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GENETICS OF SOME IMPORTANT CHARACTERS USING LINE x TESTER ANALYSIS IN MUSKMELON

M. S. DHALIWAL AND TARSEM LAL

Department of Vegetable Crops, Punjab Agricultural University Ludhiana 141004

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ABSTRACT

Sixty F_1 hybrids involving three females, viz. M 221, M 225 and W 321 and twenty males were produced in muskmelon (*Cucumis melo*) in a line x tester design. Eight economic characters contributing to earliness, fruit yield and sweetness were studied. Analysis of variance for combining ability revealed that MS due to gca lines (except TSS%), gca testers and sca hybrids were highly significant for all the characters studied. Magnitude of gca lines was greater compared to the other two components. W 321 among lines and H 172 among testers were good general combiners for majority of characters. Among the crosses, M 221 x N 231, M 225 x A 102, M 225 x M 224, M 225 x F 143, W 321 x M 222 and W 321 x N 233 combined well to produce significant desirable sca effects for days to picking, yield per plot and TSS%. Cross W 321 x N 233 outyielded Punjab Hybrid (check) by more than 50% and was also significantly earlier than Punjab Hybrid.

Key words: Muskmelon, *Cucumis melo*, combining ability, line x tester analysis.

Muskmelon (*Cucumis melo* L.) is a strictly crosspollinated crop. Yet, it does not suffer from inbreeding depression owing to evolutionary rigours it had to go through [1]. Consequently, muskmelon can be improved genetically following breeding methods suitable for allogamous as well as autogamous crops. Monoecism has been assessed for its use in the heterosis breeding [2]. Male sterility has also been utilized in ascertaining the magnitude of heterosis and combining ability [3] and exploited commercially [4]. Availability of gynoecious line in muskmelon [5] has brightened the scope of heterosis breeding in this crop. The present study proposes to involve three pollination mechanisms in the female parents, viz. monoecy, gynoecy and male sterility, and twenty male parents to produce sixty hybrids in a line x tester design. Inferences so drawn will be of immense utility in the development of superior inbred lines and/or hybrids.

MATERIALS AND METHODS

Sixty F_1 hybrids involving three female parents, viz. M 221 (monoecious), M 225 (male sterile), W 321 (gynoecious) and twenty male parents were produced in line x tester combinations. These hybrids were first grown in polythene bags and later transplanted to the field in RBD with three replications with the spacing of 60 cm within and 3.5 m between rows. Planting was done on both sides of the beds. Data were recorded on five plants in each replication and analysed following Kempthorne [6]. Economic heterosis was estimated over Punjab Hybrid, a national check variety, for days to first female flower, first female flowering node, days to picking, fruit weight, fruits per plant, yield per plot, flesh thickness, and total soluble solids (TSS%, using hand refractometer).

RESULTS AND DISCUSSION

Analysis of variance (Table 1) indicated that differences among progenies were highly significant for all the characters studied. Total variation among progenies when further partitioned into different components corresponding to gca lines (except TSS%), gca testers, and sca hybrids indicated that large genetic diversity existed among the selected parents. Perusal of results further revealed that both additive and nonadditive gene effects governed the inheritance of characters under study. Singh et al. [7] reported similar results using diallel analysis. The results also revealed that gca of lines accounted for greater part of the variability for fruit weight and yield per plot. For the remaining characters, the magnitude

Table 1. ANOVA (MS) for line x tester analysis in muskmelon

Source	d.f.	Days to first female flower	1st female flowering node	Days to pick-ing	Fruit weight	Fruits per plant	Yield per plot	Flesh thick-ness	TSS (%)
Hybrids	59	117.7**	1.84**	106.3**	145598**	0.44**	18.8**	1.08**	5.08**
Lines	2	1175.8**	13.66**	968.8**	1706025**	2.80**	252.1**	8.75**	0.94**
Testers	19	95.2**	1.94**	93.2**	105872	0.47**	14.9**	1.04**	8.18**
Lines x testers	38	73.3**	1.17**	67.5**	83334**	0.31**	8.5**	0.70**	3.75**
Error	118	3.4	0.18	4.9	3871	0.01	0.3	0.07	0.70
σ^2 gca lines	—	18.4	0.21	15.0	27044	0.04	4.1	0.44	—
σ^2 gca testers	—	2.4	0.08	2.9	2504	0.02	0.7	0.11	0.49
σ^2 sca hybrids	—	23.3	0.33	20.9	26487	0.10	2.7	0.63	1.01

**Significant at P = 0.01.

of σ^2 sca of hybrids was greater than the other two components, viz. σ^2 gca of lines and σ^2 gca of testers. Kitroongruang et al. [8] reported that gca testers and sca hybrids were more important than gca lines for plant growth and fruit quality characters in Thai melon.

