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Genetic Variability in Muskmelon (*Cucumis melo* L.) Under Protected Condition

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A B S T R A C T

The present study was undertaken with eight varieties of muskmelon were evaluated to determine genetic variability, heritability and genetic advance for eighteen contributing characters during the 2016-17. Significant variations were recorded for the various characters studied. Widest range of variation was observed in fruit volume, days to first fruit harvest, day to fruit set, day to first female flower appear, day to 50% flowering. Fruit girth. Maximum genotypic and phenotypic coefficient of variation (GCV and PCV) was observed for rind thickness followed by average fruit weight, fruit yield per plot, fruit volume, node number of first female flower, node number at first male flower appear. High magnitude of heritability was observed for fruit volume (98.8) followed by yield per plot (94.6), days to first male flower (89.7), average fruit weight (89.6), rind thickness (84.5), fruit girth (82.3. The maximum genetic advance as percentage of mean was observed high for fruit length (91.89), fruit girth (90.47), rind thickness (86.79). expected genetic advance as percent of mean and its estimated percent mean for various character revealed that the average fruit length, showed highest genetic advance percentage of mean followed by fruit girth, rind thickness, fruit volume, number of fruit per plant, yield per plot, average fruit weight, node number of first male flower appear, plant height, number of primary branch per plant, node number of first female flower appear.

Keywords

Muskmelon, Genetic variability, Heritability, Genetic advance.

Introduction

Melon (*Cucumis melo* L.) is an important summer vegetable crop. Muskmelon (*Cucumis melo* L.) is a beautiful, juicy, tasty and delicious fruit popular and commercial crop of the tropics and sub tropics, grown all over the world for its nutritive and medicinal properties. The species is commonly called melon, sweet melon, muskmelon, casaba and cantaloupe (Nayar and Singh, 1998). The origin of melon is in dispute, most authorities consider that it originated in Africa (Kerge and Grum, 2000). Recently phylogenetic data demonstrated that *Cucumis* originated from Asia (Sebastian *et al.*, 2010; Telford *et al.*, 2011). It grows well in all tropical and subtropical areas of the world, but prefers hot climate. It ranks second after watermelon (Jebari *et al.*, 2004).

The main areas under muskmelon cultivation in India are riverbeds of Jamuna, Ganges, Narmada rivers in the north and Pennar, Kaveri, Krishna and Godavari rivers in the south (Singh, 1998). *Cucumis melo* L. shows extreme variation especially in vegetative and fruit morphology (Kirkbride, 1993). Muskmelon is gaining lot of importance due to its short duration, high production potential with high nutritive value, taste, delicacy and also its suitability for cultivation under rainfed, irrigated, green house conditions almost throughout the year. Muskmelon fruits are an extremely healthful food choice as they are rich in ascorbic acid, carotene, folic acid, and potassium as well as a number of other human health-bioactive com-pounds (Lester and Hodges 2008). Muskmelon fruits are also a rich source of vitamin A, C, β-carotene, carbohydrates, sugars, protein and traces of vitamin K, B_1, B_2, B_6 and niacin.

However, very little work has been carried out on improvement of the muskmelon crop. For any crop improvement programme aimed at achieving maximum productivity, a detailed knowledge of genetic variability and diversity, heritability and genetic advance of various quantitative characters, and their contribution to yield, is essential. planning and execution of a breeding programme for the improvement of quantitative attributes depends, to a great extent, upon the genetic magnitude of genetic variability. The genotypic and phenotypic coefficient variation are helpful in exploring the nature of variability in the breeding population whereas, the estimate of heritability provides index of transmissibility of characters. The estimate of direct selection parameters like coefficient of variation, heritability and genetic advance are useful in formulating suitable selection strategy for higher yield in muskmelon. Burton (1952) suggested that GCV together with heritability estimates would give best picture about the extent of advance to be expected by selection.

Muskmelon is an unexploited vegetable crop and very less breeding programmes have been used to exploit available genetic variability. Therefore, an attempt was made to gather information on extent of variability, heritability and genetic advance for eighteen qualitative and quantitative characters in 8 different varieties of muskmelon.

