044, CM 099, CM 122 and CM 122) of sweet gourd genotypes were included in this study. The materials were collected from 'CVFB' Project.

Cultivation procedure

The land was opened with a power tiller and kept opened to sunlight. The land was subsequently ploughed for several times to bring the soil about a good tilth. All uprooted weeds and stubbles were removed from the field, and big clods were broken into small pieces by hand tools. The experimental field was leveled and the experimental plots were laid out according to plan. The doses of organic and inorganic fertilizers were applied as per the recommendation of BARC (1997). Fifty percent of cowdung was applied at the time of final land preparation. The remaining cowdung, entire quantity of TSP and half of each urea and MP were applied as basal dose during pit preparation. The rest of urea and MP were top dressed in two installments at 30 and 50 days after transplanting. The experiment was laid out in the Randomized Complete Block Design (RCBD) with three replications. One genotype represented one treatment, and three plants in genotypes comprised one replication. The unit plot size was 3 m × 3 m maintaining a distance of 0.5 m between the plots. Treatments were randomly assigned to different plots of each block separately. After final land preparation, the plots were raised by 10 cm from the ground level. The pits of 50 cm × 50 cm × 30 cm size were prepared in each plot at a spacing of 3 m pit to pit. The sweet gourd seeds of different genotypes were dibbled in each pit. The seeds were presoaked for 24 hours and six seeds were dibbled in each pit and covered with fine soil. Careful observations were always kept on the seedlings. Necessary intercultural operations were done throughout the cropping season for proper growth and development of the plant. Germination of seeds was completed within 16 days of sowing. When seedlings were attained a height of about 8-10 cm, they were thinned out keeping 3 healthy seedlings per pit. At the same time gap filling was done where needed. Three weddings were done to keep the plot free from weeds. The soil was mulched after each irrigation to prevent crust formation and to facilitate good aeration. Mud plates were used under each fruit to protect them from coming in contact with soil to prevent soil pest and disease attack. Harvesting of sweet gourd was started after 120 days of plant emergence when the fruit peduncle dried out on maturity.

Data collection

Three plants were selected at random from each plot for recording data. Growth, yield, and quality characters were measured.

Statistical analysis

Collected data on plant, leaf, flower, fruit and seed characteristics under study were statistically analyzed to find out the significance of difference among the treatment means. The analyses of variances for most of the characters under consideration were performed by F variance test. The significance of different among the means was evaluated by least significant difference (LSD) test for interpretation of the result (Gomez and Gomez, 1984). Association of different characters under the study was analyzed by working out simple correlation co-efficient for all the possible pairs of character combinations. Simple correlation co-efficient (r) among the important characters of sweet gourd genotypes were estimated according to Singh and Chaudhury (1985). According to Johnson et al. (1955) the genotypic and phenotypic variances were calculated. The genotypic and phenotypic co-efficient of variation was also calculated according to Burton (1952).

RESULTS AND DISCUSSION

Field performance and morphology of 20 sweet gourd genotypes

Days to seed germination

The analysis of variance indicates that significant difference was present among the 20 sweet gourd genotypes for seed germination. Minimum days (7.33) for seed germination was recorded in cross of CM26 × CM44 which was statistically similar with CM 020 (8.67 days), CM44 (8.33 days), CM20 × CM 44 (7.67 days), CM20 × CM122 (8.00 days), CM44 × CM122 (8.67 days), CM73 × CM118 (7.67 days), CM118 × CM122 (8.33 days) and CM26 × CM73 (8.00 days) (Table 1) and maximum days (15.67) for seed germination was recorded in CM099 which was statistically similar with CM 99 × CM 122 (13.33 days), CM99 × CM 120 (14.67 days) and CM118 × CM 120 (13.67 days) (Table 1). Rahman (1988) also found significant difference in seed germination of pointed gourd which varied from 2 to 3 weeks. The genotypic and phenotypic variance was 5.80 and 8.51 genotypic coefficient of variation (23.74%) was lower than phenotypic co-efficient of variation (28.75%) which indicated that larger influence of environment on the performance of particular character. Saha et al. (1992) also found higher PCV than GCV in most of the traits. Heritability in broad sense was calculated. It was 68.21% which was moderately high (Table 7).

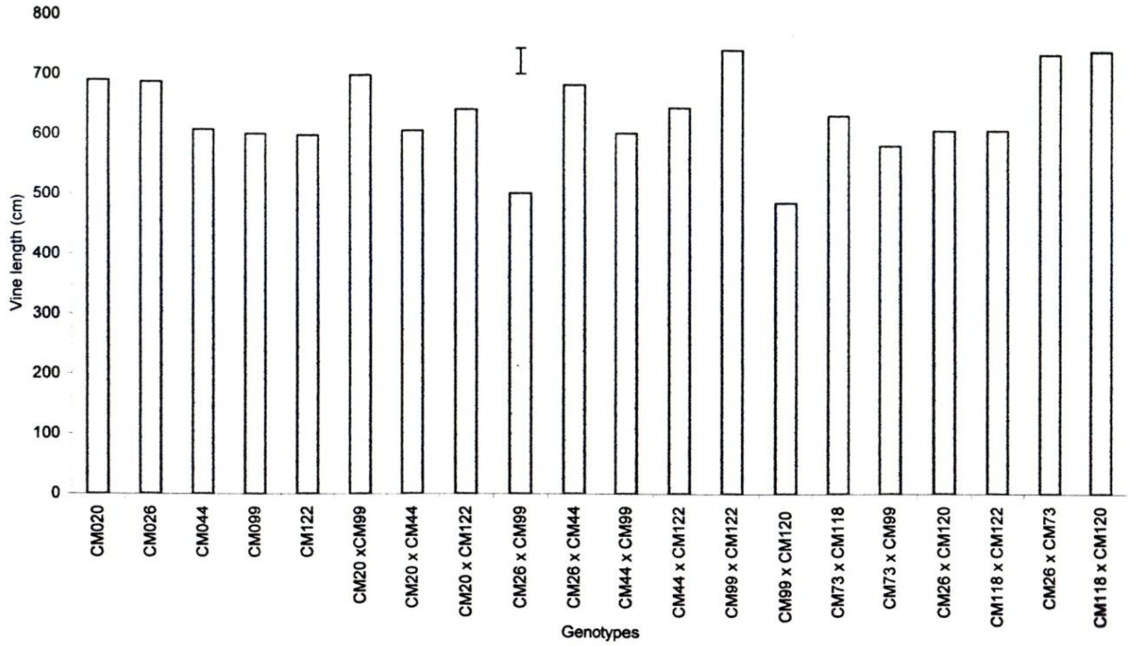

Fig. 1 Vine length at harvest of 20 sweet gourd genotypes. Vertical bar represents LSD at 1% level of probability.

Vine length

Data on vine length was recorded at 30, 45 60 days after germination (DAG) and at final harvest. Significant differences were found at all the stages of plant growth. Vine length at 30 DAG ranged from 23.13 cm to 43.88 cm. The lowest vine length at 30 DAG was recorded in CM099 and the highest was in CM20 × CM44. The maximum and minimum values for vine length was recorded at 45, 60 DAG and at final harvest in CM20 × CM44, CM26 × CM44 and CM99 × CM122 and minimum value was recorded in CM099, CM20 × CM99 and CM99 × CM 120 (Table 1 and Fig. 1). The GCV for vine length at 30, 45, 60 DAG and final harvest were 15.42 12.39, 13.75 and 10.96%, respectively and the PCV for those characters were 16.90, 12.71, 14.15 and 11.56%, respectively. Heritability in broad sense was also measured which was higher for all these stages of growth. The genotypic and phenotypic variance of vine length at 30, 45, 60 DAG and final harvest were 27.21 and 32.69, 474.36 and 498.64, 2619.12 and 2773.48 and 4821.71 and 5087.02, respectively. The heritability (h^2b) were 83.24, 95.13, 94.43 and 94.78% for vine length at 30, 45, 60 DAG and at final harvest, respectively (Table 7). The higher phenotypic variance and co-efficient of variation than genotypic indicate that there was an environmental effects on this traits.

