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VARIABILITY STUDIES IN MUSKMELON *(CUCUMIS MELO* L.)

K. R. M. Swamy[1], O. P. Dutta[2], P. R. Ramachander[3], and S. D. Wahi[3]

Phenotypic and genotypic coefficients of variation, heritability (broad sense) and genetic advance were assessed in 45 genotypes of muskmelon (*Cucumis melo* L.). The differences between the genotypes were highly significant for all the 20 characters studied. The heritability estimates were invariably moderate to high for all the characters studied. High heritability along with high genetic advance as percentage of mean was observed for sutures, netting, shape index, flesh thickness, average weight per fruit, total yield per plant and titratable acidity. Hence, these traits are the most suitable for further improvement through selection.

Estimating variability in a population forms an effective tool for the breeder to design his testing procedures for identifying superior genotypes. It is known that the apparent variability in a population is the result of genetic and environmental factors. To apportion the observed variability to these two factors, parameters such as genotypic and phenotypic coefficients of variation (GCV and PCV) have to be assessed. Heritability is another index for calculating the influence of environment on the expression of the genotype. Burton (1952) suggested that GCV together with heritability estimates would give best picture about the extent of advance to be expected by selection. Estimates of genetic advance (GA) together with heritability would be helpful in assessing nature of gene actions. With the above objctives in view, the present studies were conducted to estimate PCV, GCV, heritability and genetic advance for quantitative characters in muskmelon.

MATERIALS AND METHODS

Forty five varieties/lines of muskmelon, both of indigenous and exotic origin, were grown at the Experiment Station of Indian Institute of Horticultural Research, Bangalore during summer season of 1982 using Randomised Block Design with three replications. A single row of 3.5m length was used for each genotype. A spacing of 2.5m was kept between rows. In each row, sowing hills were prepared at a distance of 75cm and in each hill 5 seeds were sown. Two seedlings were retained by thinning the excess seedlings in each hill after 25 days of sowing. The

1 - 2 Scientists S-1 and S-3 respectively, I. I. H. R., Bangalore.

3 Scientist S-1, Indian Statistical Research Institute, New Delhi.

data were recorded on five plants from each entry, excluding the border plants on both sides of the row. The means of these observations in each case were utilized for statistical analysis.

Observations were recorded on number of days taken to first harvest, marketable yield per plant (g), total yield per plant (g), number of fruits per plant, average weight per fruit (g), main stem length (cm), number of nodes on main stem, internodal length (mm), number of primary branches per plant, netting (0 to 4 scale, 0 being absence of nets and 4 being maximum nets), sutures (0 to 4 scale, 0 being absence of sutures and 4 being presence of deep sutures), shape Index, flesh thickness (mm), flesh proportion, total soluble solids-T.S S. (%), ascorbic acid (mg/100g flesh), titratable acidity (% anhydrous citric acid), dry matter (%), seed weight per fruit (g) and 100 seed weight (g). Shape index, flesh thickness and flesh proportion were calculated using appropriate formulae (Davis *et al*, 1964 and Davis *et al.*, 1967). T.S.S. was estimated with the help of a hand refractometer. Ascorbic acid content was estimated by 2, 6-Dichlorophenol indophenol method (AOAC, 1975). Titratable acidity was determined according to Ranganna (1977). Fruit dry matter content was estimated by drying the flesh portion to a constant weight of 65± 2°C.

The data for all the characters were analysed statistically and the various genetic parameters such as CV, PCV, GCV, heritability (broad sense) and GA were worked out by making use of appropriate formulae (Singh and Chaudhary, 1977 and Johnson *et al.*, 1955).

RESULTS AND DISCUSSION

The analysis of variance revealed that the differences among the genotypes were highly significant for all the 20 characters studied (Table 1). From CV, it is seen that the variation was maximum for sutures (71.77%) followed by marketable yield per plant (51.70%) and netting (42 18%). The range of variability was also high for these characters. The CV was the lowest (5.81%) for days to first harvest.

The estimates of variance, PCV-GCV, heritability, GA and GA as per, centage of mean for different characters are presented in Table 2 The GCV as well as PCV were highest for total yield per plant followed by marketable yield per plant, average weight per fruit, main stem length and internodal length. Titratable acidity had the lowest values for GCV and PCV.

The PCV was the highest for sutures (117.2%) followed by netting (86 58%) and was the lowest for days to first harvest. GCV would be more useful for the assessment of inherent or real variability as it exhibites the heritable portion only (Allard, 1970). The estimates of GCV for different characters were less than those of PCV. It is evident, there-

fore, that the influence of environment of the expression of these characters was considerable in this study The magnitude of environmental influence (PCV - GCV) ranged from 2 50 for days to first harvest to 27.27 for marketable yield per plant. Such influence of environment was also observed by Deol *et al.* (1980-81) in muskmelon for yield and other characters. It may be assumed, therefore, that the phenotypic valu as such cannot be utilised in makir selection.