Materials and Methods

The present investigation "Genetic Variability in Muskmelon (*cucumis melo* L.) Under Protected Condition" was conducted during Nov-April, 2016-17 at naturally ventilated polyhouse at centre of excellence on protected cultivation, research cum instructional farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The experimental site is situated in the central part of Chhattisgarh at 21°16' N latitude, 81°36' E longitude and at an altitude of 289.56 m from mean sea level. It comes under the seventh agro-climatic zone of country, which is eastern plateau and hills. The site has silty loam soil. The plants were managed under the protected conditions and growing vertically on a trellis system. The experiment was laid out in Complete randomized design (CRD) with three replications with above nine treatments with plot size of 6 m X 1.2 m and each treatment consist of 9 plants out of them 5 plants are randomly selected representative sample for studying growth performance, viz., by recording observations on Day to 50% flowering, Number of branch, Plant height, node no. of first female flower, Day to first female flower, Node number, of first male flower, Day to first male flower, Day to fruit set, Day to fruit harvest, Fruit length, 1Fruit girth, Fruit volume, Average fruit weight, No. of fruit/plant, Rind thickness, Seed weight, Acidity, Fruit yield /plot by taking observations. Plant is grown in trellising. The data were analyzed to estimate genotypic and phenotypic co-efficient of variation using the formula of, heritability in broad sense and genetic advance was estimated by formula suggested. All cultivars were sown in nursery on 24 November 2016 with pro-tray. The seedling were transplanted in main field on 17 December 2017 with plant spacing of plant to plant distance 60 cm. and row to row distance is 120 cm.

Results and Discussion

The analysis of variance for the different traits (Table 1) indicated that the mean sum of squares due to genotypes were highly significant for all the characters, this is an indication of presence of good amount of genetic variability among the genotypes. Isolation of superior genotypes depends mainly on the exploration of genetic variability to a greater extent. This emphasizes the importance of variability for crop improvement. Analysis of variance indicated that the mean sum of squares due to genotypes were highly significant for all traits indicated the presence of significant variation for most of the characters which are useful for muskmelon improvement.

The investigation for present of variability in eight varieties of muskmelon was measured in term of range, phenotypic coefficient of variation (PCV), genotypic coefficient of variance (GCV), heritability (broad sense) and genetic advance (Table 2). Wide range of variation observed for all the characters. The wide range was recorded for Fruit volume (482.47, 961.47) followed by Day to first fruit harvest (81.27, 89.63), Day to fruit set (53.20, 58.87), Days to first female flower (35.53, 43.47), Days to 50% flowering (35.27, 43.40), Fruit girth (cm.) (32.22, 37.68), Days to first male flower (29.80, 38.60), Yield per plot (kg.) (20.10, 43.87), Number of primary branch / plant (15.53, 21.87), Fruit length (cm.) (14.26, 17.99), indicating that presence of sufficient variability among the genotypes these are used for selecting desirable characters. But Node no of first female flower (4.27, 6.90), Plant height (m) (3.51, 5.04), Number of fruit/plant (3.27, 4.81), Node no of first male flower (3.07, 4.90), Seed weight (2.61, 3.53), Average fruit weight (kg) (0.57, 1.25), Rind thickness (0.40, 2.56), Acidity (0.25, 0.39) as recorded minimum variation and less scope for selection of this character from the present collection.