Internode length (cm) of main stem

Significant difference was observed in case of internode length of sweet gourd (Table 1). The mean value of internode length was 19.65. The length varied from 17.94 to 21.33 cm. The minimum length (17.94 cm) was found in cross number CM73 × CM99 and the maximum length (21.33 cm) was found in CM020 which was statistically similar to CM 20 × CM99 (18.94 cm), CM26 × CM120 (18.99 cm), CM26 × CM73 (18.66 cm), CM118 × CM 120 (18.60 cm) and CM044 (20.44 cm), CM 122 (20.72 cm), CM20 × CM44 (20.94 cm), CM20 × CM122 (20.05 cm), CM26 × CM44 (20.05 cm) and CM44 × CM 122 (20.16 cm). The genotypic and phenotypic variances for internode length were 0.58 and 0.94, respectively. The heritability in broad sense (h^2b) for internode length was 61.70% (Table 7). Little differences were observed between genotypic and phenotypic variance as well as genotypic and phenotypic co-efficient of variation indicating low environment influence on this trait.

Table 1. Performance of 20 sweet gourd genotypes for different vegetative characters.

Genotypes	Days to seed germination	Vine length (cm)				Internode (cm)
		30 days	45 days	60 days	At final harvest	
CM020	8.67	38.01	203.33	430.44	690.27	21.33
CM026	9.33	29.52	185.33	341.00	687.17	19.77
CM044	8.33	28.48	157.83	327.44	607.49	20.44
CM099	15.67	23.13	128.47	290.53	600.50	19.39
CM 122	10.33	26.24	145.50	292.16	598.17	20.72
CM20 × CM99	9.67	25.94	158.44	280.00	698.10	18.94
CM20 × CM44	7.67	43.88	205..61	442.33	605.55	20.94
CM20 × CM122	8.00	38.35	202.55	411.22	640.80	20.05
CM26 × CM99	9.00	33.86	177.09	400.53	500.82	19.74
CM26 × CM44	7.33	39.55	203.55	446.83	681.50	20.05
CM44 × CM99	12.67	37.55	201.39	415.50	601.44	19.55
CM44 × CM122	8.67	34.66	159.87	395.53	644.17	20.16
CM99 × CM122	13.33	33.89	172.44	400.50	740.44	19.79
CM99 × CM 1 20	14.67	36.22	1 90.44	388.83	485.43	19.61
CM73 × CM118	7.67	38.27	171.00	340.94	630.78	19.33
CM73 × CM99	12.33	33.35	159.89	337.20	580.33	17.94
CM26 × CM120	9.67	36.16	183.33	370.39	605.44	18.99
CM118 × CM122	8.33	32.39	150.83	325.50	605.44	19.04
CM26 × CM73	8.00	38.55	172.78	407.83	731.50	18.66
CM118 × CM120	13.67	28.50	183.50	401.00	737.17	18.60
LSD (0.01)	3.64	5.18	10.91	27.51	36.06	1.32
LSD (0.05)	2.72	3.87	8.14	20.54	26.92	0.98

Number of primary branches per plant at harvest

Significant difference was observed for number of primary branches plant^{-1} among the sweet gourd genotypes. The mean value for this trait was 12.01. The range varied from 9.16 to 15.18. Highest number of primary branches was found in cross number CM26 × CM73 (15.18) and the lowest number of primary branches was found in cross number CM99 × CM 120 (9.16) (Table 2). The genotypic and phenotypic variances were 1.35 and 1.66, respectively. The genotypic and phenotypic co-efficient of variation were 9.67% and 10.73%, respectively which indicated low influence of environmental effect on this trait. The heritability was moderately high (81.33%) for this character (Table 7). Banik (2003) found significant differences in number of primary branches (5.23 - 11.88) in 26 genotypes of snake gourd.

Number of node per plant at harvest

Number of node per plant at harvest varied significantly among the genotypes and ranged from 31.54 - 45.00 with the mean value 36.39. The highest number of node per plant was observed in CM020 (45.00) followed by cross number CM73 × CM118 (39.28) while the lowest number of node per plant was found in cross number CM26 × CM99 (31.94) followed by CM026, CM44 × CM99, CM99 × CM 120 and CM73 × CM99 (32.00, 33.05, 32.94, and 32.94 respectively) (Table 2). The genotypic and phenotypic variances were 9.81 and 10.25, respectively. The genotypic and phenotypic co-efficient of variation was 8.61 and 8.79%, respectively. Phenotypic co-efficient of variation was slightly higher than genotypic co-efficient of variation indicating the moderate environmental influence on this trait. High heritability (95.71%) was also observed for this trait (Table 7).

Leaf length

It was observed that leaf length varied significantly among the sweet gourd genotypes and ranging from 17.03 to 25.23 cm with the mean value of 21.01 cm (Table 2). The highest length of leaf (25.23 cm) was found in cross & number CM20 × CM44 followed by CM020, CM26 × CM99, CM26 × CM44, CM99 × CM122, CM99 × CM120 and CM118 × CM120 (25.03, 22.57, 22.00, 22.30, 22.50 and 22.17 cm, respectively) while the lowest length of leaf (17.03 cm) was found in CM099 and CM122 followed by CM77 × CM99 (17.90 cm). Considerable differences were found between genotypic (4.74) and phenotypic (5.01) variances. Genotypic (10.36%) and phenotypic (10.64%) co-efficient of variations indicated environmental effect upon the expression of the character. High heritability (94.61%) was found for leaf length (Table 7).

Leaf breadth

The sweet gourd genotypes showed significant variation in respect of leaf breadth and ranged from 26.00 - 31.23 cm with the mean value of 27.48 cm (Table 2). The plant of cross number CM20 × CM99 showed lowest (21.00 cm) value of leaf breadth and CM73 × CM118 showed the highest (31.23 cm) value of leaf breadth which differed significantly from the other genotypes (Table 2). The heritability for this character was (94.64%). GCV (10.26%) was slightly lower than the PCV (10.55%) indicating that there was low environmental influence on the expression of this trait (Table 7).

Petiole length

Petiole length varied significantly among the genotypes and ranged from 17.05 - 36.03 cm (Table 2). The mean value for this character was 26.59 cm. Haque (1971) found that petiole length for bottle gourd, sweet gourd and white gourd were 13.84 cm, 14.53 cm and 12.14 cm respectively. The lowest value of petiole length was recorded for CM122 (17.05 cm) and the highest value of petiole length was recorded in cross number CM20 × CM

122 (36.03 cm) which was statistically similar to CM99 × CM122 (32.96 cm), CM99 × CM120 (35.60 cm) and CM73 × CM118 (35.60 cm). The GCV and PCV were 20.76 and 20.87%, respectively. The PCV was almost similar to GCV which indicated that there was low environmental influence on the expression of this trait. High (98.93%) heritability was found in this character (Table 7).

Table 2. Performance of 20 sweet gourd genotypes for different leaf characters.