The heritability estimates we found to be invariably moderate high for all the characters which aga confirmed the influence of enviro ment on the expression of the characters. The estimates of herit bility varied from 18.0 per cent f

TABLE 1. Phenotypic variability for different characters in muskmelon

Character	Range	Mean	±SEm	CV (%)	'F' Val
1. Days to first harvest	75.0 — 96.6	84.6	4.0	5.81	3.71*
2. Marketable yield / plant	238.0 —2186.0	943.0	398.0	51.70	2.40*
3. Total yield / plant	349.0 —3061.0	199.0	463.0	28.53	5.52*
4. No. of fruits / plant	1.2 — 3.9	2.2	0.4	24.05	4.76*
5. Average wt. / fruit	314.0 —1517.0	907.0	202.0	27.03	5.91*
6. Main stem length	50.0 — 279.0	168.0	30.0	21.88	4.76*
7. No. of nodes on main stem	17.6 — 46.6	31.6	4.3	16.83	3.35*
8. Intermodal length	20.0 — 80.0	52.5	6.6	15.50	4.72*
9. No. of primary branches/ plant	2.3 — 8.3	5.7	1.4	30.59	1.65*
10. Netting	0.0 — 3.3	1.2	0.41	42.18	10.79*
11. Sutures	0.0 — 2.2	0.6	0.36	71.77	6.18*
12. Shape index	0 81 — 4.90	1.2	0.18	18 33	23.78*
13. Flesh thickness	9.0 — 29.1	11.9	3.0	31.25	5.32*
14. Flesh proportion	0.18 — 0.50	0.34	0.05	18.33	2.99*
15. Total soluble solids	4.7 — 15.3	10.0	1.5	17.88	6.40*
16. Ascorbic Acid	10.9 — 47.5	22.1	6.5	36.88	2.53*
17. Titratable Acidity	0.061— 0.244	0.117	0.027	27.95	5.55*
18. Dry matter	3.3 — 11.0	6.3	1.2	23.49	3.85*
19. Seed wt./ fruit	6.2 — 24.4	15 5	3.4	27.12	3.93*
20. 100 seed wt.	2.1 — 6.4	3.4	0.34	12.20	12.40*

* P = 0.05,
** P = 0.01.

number of primary branches per plant to 88.4 per cent for shape index. High estimates of heritability were recorded for total yield per plant, average weight per fruit, netting, sutures, shape index, flesh thickness, T.S.S., titratable acidity and 100 seed weight. The other traits had moderate to low heritability estimates. High heritability estimates are helpful in making selection of superior genotypes on the basis of phenotypic performance of quantitative characters. However, Johnson *et al.* (1955) reported that heritability along with genetic gain is more useful than the heritability alone in predicting the resultant effect for selecting the best individuals. In the present study, high genetic advance as percentage of mean was observed for sutures (154.8%), followed by netting (136.9%)

TABLE 2. Variance, Phenotypic and Genotypic Coefficients of Variation (PCV & GCV), heritability and genetic advance (GA) for different characters in muskmelon

Character	Phenotypic variance	Genotypic variance	PCV	GCV	PCV-GCV	Heritability (%)	GA	GA (% of mean)
1. Days to first harvest	46.1	21.86	8.03	5.53	2.50	47.4	6.63	7.8
2. Marketable yield / plant	348656.5	110975.00	62.56	35.29	27.27	31.8	387.1	41.0
3. Total yield / plant	808351.1	485944.00	45.17	35.03	10.14	60.1	1113.4	35.9
4. No. of fruits / plant	0.63	0.35	35.11	26.19	8.92	55.6	0.91	41.3
5. Average wt. / fruit	162028.0	100010.0	44.36	34.96	9.40	62.1	514.9	56.7
6. Main stem length.	3046.0	1694.0	32.70	24.39	8.31	55.6	63.35	37.6
7. No. of nodes on main stem	50.5	22.2	22.44	14.88	7.56	44.0	6.43	20.3
8. Internodal length	148.6	82.3	23.19	17.26	5.93	55.4	13.91	26.5
9. No. of primary branches / plant	3.7	0.67	33.56	14.24	19.32	18.0	0.71	12.4
10. Netting	1.07	0.82	86.58	75.76	10.82	76.6	1.63	136.9
11. Sutures	0.54	0.34	117.21	93.27	23.94	63.3	0.96	154.8
12. Shape index	0.43	0.38	53.87	50.64	3.23	88.4	1.19	97.5
13. Flesh thickness	33.78	19.95	30.70	23.59	7.11	59.0	7.07	59.4
14. Flesh proportion	0.007	0.003	24.11	15.23	8.88	39.9	0.07	20.6
15. Total soluble solids	8.98	5.77	29.62	23.75	5.87	64.3	3.97	39.7
16. Ascorbic Acid	100.42	33.92	45.30	26.33	18.97	33.8	6.97	31.5
17. Titratable Acidity	0.001	0.002	44.02	34.18	9.84	60.3	0.06	51.3
18. Dry matter	4.29	2.09	32.39	22.62	9.67	48.8	2.08	33.0
19. Seed wt./fruit	34.98	17.30	37.92	26.67	11.25	49.5	5.03	38.9
20. 100 seed wt.	0.83	0.66	26.65	23.71	2.94	79.2	1.48	43.5

shape index (97.5%), flesh thickness (59.4%), average fruit weight per fruit (56.7%), total yield per plant (55.9%) and titratable acidity (51.3%). These characters also had high heritability values. Such conditions arise due to action of additive genes (Panse, 1957). Certain characters like T.S.S., days to first harvest, number of nodes on main stem and internodal length, had moderate to high heritability estimates but low genetic advance as percentage of mean, suggesting that high heritability of these characters was due to non-additive gene effects (dominance, over dominance, epistasis and their interaction) (Panse, 1957) High heritability along with GA as percentage of mean for number of fruits per plant and yield per plant (Nandpuri *et al.*, 1975), internodal length and T.S.S. (Chhonkar *et al.*, 1979) were also reported in muskmelon.

It is obvious from the above findings, that the most suitable characters for further improvement through selection are sutures, netting, shape index, flesh thickness, average weight per fruit, total yield per plant and titratable acidity.

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