Genotypic and phenotypic coefficients of variation of different characters are presented in Table 2. High phenotypic and genotypic coefficients of variation were observed for rind thickness (49.84 and 45.80), average fruit weight (32.77 and 31.03), yield per plot (30.86), fruit volume (25.26 and 25.11), node number of first female flower (20.94 and 14.50), node number at first male flower appear (18.84 and 15.27) suggested the substantial improvement on muskmelon through selection for these traits. Moderate phenotypic and genotypic coefficients of variation were observed for acidity (17.28 and 9.63), number of fruit per plant (14.91 and 12.33), number of primary branch (13.90 and 12.06), 100 seed weight (13.46 and 9.63), plant height (13.02 and 11.73) suggested existence of considerable variability in the population. Selection for these traits may also be given the importance for improvement programme. Characters like day to first male flower appear (9.50 and 9.00), fruit length (9.14 and 7.27), day to first female flower appear (9.09 and 7.00), days to 50% flowering (8.71 and 6.09), fruit girth (6.19 and 5.61), day to fruit set (4.41 and 3.86), day to first fruit harvest (3.73 and 2.69) had low genotypic and phenotypic coefficient of variation. Similar results have also been reported earlier by Kalloo *et al.,* (1983), Dhaliwal *et al.,* (1996) Tarsem and Singh (1997), Taha *et al.,* (2003), Narouid Rad *et al.,* (2010) and Sundaram *et al.,* (2011). Phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV) for all the traits indicating that environmental factors were influencing their expression. Wide difference between phenotypic and genotypic coefficient of variations indicated their sensitiveness to environmental fluctuations whereas narrow difference showed less environmental interference on the expression of these traits. The traits which showed high phenotypic and genotypic coefficient of variations are of economic importance and there is scope for improvement of these traits through selection. These characters implied their relative resistance to environmental variation.

Heritability estimate provides the information regarding the amount of transmissible genetic variation to total variation and determines genetic improvement and response to selection. The term heritability in broad sense was defined as the ratio of genetic variance to the total phenotypic variance (Lush, 1940; Jonson *et al.,* 1955). It provides an idea of the extent of genetic control for the expression of a particular trait and the reliability of phenotype in predicting its breeding value (Chopra, 2000). High heritability indicates less environmental influence in the observed variation (Mohanty, 2003; Eid, 2009). Heritability in the broad sense (h^2bs) indicates only whether there is sufficient genetic variation present in a population or not, which implies whether a population will respond to selection pressure or not (Milatovic *et al.,* 2010).

Among the characters studied, highest heritability estimate was recorded for fruit volume (98.8), yield per plot (94.6), days to first male flower (89.7), average fruit weight (89.6), rind thickness (84.5), fruit girth (82.3), plant height (81.1), day to fruit set (76.5), number of primary branch per plant (75.3) suggesting the important role of genetic constitution in the expression of the traits. moderate heritability estimated in number of fruit per plant (68.4), node number at first male flower appear (65.6), fruit length (63.3), day to first female flower appear (59.2), day to first fruit harvest (52.0), seed weight (51.2), and low heritability estimated in day to 50% flowering (48.9), node number at first female flower appear (48.0), acidity (31.0).

High heritability characters are suggesting the important role of genetic constitution in the expression of the characters and these traits are considered to be dependent from breeding point of view. All the estimated heritable characters are less influence by environmental factors and control by additive gene. Similar results have also been reported earlier by Swamy and Dutta (1991), Dhaliwal *et al.,* (1996), Tarsem and Singh. (1997) and Boujghagh *et al.,* (1999), Tomar *et al.,* (2008) and Mohan *et al.,* (2004).

Genetic advance was worked out as percent mean for all the characters and presented in Table 2. The highest estimate of genetic advance as percent of mean was recorded for fruit length (91.89), fruit girth (90.47), rind thickness (86.79), fruit volume (81.43), number of fruit per plant (80.94), yield per plot (60.17), average fruit weight (59.96), node number of first male flower appear (25.55), plant height (21.86), number of primary branch per plant (21.56), node number of first female flower appear (20.69), moderate genetic advance estimate for day to first male flower (17.55), seed weight (14.26), day to first female flower appear (11.07), low genetic advance estimate for acidity (9.54), day to 50 % flowering (8.77), day to fruit set (6.96) and day to first fruit harvest (3.99). The high value of genetic advance for these traits showed that these characters are governed by additive genes and selection will be rewarding for the further improvement of such traits. Moderate genetic advance for the traits suggest that both the additive and non-additive variance are operating in these traits and the traits exhibiting low genetic advance indicates significance of non-additive gene effects.