Genotypes	No. of primary branches plant^{-1}	No. of nodes plant^{-1}	Leaf length (cm)	Leaf breadth (cm)	Petiole length (cm)
CM020	11.72	45.00	25.03	25.15	28.50
CM026	12.72	32.00	19.10	27.20	20.43
CM044	11.28	38.28	19.37	26.37	27.57
CM099	12.24	37.67	17.03	27.13	21.10
CM 122	12.05	38.94	17.03	21.50	17.05
CM20 × CM99	11.55	36.05	21.10	21.00	26.03
CM20 × CM44	13.05	38.50	25.23	28.03	27.57
CM20 × CM122	11.33	37.44	21.33	28.77	36.03
CM26 × CM99	11.94	31.94	22.57	30.27	25.67
CM26 × CM44	12.50	37.61	22.00	28.83	29.10
CM44 × CM99	13.72	33.05	21.70	30.20	24.67
CM44 × CM122	12.05	34.00	20.97	30.43	25.03
CM99 × CM122	11.72	34.32	22.30	30.43	32.97
CM99 × CM120	9.16	32.94	22.50	28.00	35.10
CM73 × CM118	10.67	39.28	21.13	31.23	35.60
CM73 × CM99	12.50	32.94	17.90	24.43	21.00
CM26 × CM120	11.28	35.83	20.50	27.03	21.43
CM118 × CM122	11.27	36.94	20.27	25.50	20.03
CM26 × CM73	15.18	38.05	21.00	28.90	30.90
CM118 × CM120	12.28	37.05	22.17	29.23	26.13
LSD (0.01)	1.22	1.47	1.15	1.47	1.27
LSD (0.05)	0.91	1.09	0.86	1.10	0.95

Number of male flower per plant

The analysis of variance revealed highly significant differences among the sweet gourd genotypes for male flowers per plant. The number of male flowers per plant ranged from 42.67 - 107.67 with the mean value 76.94 (Table 3). The maximum number of male flowers per plant (107.67) was found in the genotypes number CM099 which was statistically identical with cross number CM44 × CM99 (105.33) and CM73 × CM118 (101.44). On the other hand, the minimum number of male flowers per plant (42.67) was found in the cross number CM118 × CM122 which was statistically similar with the cross number CM44 × CM122, CM73 × CM99 and CM26 × CM120 (51.67, 58.67 and 57.67, respectively). The results of the study agree with the findings of Masud (1995). Slight differences were observed between genotypic (23.45%) and phenotypic (24.29%) co-efficient of variation indicating low environmental influence on this trait (Table 7). Bindu et al. (2000) observed similar genotypic and phenotypic co-efficient of variation of male flowers per plant. High heritability (93.13%) was found in this trait.

Number of female flower per plant

As female flower per plant showed significant variation among the genotypes of sweet gourd and ranged from 4.22 - 15.44 with the mean value of 6.89 (Table 3). The plant of cross number CM73 × CM118 showed the maximum number of female flowers plant^{-1} (15.44) which was statistically similar with the cross number CM20 × CM44 and CM26 × CM73 (10.00 and 9.67, respectively). The plant of cross number CM26 × CM99 showed the minimum number of female flowers per plant (4.22) which was statistically similar with the genotypes number CM020 (5.00), CM026 (5.78), CM20 × CM122 (5.67), CM44 × CM122 (4.67), CM99 × CM120 (5.67), CM73 × CM99 (5.67), CM26 × CM120 (5.33), CM118 × CM122 (5.67) and CM118 × CM120 (5.44). Srivastava (1976) found high variability regarding the number of female flowers plant^{-1}. Masud (1995) reported similar result in respect of female flower per plant in sweet gourd. Low differences were observed between phenotypic (6.12) and genotypic (6.83) variances as well as phenotypic (35.91%) and genotypic (37.93%) coefficient of variation indicating low environmental influence on this trait. This result agreed with the findings of Masud (1995). The heritability of this character is (89.60%) (Table 7).

Sex ratio (male: female flower)

As regards to sex ratio (male: female flower ratio) it was observed that it varied significantly among the sweet gourd genotypes and it ranged from 6.38 - 21.69 with the mean value of 11.57 (Table 3). The plant of cross number CM26 × CM99 showed the highest sex ratio (21.69) which was statistically similar with the genotypes of CM099 and CM026 (17.62 and 15.68, respectively). The lowest sex ratio (6.38) was observed in cross number CM73 × CM118 which was statistically similar with the genotypes number CM044 (9.50), CM20 × CM44 (9.17), CM26 × CM44 (9.00), CM99 × CM122 (8.45), CM118 × CM122 (7.52) and CM26 × CM73 (8.02). In cucurbit sex ratio varies from 15:1 - 30.1, the former condition is advantageous and economical, because it results in greater number of pistillate flowers plant^{-1}, consequently higher fruit set and yield (Bose and Som, 1986). Slightly differences were observed between phenotypic (14.39) and genotypic (11.14) variances as well as phenotypic (32.79%) and genotypic (28.85%) co-efficient of variation indicating low environmental influence upon the expression of this trait (Table 7). This result obtained related with the findings of Arora *et al* (1983). The heritability (77.41%) was also high.

Days to first male flowering

It is one of the most important plant characters. Among 20 sweet gourd genotypes, CM26 x CM73 showed early flowering. It took the shortest time (52.67 days) to flower which was statistically similar to CM20 × CM99, CM20 × CM44, CM26 × CM44, CM73 × CM118 and CM118 × CM120 (55.67, 55.00, 53.89, 54.56 and 55.44 days, respectively) (Table 3) and CM099 took the highest time of flowering (64.33 days) which was statistically similar to CM020 (60.67 days), CM122 (61.67 days), CM99 × CM 122 (61.55 days), CM99 × CM120 (62.11 days), CM26 × CM120 (60.67 days) and CM118 × CM122 (62.45 days). Banik (2003) found significant differences for days to first male flower opening in snake gourd. The genotypic (9.88) and phenotypic (11.51) variances were moderate as well as the differences between GCV (5.37%) and PCV (5.79%) were low which indicated less environmental effect upon the expression on of this trait. Heritability was 85.84% (Table 7).

Days to first female flowering

It is an important character that influences the yield. Analysis of variance indicates that there was wide range of variability among the 20 sweet gourd genotypes. The range varied from 57.00 to 68.33 days. The cross number CM73 × CM118 showed early female flowering (57.00 days) and CM020 showed late female flowering (68.33 days). Phenotypic variance (13.20) was higher than the genotypic variance (9.82). High differences were observed between GCV (4.94%) and PCV (5.73%). Heritability was moderately high (74.39%) (Table 7).

Nodal position for first male flowering

Nodal position for first male flowering varied significantly among the sweet gourd genotypes and ranged from 2.66 - 4.67 (Table 3). The mean value was 3.56. The minimum value was recorded for CM044 (2.67) and CM118 × CM122 (2.67) and the maximum value was recorded for CM73 × CM99 (4.67) which was statistically similar to CM026 (4.33), CM20 × CM99 (4.00), CM44 × CM122 (4.00), CM73 × CM 118 (4.33) and CM118 × CM120 (4.33) (Table 7). The genotypic variance and phenotypic variance were 0.25 and 0.44, respectively. The difference between GCV (14.04%) and PCV (18.63%) was high which indicate that this character was influenced by environment on the expression of this character. The heritability (h^2b) was found 56.81%. Saha et al. (1986) found significant difference in node number for first male flowering in pumpkin genotypes.

Table 3. Performance of 20 sweet gourd genotypes for different reproductive characters.

