The Asian Journal of Horticulture, Vol. 3 No. 2 : 208-212 (December-2008)

Genetic components for yield and its contributing traits in muskmelon (*Cucumis melo* L.)

RUKAM S. TOMAR, D.K. KAKADE, G.U. KULKARNI, A.D. PATEL AND R.R. ACHARYA

Accepted : ***July, 2008***

See end of the article for authors' affiliations

Correspondence to :

RUKAM S. TOMAR
National Research Centre from Groundnut (I.C.A.R.)
JUNAGADH (GUJARAT)
INDIA

ABSTRACT

The estimates of D which measures the variance due to additive genetic effects was significant for number of node on which first female flower appears in E_2 and on pooled basis, days to first female flower open in E_1, number of primary branches per plant on pooled basis and days to first harvesting in both the environments and on pooled basis. While, H_1, which measures the variance due to non-additive effects was significant for all the characters in both the environments and on pooled basis except for number of node on which first female flower appears in E_1. The above findings indicate that both additive and dominance components were important in the inheritance of these traits. However, additive component was lower in magnitude than dominance component for most of the traits in both environments, suggesting the preponderance of non-additive gene action. The narrow sense heritability estimated for all the non-significant characters was either medium or low suggesting that non-additive genetic variance was largely predominating.

Key words : Gene action, Narrow sense heritability, Muskmelon.

Muskmelon (*Cucumis melo* L.) is an important vegetable crop of family cucurbitaceae. Being a dessert fruit, it is not only the yield, but quality characters of hybrid over improved population should be a major objective in heterosis breeding programme. In spite of wide genetic variability available in this crop especially for fruit characters, meagre emphasis has been given to the improvement of quality characters and also on the genetics (gene action) of quality traits of this vegetable. Hence, an attempt was made to investigate the gene action of some important quality characters.

MATERIALS AND METHODS

Ten varieties of muskmelon, *viz.* Punjab Sunehri, Pusa Madhuras, AMM- 00-25, AMM- 00-11, AMM- 01-18, DM-1, AMM- 02-26, PMM- 96-20, Hara Madhu and RM-50 were crossed in all possible combinations excluding reciprocals. The resulting 45 F_1 hybrids alongwith their parents were sown in randomized block design with three replications at spacing of 150 cm and 90 cm in two environments created by sowing dates (E_1=15th October, 2003 and E_2=15th February, 2004). All the recommended cultural practices were followed during experimentation. Observations were recorded on number of node on which first female flower appeared, days to first female flower opened, number of primary branches per plant, days to first harvesting, fruit length (cm), fruit girth (cm), fruits per plant, fruit weight (g), fruit yield per plant (kg), flesh thickness (cm), moisture content (Per cent), total soluble solids (TSS in per cent), acidity (Per cent) and total soluble sugars (mg g^{-1}). These genetic components of variation were calculated from the diallel table following the methods outlined by Hayman (1954, 1954 a, b; 1957, 1958 and 1960) and Jinks (1954 and 1956) as described in detail by Mather and Jinks (1982) and Singh and Chaudhary (1985). To test failure of either of the assumption of diallel analysis, 't^2' was applied as suggested by Hayman (1954 a).

RESULTS AND DISCUSSION

The validity of hypothetical assumptions underling diallel analysis as postulated by Hyman (1954 a) was tested by t^2 test. The non-significant value of t^2 estimated probably suggested fulfillment of the assumptions and confirm the validity of the hypothesis. The estimated 't^2' value for different characters indicated non-significance for most of the characters except fruit length, fruit weight, fruit yield per plant, moisture content, acidity and total soluble sugars. However, for characters total soluble solids 't^2' value was non significant in E_1, while E_2 and on pooled basis this trait was significant. For these characters, one or few assumptions of diallel analysis could not be fulfilled.

The estimates of D which measures the variance due to additive genetic effects was significant for number of node on which first female flower appears in E_2 and on pooled basis, days to first female flower open in E_1, number of primary branches per plant on pooled basis and days to first harvesting in both the environment and on pooled basis. While, H_1, which measures the variance due to non-additive effects were significant for all the characters in both the environment and on pooled basis except for number of node on which first female flower