Heritability estimates along with genetic advance are more useful than the heritability value alone for selecting the best individual. high estimates of heritability coupled with high genetic advance as percentage of mean were observed for Fruit volume (98.8 and 81.43), yield per plot (94.6 and 60.17), days to first male flower (89.7 and 17.55), average fruit weight (89.6 and 59.96), rind thickness (84.5 and 86.79), fruit girth (82.3 and 90.47), plant height (81.1 and 21.86), day to fruit set (76.5 and 6.96), number of primary branch per plant (75.3 and 21.56), number of fruit per plant (68.4 and 80.94), node number at first male flower appear (65.6 and 25.55), fruit length (63.3 and 91.89), day to first female appear (59.2 and 11.07), day to first fruit harvest (52.0 and 3.99), seed weight (51.2 and 14.26), day to 50% flowering (48.9 and 8.77), node number at first female flower appear (48.0 and 20.69), acidity (31.0 and 9.54). The high magnitude of phenotypic and genotypic coefficient of variation was recorded for rind thickness followed by average fruit weight.

Expected genetic advance as percent of mean revealed that the average fruit length, showed highest genetic advance percentage of mean followed by fruit girth and rind thickness, Among the characters studied, highest heritability estimate was recorded for fruit volume followed by, yield per plot.

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Table.1 Analysis of variance for fruit yield and its component characters in Muskmelon

S.No.	Character (df)	Mean sums of square	
		Treatment	Error
		7	16
01	Days to 50% flowering	22.28*	5.76
02	Number of primary branch / plant	19.15**	1.89
03	Plant height (m)	0.787**	0.057
04	Node no of first female flower	2.60*	0.691
05	Days to first female flower	27.35**	5.11
06	Node no of first male flower	1.25**	0.186
07	Days to first male flower	27.64**	1.01
08	Day to fruit set	15.62**	1.45
09	Day to first fruit harvest	20.16**	4.74
10	Fruit length (cm.)	4.68**	0.758
11	Fruit girth (cm.)	12.23**	0.819
12	Fruit volume (cm^3)	81580.551**	316.84
13	Average fruit weight (kg)	0.177**	0.007
14	Number of fruit / plant	0.950**	0.127
15	Rind thickness (mm)	1.23**	0.071
16	Seed weight (100 seed)	0.381**	0.092
17	Acidity (%)	0.005	0.002
18	Yield per plot (kg.)	247.94**	4.59

*: Significant at 5%, **: Significant at 1

Table.2 Genetic parameters of variation for fruit yield and its component characters in muskmelon

S.No.	Characters	Mean	Range		Coefficient of variation (%)		Heritability (h^2 %)	Genetic advance as % of mean
			Minimum	Maximum	Phenotypic	Genotypic		
1	Days to 50% flowering	38.53	35.27	43.40	8.71	6.09	48.9	8.77
2	Number of primary branch / plant	19.89	15.53	21.87	13.90	12.06	75.3	21.56
3	Plant height (m)	4.20	3.51	5.04	13.02	11.73	81.1	21.86
4	Node no of first female flower	5.50	4.27	6.90	20.94	14.50	48.0	20.69
5	Days to first female flower	38.91	35.53	43.47	9.09	7.00	59.2	11.07
6	Node no of first male flower	3.91	3.07	4.90	18.84	15.27	65.6	25.55
7	Days to first male flower	33.09	29.80	38.60	9.50	9.00	89.7	17.55
8	Day to fruit set	56.37	53.20	58.87	4.41	3.86	76.5	6.96
9	Day to first fruit harvest	84.32	81.27	89.63	3.73	2.69	52.0	3.99
10	Fruit length (cm.)	15.72	14.26	17.99	9.14	7.27	63.3	91.89
11	Fruit girth (cm.)	34.74	32.22	37.68	6.19	5.61	82.3	90.47
12	Fruit volume	655.35	482.47	961.47	25.26	25.11	98.8	81.43
13	Average fruit weight (kg)	0.76	0.57	1.25	32.77	31.03	89.6	59.96
14	Number of fruit / plant	4.31	3.27	4.81	14.91	12.33	68.4	80.94
15	Rind thickness	1.35	0.40	2.56	49.84	45.80	84.5	86.79
16	Seed weight	3.22	2.61	3.53	13.46	9.63	51.2	14.26
17	Acidity	0.31	0.25	0.39	17.28	9.63	31.0	9.54
18	Yield per plot (kg.)	29.99	20.10	43.87	30.86	30.02	94.6	60.17

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