Genotypes	No. of male flowes plant^{-1}	No. of female flowers plant^{-1}	Days to 1st male flowering	Davs lo 1st female flowering	No. of nodes for 1st male flowering	No. of nodes for 1st female flowering	Sex ratio (M:F)*
CM020	60.33	5.00	60.67	68.33	3.33	16.33	12.07
CM026	90.67	5.78	57.56	63.56	4.33	15.67	15.68
CM044	65.11	6.78	59.56	65.44	2.67	16.00	9.50
CM099	107.67	6.21	64.33	68.56	3.33	18.67	11.75
CM 122	92.44	7.56	61.67	67.33	3.67	17.33	12.23
CM20 × CM99	73.67	6.44	55.67	64.56	4.00	15.00	11.43
CM20 × CM44	91.67	10.00	55.00	59.56	3.67	16.67	9.17
CM20 × CM122	80.44	5.67	59.67	63.56	3.33	17.33	14.18
CM26 × CM99	91.56	4.22	58.67	62.00	3.67	19.33	21.69
CM26 × CM44	72.00	7.67	53.89	60.56	3.33	16.67	9.00
CM44 × CM99	105.33	7.00	57.89	62.56	3.00	14.67	15.05
CM44 × CM122	51.67	4.67	57.00	59.33	4.00	17.33	11.06
CM99 × CM122	67.67	8.00	61.55	67.56	3.33	18.33	8.45
CM99 × CM120	80.44	5.67	62.11	65.56	3.00	16.67	14.20
CM73 × CM118	101.44	15.44	54.56	57.00	4.33	19.67	6.38
CM73 × CM99	58.67	5.67	59.00	63.44	4.67	15.00	10.35
CM26 × CM120	57.67	5.33	60.67	65.56	3.33	18.33	10.81
CM118 × CM122	42.67	5.67	62.45	64.22	2.67	15.67	7.52
CM26 × CM73	77.56	9.67	52.67	61.89	3.30	14.67	8.02
CM118 × CM120	70.06	5.44	55.44	58.56	4.33	20.00	12.87
LSD(0.01)	10.85	1.86	2.82	4.07	0.98	1.71	3.99
LSD(0.05)	8.10	1.39	2.10	3.04	0.73	1.27	2.98

* Male : Female

Nodal position for first female flowering

Significant difference was found for this character. The range varied form 14.67 - 20.00. The lowest value was fond in cross number CM44 × CM99 (14.67) and CM26 × CM73 (14.67) while the highest value (20.00) was found in cross number CM118 × CM 120 (Table 3). The mean for this trait was 16.97. The genotypic variance (2.56) was lower than phenotypic variance (3.15) as well as GCV (9.43%) was slight lower than PCV (10.46%) indicating environmental influence on the expression of this trait. The heritability (h^2b) was high (81.27%) (Table 7). Masud (1995) reported that generally female flower of pumpkin borne in 17.67- 30.00 nodes.

Fruit characteristics

Fruit characteristics pertaining fruit length, fruit diameter, flesh thickness, total soluble solids (TSS), cavity length, cavity breadth, average fruit weight, fruits per plant, amount of placental tissue and yield per plant were studied and shown in (Table 4).

Fruit length

Significant difference was observed in fruit length among 20 sweet gourd genotypes. Among the genotypes studied, longest fruit (41.50 cm) was observed in cross number CM99 × CM 120 while the shortest fruit length (22.05 cm) was recorded in cross number CM20 × CM44 (Table 4). The mean fruit length was 30.88 cm. The genotypic and phenotypic variance, genotypic and phenotypic co-efficient of variation were 29.61, 34.27, 17.62 and 18.96%, respectively (Table 7). It indicated that there was low environmental influence on the expression of this trait. Heritability was high (86.40%). Rahman et al. (1986) reported similar result in bottle gourd.

Fruit diameter

Diameter of edible fruit varied significantly among 20 sweet gourd genotypes and ranged from 41.16 - 94.83 cm. The mean value was 72.29 cm. The highest diameter recorded in cross number CM73 × CM118 (94.83 cm) and the lowest diameter recorded in CM044 (41.16 cm) (Table 4). The difference between GCV (15.65%) and PCV (17.14%), indicated the influence of environment on expression of this trait. Heritability (h^2b) was (83.46%) (Table 7). Rahman et al. (1991) reported almost similar results to the above findings in bottle gourd.

Peduncle length

The peduncle length of fruits varied significantly among the sweet gourd genotypes. Among the genotypes studied, longest peduncle length (13.12 cm) was observed in cross number CM118 × CM 122 while the shortest peduncle length (4.40 cm) was recorded in CM99 × CM 120 (Table 4). The mean peduncle length was 9.21 cm. The genotypic variance was 4.06 and phenotypic variance was 4.09. The GCV and PCV were (21.88%) and (21.96%), respectively. It indicated that there was low environmental influence on the expression of the trait. Heritability (h^2b) was high (99.26%).

Flesh thickness

There was significant variation among 20 sweet gourd genotypes in flesh thickness of fruit and ranged from 3.10 cm to 5.33 cm with the mean value of 3.81 cm (Table 4). The highest flesh thickness of fruit (5.33 cm) was found in the cross number CM44 × CM122 while the lowest flesh thickness of fruit (3.10 cm) was observed in CM99 × CM122. Similar result in respect of flesh thickness (2.53 to 4.50 cm) was observed by Masud (1995). The highest thickness produced by cross number CM44 × CM122 was probably due to its genetic character. Moderate value of GCV and PCV were recorded for flesh thickness (15.53% and 15.75%) indicated low genetic variability within the genotypes (Table 7). That means low environmental effect on expression of this character. Heritability was high (97.22%).

Cavity length

The results on length of fruit cavity varied significantly and ranged from 9.77 cm to 22.39 cm with the mean value of 17.73 cm. The longest length of cavity (22.39 cm) was found in cross number CM99 × CM 120 which statistically similar with the genotypes number CM044 (21.16 cm), CM 122 (22.00 cm), CM44 × CM 122 (22.16 cm) and CM118 × CM 122 (21.39 cm). The lowest length of cavity (9.77 cm) was observed in genotypes number CM026 (Table 4). Slight differences were observed between phenotypic (9.26) and genotypic (9.19) variance as well as phenotypic (17.16%) and genotypic (17.10%) coefficient of variation on this trait (Table 7). Heritability of this character was (99.24%) high.

Table 4. Performance of 20 sweet gourd genotypes for different fruits characters.

Genotypes	Fruit length (cm)	Fruit diameter (cm)	Peduncle length (cm)	Flesh thickness (cm)	Cavity length (cm)	Cavity breadth (cm)
CM020	25.94	76.61	9.50	4.40	16.49	15.45
CM026	28.16	80.93	10.45	3.47	9.77	15.33
CM044	35.61	41.16	8.40	3.30	21.16	8.82
CM099	36.96	62.61	7.40	3.13	17.73	14.30
CM 122	25.69	56.94	8.89	3.33	22.00	11.33
CM20 × CM99	24.04	64.16	9.27	3.17	17.91	14.74
CM20 × CM44	22.05	77.94	10.43	4.17	17.75	15.76
CM20 × CM122	27.69	76.05	10.77	3.60	19.00	15.66
CM26 × CM99	32.00	77.94	11.49	4.17	16.58	17.54
CM26 × CM44	24.61	61.44	10.71	4.30	16.75	20.34
CM44 × CM99	28.16	55.94	9.30	4.13	15.76	15.35
CM44 × CM122	39.93	76.05	8.68	5.33	22.16	16.66
CM99 × CM122	28.27	78.05	10.69	3.10	15.70	17.44
CM99 × CM120	41.50	67.59	4.40	3.20	22.39	11.34
CM73 × CM118	28.61	94.83	7.30	4.17	15.75	15.28
CM73 × CM99	31.16	78.72	7.14	4.23	16.72	17.33
CM26 × CM120	34.05	70.28	6.15	3.17	14.82	15.33
CM118 × CM122	39.16	76.16	13.12	3.50	21.39	23.32
CM26 × CM73	33.27	80.66	9.50	4.12	17.05	19.37
CM118 × CM120	30.73	71.61	10.64	4.20	17.76	15.80
LSD(0.01)	4.78	11.16	0.40	0.23	0.79	0.61
LSD(0.05)	3.57	8.32	0.30	0.17	0.59	0.46