Table 1 : Components of genetic variance for various characters in muskmelon

	Number of node on which first female flower appears			Days to first female flower open			Number of primary branches per plant		
	E_1	E_2	P	E_1	E_2	P	E_1	E_2	P
$\hat{E}$	0.09	0.18	0.07	0.54	1.39	0.48	0.12 *	0.17	0.07
$\hat{D}$	0.30	3.09 **	0.88 **	2.58 *	2.28	1.27	0.26	0.69	0.51 **
$\hat{F}$	0.45	4.22	1.50 *	5.64 *	3.58	2.30	0.03	0.80	0.47
$\hat{H}_1$	1.21	7.48 **	2.45 **	11.54 **	34.89 **	10.80 **	2.20 **	3.65 **	2.90 **
$\hat{H}_2$	0.96 *	5.43 **	1.65 **	6.97 **	28.68 **	8.75 **	1.99 **	2.88 **	2.39 **
$\hat{h}^2$	0.01	-0.06	-0.01	-0.10	-0.50	-0.15	2.05 **	0.04	0.76
$[\hat{H}_1 / \hat{D}]^{0.5}$	2.02	1.55	1.67	2.12	3.92	2.91	2.93	2.30	2.39
$\hat{H}_2 / 4\hat{H}_1$	0.20	0.18	0.17	0.15	0.21	0.20	0.23	0.20	0.21
$4(\hat{D}\hat{H}_1)^{0.5} + F / 4(\hat{D}\hat{H}_1)^{0.5} - F$	2.19	2.56	3.09	3.14	1.50	1.90	1.04	1.67	1.48
h^2/H_2	0.01	-0.01	-0.01	-0.01	-0.02	-0.02	1.03	0.02	0.32
h^2	20.96	43.85	42.11	24.26	5.81	10.87	8.79	16.43	15.77
t^2	0.07 NS	3.60 NS	0.43 NS	0.35 NS	3.56 NS	3.71 NS	2.53 NS	0.32 NS	2.21 NS

* and ** indicates significance of values at P=0.05 and P=0.01, respectively E_1 = 15th October, 2003 E_2 = 15th February, 2004 NS=Non-significance

Table 1 contd...

	Days to first harvesting			Fruit length			Fruit girth		
	E_1	E_2	P	E_1	E_2	P	E_1	E_2	P
$\hat{E}$	3.09 *	0.44	0.88	0.51	1.08	0.40	0.47	2.56	0.76
$\hat{D}$	9.68 *	3.59 *	4.24 *	0.15	1.90	0.21	6.10	6.07	2.79
$\hat{F}$	20.70 *	6.76	8.56 *	-0.70	2.79	0.50	2.33	8.01	2.98
$\hat{H}_1$	48.65 **	11.64 *	15.91 **	7.13 **	18.32 **	7.59 **	30.18 **	49.17 **	24.59 **
$\hat{H}_2$	33.24 **	7.78 **	10.07 **	6.69 **	16.04 **	6.69 **	26.99 **	39.83 **	20.84 **
$\hat{h}^2$	73.08 **	0.56	14.76 **	1.76	11.94 **	5.87 **	4.03	15.21 *	8.93 *
$[\hat{H}_1 / \hat{D}]^{0.5}$	2.24	1.80	1.94	6.95	3.11	6.07	2.22	2.85	2.97
$\hat{H}_2 / 4\hat{H}_1$	0.17	0.17	0.16	0.23	0.22	0.22	0.22	0.20	0.21
$4(\hat{D}\hat{H}_1)^{0.5} + F / 4(\hat{D}\hat{H}_1)^{0.5} - F$	2.82	3.19	3.18	0.49	1.62	1.50	1.19	1.60	1.44
h^2/H_2	2.20	0.07	1.47	0.26	0.74	0.88	0.15	0.38	0.43
h^2	19.35	35.07	28.04	1.47	8.72	2.32	17.01	10.55	10.17
t^2	2.89 NS	0.003 NS	0.06 NS	12.47 S	4.79 S	12.35 S	0.24 NS	2.42 NS	3.70 NS

* and ** indicates significance of values at P=0.05 and P=0.01, respectively E_1 = 15th October, 2003 E_2 = 15th February, 2004 NS=Non-significance

Table 1 contd...