Gca estimates of selected parents are presented in Table 2. Among the three lines, W 321 was a good general combiner for most of the characters studied. Lines M 221 and M 225 were poor combiners for majority of the characters. All three lines were average combiners for TSS%.

Table 2. General combining ability effects of selected parents in muskmelon

Parent	Days to first female flower	1st female flowering node	Days to picking	Fruit weight	Fruits per plant	Yield per plot	Flesh thick-ness	TSS (%)
Females:								
M 221	-4.99**	-0.25**	1.36**	-108.3**	-0.14**	-1.26**	-0.33**	0.00
M 225	3.45**	0.55**	3.16**	-85.9**	-0.11**	-1.11**	-0.09**	-0.13
W 321	1.54**	-0.30**	-4.52**	194.3**	0.25**	2.37**	0.42**	0.13
Males:								
2-6-1	-0.78	0.13	-1.58*	-133.9**	-0.04	-1.18**	0.07	1.07**
H 172	-3.61**	-0.06	-4.80**	-26.1	0.25**	1.03**	-0.26**	0.63*
L 211	0.94	0.03	0.09	110.7**	0.03	0.92**	-0.10	0.24
F 151	-5.67**	-0.64**	-3.02**	-50.1*	-0.15**	-0.93**	0.14	1.02**
M 222	-1.56*	-0.02	-0.58	114.8**	0.25**	1.96**	-0.38**	-1.37**
A 102	-4.00**	-0.73**	-1.02	-155.1**	-0.24**	-1.93**	-0.13	1.13**
M 224	-2.17**	-0.27*	-0.13	-65.7**	0.23**	0.18	-0.13	1.57**
N 233	-0.84	-0.06	-4.13**	-61.5**	-0.04	-0.31	-0.43**	1.02**
M 228	-1.11	-0.11	0.64	24.1	0.36**	1.48**	0.28**	0.07
B 111	1.16	-0.27*	5.53**	-10.8	-0.37**	-1.43**	1.08**	-2.09**
U 301	1.72**	0.20	4.64**	159.3**	-0.10*	0.38*	0.11	0.07
A 101	-0.56	-0.28*	-1.02	266.0**	-0.16**	1.04**	0.16	-0.70*
P 252	0.66	-0.17	0.64	16.7	0.10*	0.45*	0.17	-0.54*
S 281	3.33**	0.60**	1.76*	22.9	0.14**	0.56**	0.37**	-1.09**
N 232	9.00**	1.35**	-1.91**	55.5**	0.16**	1.47**	-0.12	-0.43
N 231	4.27**	0.20	4.98**	61.3**	0.32**	1.71**	0.06	-0.43

*,** Significant at 5% and 1% levels, respectively.