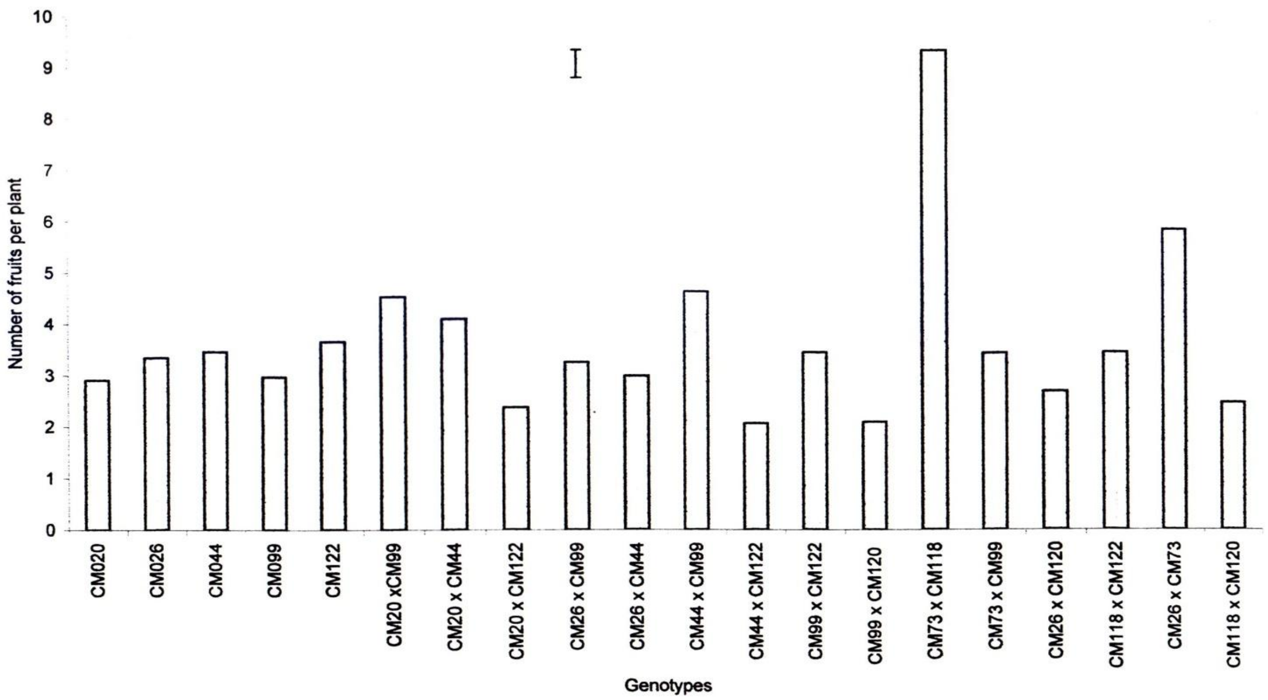

Fig. 2 Number of fruits per plant of 20 sweet gourd genotypes. Vertical bar represents LSD at 1% level of probability.

Cavity breadth

In respect of diameter of cavity of fruit significant variation was observed among sweet gourd genotypes and the ranged from 8.82 cm to 23.32 cm with the mean value of 15.83 cm. The highest breadth of cavity of fruit (23.32 cm) was observed from the cross number CM118 × CM122 which was statistically similar with the cross number CM26 × CM44 (20.34 cm) and CM26 × CM73 (19.37 cm). On the other hand, the lowest breadth of cavity of fruit (8.82 cm) was recorded from the genotypes number CM044 (Table 4). The value of GCV and PCV were recorded for cavity breadth (20.04%) and (20.11%) indicated low genetic variability with the genotypic (Table 7). This result agreed with the findings of Masud (1995). Heritability was (99.21%).

Fruits per plant

It was observed that the maximum number of fruits per plant (9.32) was produced by cross number CM73 × CM118 which was significantly different from the other genotypes (Table 5). The minimum fruit bearing (2.07) per plant was observed in cross number CM44 × CM122 and followed by CM020 (2.91), CM099 (2.98), CM20 × CM122 (2.38), CM26 × CM44 (2.99), CM99 × CM120 (2.10), CM26 × CM120 (2.68) and CM118 × CM120 (2.46) (Fig. 2). Slight differences were observed between phenotypic (2.89) and genotypic (2.46) variance as well as phenotypic (46.57%) and genotypic (42.97%) co-efficient of variation on this trait. The heritability was also high (85.12%) (Table 7).

Average fruit weight

The range of average fruit weight lies between (2.20-8.40 kg) with the mean value of 5.11 kg. The fruit weight 8.40 kg was maximum in cross number CM118 × CM122 which significantly differed from all other genotypes. The minimum fruit weight 2.20 kg was produced by CM44 × CM99 followed by CM044 (3.52 Kg), CM099 (3.15 Kg), CM20 × CM99 (3.20 Kg) and CM73 × CM118 (2.50 Kg) (Table 5 and Fig 3). The variations in fruit weight are in agreement with Doijode and Sulladmath (1986) in pumpkin. The genotypic and phenotypic variance was 25.74 and 28.05. The phenotypic co-efficient of variation (30.88%) was higher than the genotypic co-efficient of variation (29.58%) which indicated the influence of environment on the expression of this trait. Heritability for fruit weight was 91.76% (Table 7).

Weight of placenta

It was revealed from the results that amount of placental tissue varied significantly among the sweet gourd genotypes and ranged from 366.71 - 686.00 g with the mean value of 485.98 g. The highest amount of placental tissue (686.00 g) was observed in the cross number CM118 × CM122 which was statistically similar with CM122 (586.55 g), CM44 × CM 122 (582.68 g) and CM73 × CM99 (564.66 g). Whereas, the lowest amount of placental tissue (366.71 g) was observed in the cross number CM73 × CM118 which was statistically similar with CM118 × CM 122 (386.33 g) (Table 5). The phenotypic co-efficient of variation (25.47%) was higher than the genotypic co-efficient of variation (15.74%) which indicated environmental influence on this trait. This result agreed with the findings of Masud (1995). The heritability of this character was 38.18% (Table 7).

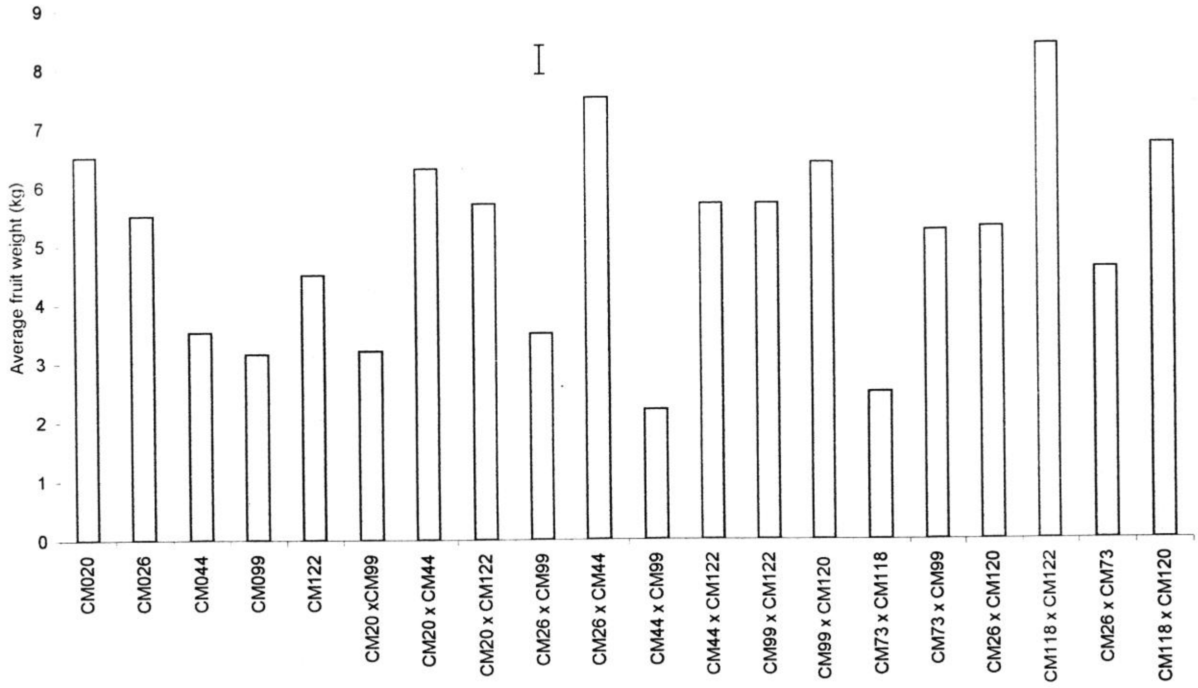

Fig. 3 Average fruit weight of 20 sweet gourd genotypes. Vertical bar represents LSD at 1% level of probability.