	Fruits per plant			Fruit weight		
	E_1	E_2	P	E_1	E_2	P
$\hat{E}$	0.39 **	0.08	0.12 **	1465.55	4494.46	1490.00
$\hat{D}$	0.17	0.07	0.01	557.56	-3065.90	-106.26
$\hat{F}$	0.40	0.04	0.03	1334.35	-6696.82	-1562.09
$\hat{H}_1$	3.72 **	1.06 **	1.16 **	43361.97	94777.86 **	37648.56 **
$\hat{H}_2$	3.15 **	0.91 **	0.99 **	39494.10	92442.18 **	37370.24 **
$\hat{h}^2$	0.86	1.11 **	1.03	-502.26	44628.30 *	11572.71 **
$[\hat{H}_1/\hat{D}]^{0.5}$	4.70	3.87	10.77	8.82	5.55	18.88
$\hat{H}_2/4\hat{H}_1$	0.21	0.21	0.21	0.23	0.24	0.25
$4(\hat{D}\hat{H}_1)^{0.5}+F\,/\,4(\hat{D}\hat{H}_1)^{0.5}-F$	1.68	1.17	1.33	1.31	0.67	0.43
h^2/H_2	0.27	1.23	1.04	-0.01	0.48	0.31
h^2	3.34	5.06	0.60	1.15	2.63	0.23
t^2	3.43 NS	3.26 NS	0.84 NS	130.46 S	68.61 S	21.30 S

* and ** indicates significance of values at P=0.05 and P=0.01, respectively E_1 = 15th October, 2003 E_2 = 15th February, 2004 NS=Non-significance

Table 1 contd...

	Fruit yield per plant			Flesh thickness			Moisture content		
	E_1	E_2	P	E_1	E_2	P	E_1	E_2	P
$\hat{E}$	0.04 **	0.08	0.03	0.03 *	0.02	0.01	0.61	0.17	0.19
$\hat{D}$	0.01	-0.01	-0.01	0.05	0.09	0.03	2.12	0.83	1.36
$\hat{F}$	0.03	-0.04	-0.04	0.12	0.13	0.07	-0.40	0.42	0.05
$\hat{H}_1$	0.36 **	1.54 **	0.48 **	0.27 **	0.51 **	0.22 **	12.15 *	10.41 **	9.14 **
$\hat{H}_2$	0.31 **	1.38 **	0.45 **	0.18	0.45 **	0.18 **	10.69 *	10.11 **	8.66 **
$\hat{h}^2$	0.06	1.69 **	0.62 **	0.04	0.02 *	0.03	-0.13	0.60	0.01
$[\hat{H}_1/\hat{D}]^{0.5}$	7.27	12.40	6.92	2.32	2.41	0.54	2.39	3.53	2.60
$\hat{H}_2/4\hat{H}_1$	0.22	0.22	0.23	0.16	0.22	0.20	0.22	0.24	0.24
$4(\hat{D}\hat{H}_1)^{0.5}+F\,/\,4(\hat{D}\hat{H}_1)^{0.5}-F$	1.83	0.72	0.57	3.21	1.86	2.34	0.92	1.15	1.02
h^2/H_2	0.20	1.23	1.38	0.20	0.04	0.18	-0.01	0.06	0.00
h^2	1.33	0.63	2.24	16.18	16.09	14.59	12.39	7.24	12.10
t^2	3.84 S	62.53 S	55.93 S	1.70 NS	0.39 NS	2.52 NS	25.36 S	9.17 S	28.80 S

* and ** indicates significance of values at P=0.05 and P=0.01, respectively E_1 = 15th October, 2003 E_2 = 15th February, 2004 NS=Non-significance

Table 1 contd...

	Total soluble solids			Acidity			Total soluble sugars		
	E_1	E_2	P	E_1	E_2	P	E_1	E_2	P
$\hat{E}$	0.82	0.28	0.27	0.00	0.00	0.00	0.17	0.24	0.10
$\hat{D}$	3.15	1.42	1.12	0.00	0.00	0.00	0.01	0.07	0.13
$\hat{F}$	6.66	3.28	2.64	0.01	0.01	0.01	0.29	0.51	0.54
$\hat{H}_1$	29.34 **	25.75 **	19.83 **	0.08 *	0.07 *	0.08 *	4.68 **	7.92 **	6.37 **
$\hat{H}_2$	22.69 **	22.05 **	16.87 **	0.06 **	0.06 **	0.06 **	3.81 **	6.57 **	5.22 **
$\hat{h}^2$	44.09 **	13.37 **	26.59 **	0.07 **	0.05 **	0.06 **	2.75 **	4.02 **	3.39 **
$[\hat{H}_1/\hat{D}]^{0.5}$	3.05	4.26	4.20	5.06	6.93	5.09	50.33	10.70	7.13
$\hat{H}_2/4\hat{H}_1$	0.19	0.21	0.21	0.20	0.20	0.20	0.20	0.21	0.21
$4(\hat{D}\hat{H}_1)^{0.5}+F\,/\,4(\hat{D}\hat{H}_1)^{0.5}-F$	2.06	1.75	1.78	1.73	2.00	1.81	5.08	2.05	1.86
h^2/H_2	1.94	0.61	1.58	1.07	0.82	0.94	0.72	0.61	0.65
h^2	10.82	5.67	5.79	3.84	2.05	3.99	0.03	0.81	1.96
t^2	2.76 NS	40.20 S	6.99 S	25.96 S	42.52 S	32.11 S	25.27 S	62.61 S	45.64 S