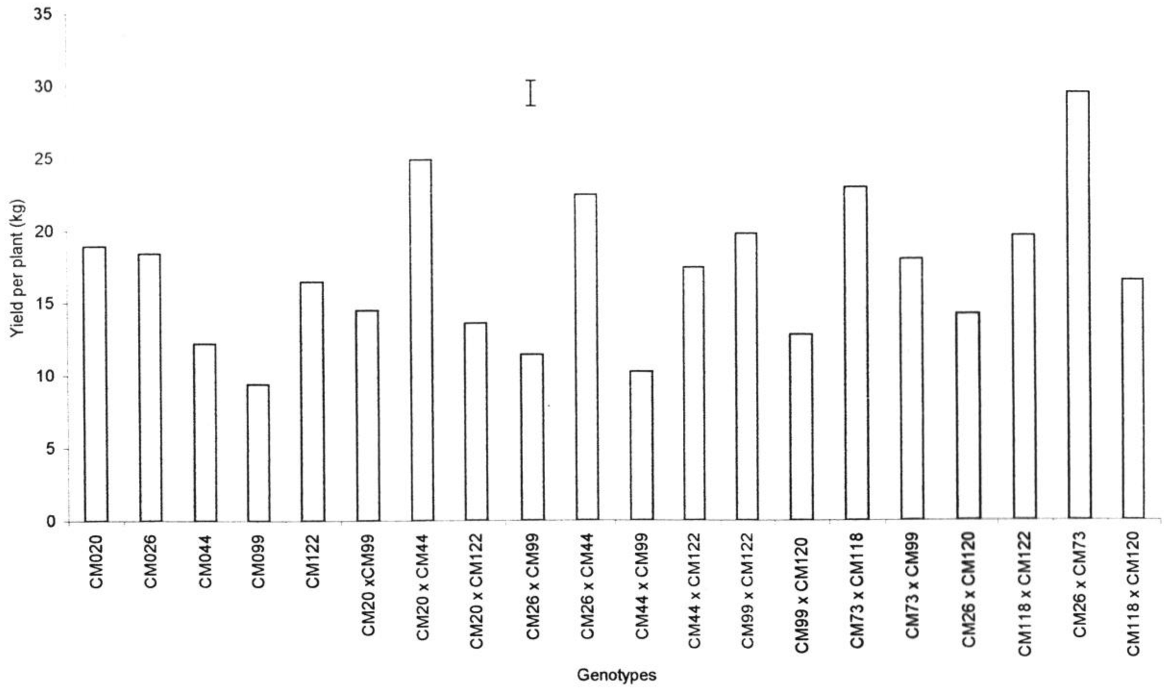

Fig. 4 Yield per plant of 20 sweet gourd genotypes. Vertical bar represents LSD at 1% level of probability.

Yield per plant

The hybrid of CM26 × CM73 gave the highest yield per plant (29.40 kg) followed by CM20 × CM44 (24.85 kg), CM26 × CM44 (22.46 kg) and CM 73 × CM118 (23.30 kg). The lowest yield 9.39 kg was found in CM099 which was statistically similar with the genotype of CM044 (12.20 kg), CM20 × CM99 (14.50 kg), CM20 × CM122 (13.58 kg), CM26 × CM99 (11.40 kg) and CM99 × CM120 (12.80 kg) (Table 5). The genotypic and phenotypic variances were 25.74 and 28.05, respectively. The phenotypic coefficient of variation (30.88%) was higher than the genotypic co-efficient of variation (29.58%) which indicated the influence of environment on the expression of this trait (Fig. 4). The present findings are in agreement with Saha et al. (1992) and Ahmed (1988). High heritability (91.76%) was found in this trait.

Table 5. Performance of 20 sweet gourd genotypes for different fruits characters.

Genotypes	No. of fruits plant^{-1}	Average fruit wt. (kg)	Wt. of placenta (g)	Yield plant^{-1} (kg)	TSS (%)
CM020	2.91	6.50	512.33	18.91	7.50
CM026	3.35	5.50	487.67	18.40	7.10
CM044	3.47	3.52	489.55	12.20	6.60
CM099	2.98	3.15	445.66	9.39	7.03
CM 122	3.66	4.50	586.55	16.48	6.86
CM20 × CM99	4.53	3.20	490.14	14.50	7.63
CM20 × CM44	4.10	6.30	426.49	24.85	8.37
CM20 × CM122	2.38	5.70	407.67	13.58	6.40
CM26 × CM99	3.26	3.50	502.56	11.40	8.10
CM26 × CM44	2.99	7.50	527.67	22.46	8.40
CM44 × CM99	4.63	2.20	459.00	10.20	8.33
CM44 × CM122	2.07	5.70	386.33	17.40	7.50
CM99 × CM122	3.46	5.70	417.67	19.73	5.73
CM99 × CM120	2.10	6.40	404.22	12.80	9.10
CM73 × CM118	0.32	2.50	366.71	22.96	6.10
CM73 × CM99	3.43	5.25	564.66	18.00	6.70
CM26 × CM120	2.68	5.30	455.00	14.20	5.36
CM118 × CM122	3.44	8.40	686.00	19.58	8.57
CM26 × CM73	5.82	4.60	582.67	29.40	5.40
CM118 × CM120	2.46	6.70	421.00	16.50	6.40
LSD (0.01)	1.45	1.81	215.40	3.36	0.19
LSD (0.05)	1.08	1.35	160.80	2.51	0.14

Total soluble solids (TSS)

Significant variation was found among 20 sweet gourd genotypes under the investigation in total soluble solids of fruit and ranged from 5.36% to 9.10% with the mean value 7.16% (Table 5). The highest total soluble solids (9.10%) was observed in cross number CM99 × CM120 while the lowest total soluble solids (5.36%) was observed in cross number CM26 × CM 120. Similar result in respect to total soluble solids (6.13 to 11.00%) reported by Masud (1995). Low differences were observed between phenotypic (1.20) and genotypic (1.19) variances as well as phenotypic (15.29%) and genotypic (15.24%) coefficient of variation indicating low environmental effect upon the expression on this trait (Table 7). Heritability of this trait was high (99.17%).

Number of seeds per fruit

A significant variation was observed in respect of number of seeds per fruit among different genotypes and ranged from 293.16 to 404.00 with the mean value 380.60 (Table 6). The maximum number of seeds (404.00) was found in the fruits of cross number CM26 × CM44 which was statistically similar with the cross number CM20 × CM44 (400.80), CM20 × CM122 (394.33) and CM44 × CM99 (395.00). Whereas, the minimum number of seeds (293.16) was found from the cross number CM99 × CM120. This result agreed with the findings of Gopalakrishnan and Peter (1987). They obtained 99.75 to 382.75 seeds per fruit in different pumpkin genotypes. The genotypic and phenotypic variance was 414.43 and 679.51, respectively. The GCV (5.36%) was lower than the PCV (6.86%) which indicated the low influence of environment on the expression of this character. The heritability of this fruit was 60.99% (Table 7).

Seed length

Significant variation was observed in seed length among 20 sweet gourds genotypes (Table 6). The seed length varied from 1.91 to 2.22 cm with the mean value of 1.99 cm. The lowest seed length (1.91 cm) was recorded in CM020 and the highest seed length (2.22 cm) was recorded in cross number CM99 × CM120. The genotypic and phenotypic variances were very low (0.005 and 0.008, respectively) with heritability (62.50%). The GCV and PCV were low i.e. 3.55% and 4.49%, respectively indicating low environmental influence on this trait (Table 7).

Seed breadth

Significant difference was found among 20 sweet gourd genotypes in this character (Table 6). The highest seed breadth (1.37 cm) was found in cross number CM44 × CM99 and the lowest seed breadth (0.86 cm) was found in CM026. The genotypic variance was very low. The GCV (8.70%) and PCV (11.96%) indicating this character is controlled by genetic makeup. The estimated heritability was 52.94% (Table 7).

Table 6. Performance of 20 sweet gourd genotypes for different seed characters.

Genotypes	No. of seeds fruit^{-1}	Seed length (cm)	Seed breadth (cm)	Wt. of 1000 seeds (g)
CM020	383.00	1.91	0.99	141.13
CM026	382.33	1.92	0.86	180.46
CM044	387.49	2.00	0.99	170.53
CM099	372.80	1.96	0.96	179.90
CM 122	382.16	1.92	0.95	160.46
CM20 × CM99	376.66	2.01	1.18	189.13
CM20 × CM44	400.80	2.05	1.08	210.80
CM20 × CM122	394.33	2.04	1.18	187.93
CM26 × CM99	367.77	1.94	1.09	212.66
CM26 × CM44	404.00	2.09	1.06	181.13
CM44 × CM99	395.00	2.04	1.37	212.80
CM44 × CM122	371.33	1.98	1.08	189.67
CM99 × CM122	379.83	2.07	1.17	202.42
CM99 × CM120	293.16	2-22	1.19	211.14
CM73 × CM118	387.49	2.01	1.09	181.35
CM73 × CM99	379.83	1.97	1.08	208.13
CM26 × CM120	386.22	1.92	1.13	209.35
CM118 × CM122	382.83	1.99	1.15	186.67
CM26 × CM73	387.33	1.95	1.07	211.46
CM118 × CM120	386.77	1.98	1.14	193.47
LSD(0.01)	36.05	0.12	0.19	23.85
LSD(O.OS)	26.91	0.09	0.14	17.81

Table 7. Genotypic variance, phenotypic variance, genotypic co-efficient of variance, phenotypic co-efficient of variance, mean of fruits and fruits producing characters of 20 sweet gourd genotypes.

Characters	Genotypic variance	Phenotypic variance	Co-efficient of variation %		Range	Mean ± SE	Heritability (%)	CV (%)
			GCV	PCV				
Germination	5.80	8.51	23.74	28.75	7.33-15.67	10.15±0.37	68.21	16.21
Vine length at 30 days (cm)	27.21	32.69	15.42	16.90	23.13-43.88	33.83+0.73	83.24	6.92
Vine length at 45 days (cm)	474.36	498.64	12.39	12.71	128.47-205.61	175.66±2.84	95.13	2.80
Vine length at 60 days (cm)	2619.12	2773 .48	13.75	14.15	280-446.83	372.28±6.72	94.43	3.34
Vine length at final harvest (cm)	482 1 .7 1	5087.02	10.96	11.56	485.43-740.44	633.63±9.16	94.78	2.57
Internode length (cm)	0.58	0.94	3.88	4.93	17.94-21.33	19.65±0.12	61.70	3.04
Primary branches/plant	1.35	1.66	9.67	10.73	9.16-15.18	12.01±0.16	81.33	4.59
No. of node/plant	9.81	10.25	8.61	8.79	31.94-45.00	36.39±0.41	95.71	1.83
Leaf length (cm)	4.74	5.01	10.36	10.64	17.03-25.23	2 1.01 ±0.29	94.61	2.49
Leaf breadth (cm)	7.95	8.40	10.26	10.55	21.00-31.23	27.48±0.37	94.64	2.43
Petiole length (cm)	30.48	30.81	20.76	20.87	17.05-36.03	26.60±0.71	98.93	2.17
No. of male flower/plant	325.54	349.55	23.45	24.29	42.67-107.67	76.94±2.37	93.13	6.37
No. of female flower/plant	6.12	6.83	35.91	37.93	4.22-15.44	6.89±0.33	89.60	12.18
Days to 1st male flowering	9.88	11.51	5.37	5.79	52.67-64.33	58.50±0.43	85.84	2.18
Days to 1st female flowering	9.82	13.20	4.94	5.73	57.00-68.33	63.45±0.46	74.39	2.90
Sex ratio	11.14	14.39	28.85	32.79	6.38-21.69	11.57±0.48	77.41	15.57
Nodes for 1st male flowering	0.25	0.44	14.04	18.63	2.66-4.67	3.56±0.09	56.81	12.45
Nodes for 1st female flowering	2.56	3.15	9.43	10.46	14.67-20.00	16.97±0.23	81.27	4.55
Fruit length (cm)	29.61	34.27	17.62	18.96	22.05-41.50	30.88±0.75	86.40	6.99
Fruit diameter (cm)	12.81	153.49	15.65	17.14	41.16-94.83	72.29±1.59	83.46	6.97
Fruit weight (kg)	2.61	3.28	31.61	35.44	2.20-8.40	5.11x0.23	79.57	16.05
Fruit cavity length (cm)	9. 1 9	9.26	17.10	17.16	9.77-22.39	17.73±0.39	99.24	2.03
Fruit cavity breadth (cm)	10.06	10.14	20.04	20.11	8.82-23.32	15.83±0.40	99.21	1.75
Peduncle length (cm)	4.06	4.09	21.88	21.96	4.40-13.12	9.21 ±0.26	99.26	1.98
Flesh thickness (cm)	0.35	0.36	15.53	15.75	3.10-5.33	3. 81 ±0.08	97.22	2.81
Placenta! weight (g)	5849.90	15318.98	15.74	25.47	366.71-686.00	485.98±15.80	38.18	20.02
% TSS	1.19	1.20	15.24	15.29	5.36-9.10	7.16±0.14	99.17	1.27
Fruits/plant	2.46	2.89	42.97	46.57	2.07-9.32	3.65±0.22	85.12	17.93
Yield/plant (kg)	25.74	28.05	29.58	30.88	9.39-29.40	17.1510.64	91.76	8.86
Seeds/fruit	414.43	79.51	5.36	6.86	293.16-404.16	380.07±3.46	60.99	4.28
Seed length (cm)	0.005	0.008	3.55	4.49	1.91-2.22	1.9910.01	62.50	2.77
Seed breadth (cm)	0.009	0.017	8.70	11.96	0.86-1.37	1.0910.02	52.94	7.98
1 000 seeds wt. (g)	341.56	457.60	9.67	11.19	141.13-212.80	191.0312.79	74.64	5.64

Weight of 1000 seeds

Significant difference was found among 20 sweet gourd genotypes in respect of 1000 seeds weight (Table 6). It varied from 141.13 to 212.80 g. The highest weight was recorded in cross number CM44 × CM99 and the lowest weight was recorded in CM020. The genotypic and phenotypic variances were 341.56 and 457.6, respectively. The phenotypic co-efficient of variation (11.19%) was slight higher than the genotypic co-efficient of variation (9.07%) which indicated low environment influence on the expression of this traits that is it was controlled genetically. The heritability was moderately high (74.64%) (Table 7).