* and ** indicates significance of values at P=0.05 and P=0.01, respectively E_1 = 15th October, 2003 E_2 = 15th February, 2004 NS=Non-significance

appeared in E_1 (Table 1). The above finding indicated that both additive and dominance components were important in the inheritance of these traits. However, additive component was lower in magnitude than dominance component for most of the traits in both environments, suggesting the preponderance of dominance. For all the characters, smaller value of H_2 component in comparison to H_1 in E_1 and E_2 and on pooled basis indicated unequal proportion of positive and negative alleles in the loci influencing the character.

The average degree of dominance $(H_1/D)^{1/2}$ was above unity in all the character studied indicating presence of over dominance, but in characters like number of node on which first female flower appeared and days to first harvesting significant value of D indicates presence of additive gene action also. Lower value (<0.25) of $H_2/4H_1$ ratio for all the character indicated asymmetrical distribution of increasing and decreasing alleles in the parents. However, the positive estimated value for ratio $[(4\,DH_1)^{0.5} + F / (4DH_1)^{0.5} - F]$ was greater than unity for all the non-significant characters indicated that the character was controlled by more number of dominant genes. Knowledge of number of genes responsible for a particular trait is important for the genetic progress through selection. In the present study, the value of h^2/H_2 was low in most of the cases in both the environment and on pooled basis, indicating that the inheritance of a particular character was generally controlled by few genes or group of gene.

The narrow sense heritability (h^2) estimated for all the non-significant character was either medium or low suggesting that non-additive genetic variance largely predominating. Similar results were obtained by Chadha and Nandpuri, 1977; Swamy and Dutta, 1985; Munshi and Verma, 1998; Munshi and Verma, 1999 and Moon *et al.*, 2002.

Authors' affiliations

D.K. KAKADE, National Research Centre from Groundnut (I.C.A.R.) JUNAGADH (GUJARAT) INDIA

G.U. KULKARNI, A.D. PATEL AND R.R. ACHARYA, Main Vegetable Research Station, Anand Agricultural University, ANAND (GUJARAT) INDIA

REFERENCES

Chadha, M.L. and Nandpuri, K.S. (1977). Estimation of top cross performance in some muskmelon (*Cucumis melo* L.) varieties. *J. Hort.*, **34** : 40-43.

Hayman, B. I. (1954). The theory and analysis of diallel crosses. *Genetics*, **42**: 336-355.

Hayman, B. I. (1954 a). The theory and analysis of diallel crosses. *Genetics,* **39**: 789-809.

Hayman, B. I. (1954 b). The analysis of variance in diallel tables. *Biometrics*, **10**: 235-244.

Hayman, B. I. (1957). Interaction, heterosis and diallel crosses. *Genetics,* **42**: 336-355.

Hayman, B. I. (1958). The theory and analysis of diallel crosses II. *Genetics*, **45**: 55-172.

Hayman, B. I. (1960). Maximum likelihood estimation of genetic components of variation. *Biometrics*, **16**: 369-381.

Jinks, J. L. (1954). The analysis of continuous variation in diallel crosses of *Nicotiana restica* varieties. *Genetics,* **39**: 760-788

Jinks, J. L. (1956). The F_2 and back cross generations from a set of diallel crosses. *Heredity*, **10**: 1-30

Mather, K. and Jinks, J.L. (1982). *Biometrical Genetics* (3rd Ed.) Chapman and Hall, London.

Moon, S.S., Verma, V.K. and Munshi, A.D. (2002). Gene action of quality traits in muskmelon (*Cucumis melo* L.). *Veg. Sci.*, **29**: 134-136.

Munshi, A.D. and Verma, V. K. (1998). A note on gene action in muskmelon (*Cucumis melo* L.). *Veg. Sci.*, **25**: 93-94.

Munshi, A.D. and Verma, V.K. (1999). Combining ability in muskmelon (*Cucumis melo). Indian J. Agri. Sci.*, **69:** 214-216

Singh, R. K. and Chaudhary, B.D. (1985). *Biometrical methods in quantitative genetic analysis*. Kalyani Publishers, New Delhi.

Swamy, K.R.M. and Dutta, O.P. (1985). Inheritance of ascorbic acid content in muskmelon (*Cucumis melo* L.). *SABRAO Journal*, **17**: 157-163.

****