Correlation co-efficient

Estimation of simple correlation co-efficient was made among eleven important yield contributing characters with yield of 20 sweet gourd genotypes. The value of "r" and the components correlated are presented in Table 8.

Vine length at final harvest

Correlation co-efficient revealed that vine length at final harvest had positive significant correlation with number of primary branches per plant (r = 0.387**), fruit diameter (r = 0.267*) and yield per plant (r = 0.468**). This indicates that number of primary branches per plant, fruit diameter and yield per plant would be increased with the increase of vine length at final harvest. Vine length at final harvest was also highly significant and negative correlation with sex ratio (r = -0.366**). This indicates vine length at final harvest would be increased with the decrease of sex ratio. On the other hand, this trait was negatively associated with male flower per plant and fruit length (Table 8). This finding was supported by Kumaran et al. (1998).

Number of primary branches per plant

It was noticed that number of primary branches per plant at harvest had significant and positive correlated with yield per plant (r = 0.341**) and flesh thickness (r = -0.330**) which indicates that yield per plant and flesh thickness would be increased with the increased of number of primary branches per plant at harvest. This character also positive but non significant association with fruits per plant, fruit diameter, fruit weight and male and female flowers per plant (Table 8). This result was supported by Badade et al. (2001).

Number of male flowers per plant

Number of male flowers per plant had highly significant and positive correlation with the number of female flowers per plant (r = 0.386**), fruits per plant (r = 0.395**) and sex ratio (r = 0.285*) which indicates those traits will be increased with the increase of number of male flower per plant (Table 8).

Number of female flowers per plant

It was observed that number of female flowers per plant showed highly significant and positive correlation with fruit per plant (r = 0.813**) and yield per plant (r = 0.542**) which indicates those traits will be increased with the increase of female flowers per plant. This trait also showed highly significant and negative correlation with sex ratio (r = -0.501**) which indicates number of female flowers per plant will be increased with the decrease of sex ratio (Table 8).

Fruits per plant

It was observed that the number of fruits per plant had highly significant and positive correlation with yield per plant (r = 0.415**) which indicates that yield per plant will be increased with the increased of fruits per plant (Table 8).

Fruit length

Correlation co-efficient revealed that fruit length had highly significant and positive correlation with fruit weight (r = 0.436**) which indicates that fruit weight will be increased with the increase of fruit length. This character had also significant and negative correlation with male flowers per plant (r = -0.321*) and sex ratio (r = -0.271*). This indicates fruit length will be increased with the decrease in male flower per plant and sex ratio (Table 8).

Fruit diameter

It was noticed that diameter of fruit had highly significant and positive correlation with fruit weight (r = 0.535**), flesh thickness (r = 0.391**) and yield per plant (r = 0.522**) which indicates those traits will be increased with the increase of fruit diameter (Table 8)

Table 8. Correlation co-efficient between yield and yield contributing characters of 20 sweet gourd genotypes.

Character	Primary branches plant^{-1}	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (kg)	Flesh thickness (cm)	Male flower plant^{-1}	Female flower plant^{-1}	Sex ratio	Fruits plant^{-1}	Yield plant^{-1} (kg)
Vine length at final harvest	0.387**	-0.201	0.267*	0.225	0..088	-0.192	0.160	-0.366**	0.141	0.468**
Primary branches plant^{-1}		-0.188	0.078	0.086	0.330**	0.177	0.121	-0.054	0.178	0.341**
Fruit length (cm)			-0.044	0.436**	0.002	-0.321*	-0.098	-0.271*	-0.196	-0.055
Fruit diameter (cm)				0.535**	0.391**	-0.242	0.132	-0.128	0.064	0.522**
Fruit weigh (kg)					0.560**	-0.414**	-0.175	-0.072	-0.238	0.407**
Flesh thickness s(cm)						-0.148	0.047	-0.002	0.052	0.342**
Male flower plant^{-1}							0.386**	0.285*	0.395**	-0.182
Female flower plant^{-1}								-0.501**	0.813**	0.542**
Sex ratio									-0.350**	-0.579**
Fruits plant^{-1}										0.415**

*Significant at 5% level of probability, **Significant at 1% level of probability

Fruit weight

Highly significant positive correlations were observed for fruit weight flesh thickness (r = 0.560**) and yield per plant (r = 0.407**) that indicated average fruit weight increases with the increasing of associated characters. It is at par with the results found by Saha et al. (1992) in different sweet gourd traits (Table 8). Fruit weight had also significant but negative correlation with male flower per plant(r = -0.414**).This indicates that fruit weight decreases with the increase of male flower per plant.

Flesh thickness

Flesh thickness exhibited significant positive correlations with yield per plant (r = 0.342**) which indicates that yield per plant will be increased with the increase of flesh thickness (Table 8).

Sex ratio

Sex ratio had highly significant and negative correlation with fruits per plant (r = -0.350**) and yield per plant (r = -0.579**) (Table 8).This indicates fruits per plant and yield per plant will be increased with the decrease of sex ratio.

Qualitative characters

Different qualitative characters of 20 sweet gourd genotypes were observed (Table 9). Wide range of variability was found in stem shape, leaf margin, flower colour, fruit shape, fruit size variability, flesh colour and predominant fruit skin colour at maturity.

Table 9. Qualitative characters of 20 sweet gourd genotypes.

Genotypes	Stem shape	Leaf margin	Flower colour	Fruit shape	Fruit size variability	Flesh colour	Predominant fruit skin colour at maturity
CM020	Angular	Dented	Orange	Round	Low	Deep yellow	Green
CM026	Angular	Dented	Orange	Round	Low	Yellow	Green
CM044	Angular	Dented	Yellow	Elliptical	Low	Yellow	Green
CM099	Rounded	Dented	Yellow	Elliptical	Low	Yellow	Green
CM 122	Angular	Dented	Yellow	Round	Low	Yellow	Green
CM20 × CM99	Angular	Dented	Yellow	Elliptical	Intermediate	Yellow	Yellow
CM20 × CM44	Angular	Dented	Yellow	Round	Intermediate	Yellow	Green
CM20 × CM122	Angular	Dented	Orange	Round	Intermediate	Yellow	Green
CM26 × CM99	Angular	Dented	Orange	Globular	Intermediate	Yellow	Green
CM26 × CM44	Angular	Dented	Yellow	Acron	Intermediate	Orange	Green
CM44 × CM99	Angular	Dented	Yellow	Elliptical	Intermediate	Yellow	Green
CM44 × CM122	Angular	Dented	Yellow	Elliptical	Intermediate	Yellow	Green
CM99 × CM122	Angular	Dented	Yellow	Round	High	Yellow	Green
CM99 × CM120	Angular	Dented	Yellow	Elliptical	High	Yellow	Green
CM73 × CM118	Rounded	Dented	Yellow	Round	Intermediate	Deep yellow	Yellow
CM73 × CM99	Angular	Dented	Yellow	Round	Intermediate	Yellow	Yellow
CM26 × CM120	Angular	Dented	Yellow	Elliptical	Intermediate	Yellow	Cream
CM118 × CM122	Angular	Dented	Yellow	Elliptical	Low	Yellow	Green
CM26 × CM73	Angular	Dented	Yellow	Acron	Low	Yellow	Cream
CM118 × CM120	Angular	Dented	Yellow	Elliptical	Intermediate	Deep yellow	Green

CONCLUSION

The results of the present study revealed that the selected F_1 hybrids performed better compared to their parents and also high heritability was recorded for many characters. Also there was an association of different yield of sweet gourd. Therefore, it can be recommended that, among the 20 sweet gourd genotypes, the cross CM26 × CM73 showed the best performance in respect of yield per plant which should be conducted regional yield trials for further evaluation as a releasing variety. Further attempt should be taken for the development of hybrid variety using all possible combination of the parents.

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