Table 3. Specific combining ability effects of selected F_1 hybrids in muskmelon

Hybrid	Days to flower	Flowering node	Days to picking	Fruit weight	Fruits per plant	Plot yield	Flesh thickness	TSS (%)
M 221 x 2-6-1	-2.62**	-0.45*	1.53	272.7**	0.25**	2.49**	0.54**	0.50
M 221 x H 172	-0.45	-0.40*	-3.91**	189.2**	0.30**	2.11**	0.00	0.44
M 221 x M 222	5.49**	-0.31	0.53	160.9**	0.23**	1.89**	0.32*	0.44
M 221 x B 111	-0.39	-0.68**	6.41**	82.9**	-0.01	1.01**	-0.97**	-0.50
M 221 x U 301	-6.62**	-0.63**	-7.69**	-164.2**	0.12*	-0.47	0.06	0.83*
M 221 x H 174	-1.28	0.71**	0.19	112.0**	0.21**	1.42**	-0.31*	1.44**
M 221 x P 252	-3.56**	-0.15	-4.69**	61.0	0.05	0.48*	0.24*	-0.55
M 221 x S 281	6.93**	-0.49*	-3.14**	174.1**	-0.39**	-0.71**	-0.12	0.50
M 221 x N 232	6.10**	0.99**	-4.47**	-156.7**	-0.28**	-2.42**	0.13	0.83*
M 221 x N 231	-2.01*	-0.20	-6.36**	148.7**	0.03	1.00**	-0.08	1.17**
M 225 x F 151	-3.00**	-0.51*	-1.83	162.4**	0.53**	3.23**	-0.28*	1.01**
M 225 x A 102	-4.84**	-0.53**	-6.49**	12.1	0.35**	1.46**	0.03	1.57**
M 225 x M 224	5.16**	-0.18	-2.71**	3.3	0.08	0.55*	-0.17	1.29**
M 225 x E 143	-1.56	-0.62**	-7.27**	145.3**	-0.07	0.57*	-0.25*	1.12**
M 225 x M 228	-6.06**	-1.15**	-6.49**	117.4**	-0.18**	0.15	0.15	0.79*
M 225 x U 301	8.27**	0.71**	6.84**	303.3**	-0.18**	0.62*	0.32*	-1.21**
M 225 x A 101	1.21	-0.40*	-2.49**	63.9**	0.06	0.45	-0.09	-0.43
M 225 x P 252	-0.01	0.15	0.17	-11.4	-0.05	-0.18	-0.23	-1.73**
M 225 x J 191	6.33**	0.42*	2.84**	130.6**	-0.27**	-0.08	0.33**	-0.48
M 225 x S 281	-8.00**	0.94**	-1.60	-72.6*	0.24**	0.51*	-0.03	0.12
W 321 x C 122	3.79**	-0.63**	0.08	217.8**	-0.20**	-0.41	-0.06	1.71**
W 321 x L 211	-4.37**	0.23	-4.59**	282.0**	-0.07	1.77**	-0.57**	0.71
W 321 x M 222	-3.87**	0.08	-5.25**	-125.4**	0.31**	0.77**	-0.43**	0.98*
W 321 x E 143	2.68**	0.74**	0.41	-97.5**	0.44**	0.83**	-0.01	-0.79*
W 321 x N 233	-2.43**	-0.31	-2.70**	31.1	0.39**	1.83**	-0.17	0.76*
W 321 x M 228	6.84**	0.70**	4.19**	91.3**	-0.14*	0.68**	0.24	-0.12
W 321 x B 111	-5.26**	-0.23	-0.36	14.9	-0.14*	-1.14**	1.78**	0.37
W 321 x A 101	2.46**	0.45*	2.85**	160.0**	0.04	1.38**	0.60**	-0.35
W 321 x J 191	-8.09**	-0.49*	-3.47**	-150.6**	0.44**	0.28	-0.07	1.09**
W 321 x N 232	-0.10	-0.85**	2.08*	188.3**	0.26**	3.02**	-0.28*	0.37

*,** Significant at 5% and 1% levels, respectively.

Among twenty testers, none was a good general combiner for all the characters studied. However, H 172 was a good combiner for days to first female flower, days to picking, fruit number per vine, yield per plot and TSS%. Highest gca estimates for days to picking, yield per plot, flesh thickness and TSS% were obtained in H 172, M 222, B 111 and M 224, respectively. Parent L 211 was a good general combiner for fruit weight and yield per plot; M 224 for days to first female flower, first female flowering node, fruits per plant and TSS%; N 233 for days to picking TSS%; and M 228 for fruits per plant, yield per plot, and flesh thickness. These parents could be used in single and multiple crosses to combine desirable genes from two or more than two parents, followed by intermating among the selected segregates, as suggested for autogamous crops [9]. Consequently, this approach is likely to throw transgressive segregates, as were obtained in earlier studies [10, 11].

The crosses M 221 x N 231, M 225 x A 102, M 225 x M 224, M 225 x E 143, W 321 x M 222, and W 321 x N 233 combined well to produce significant desirable sca effects for days to picking, yield per plot and TSS% (Table 3). The crosses M 221 x U 301, M 225 x F 151, W 321 x B 111 and M 225 x P 252 produced highest desirable sca effects for days to picking, yield per plot, flesh thickness and TSS%, respectively. For yield per plot and TSS%, the crosses M 221 x H 174 and M 225 x F 151 were also superior combiners. Data on economic heterosis of selected F_1 hybrids are in Table 4. None of these hybrids was significantly superior to Punjab Hybrid for flesh thickness and TSS%. However, the hybrid W 321 x N 233 outyielded cv. Punjab Hybrid by more than 50% and was also significantly earlier in picking. With respect to flesh thickness and TSS%, both of them were statistically comparable. Thus, the hybrid

Table 4. Economic heterosis of selected F_1 hybrids over the check variety Punjab Hybrid of muskmelon

Hybrid	Days to picking		Yield per plot		Flesh thickness		TSS	
	mean	heterosis	mean (kg)	heterosis (%)	mean (cm)	heterosis (%)	mean (%)	heterosis (%)
M 221 x N 231	74.7	- 2.1	6.77	17.2*	2.43	- 2.8	9.7	- 14.4*
M 221 x H 174	72.7	- 4.7*	4.17	- 28.1**	1.83	- 26.8**	10.7	- 5.6
M 225 x A 102	70.3	- 7.9**	3.73	- 35.7**	2.60	4.0	11.5	1.8
M 225 x F 151	73.0	- 4.3	6.50	12.1	2.57	2.8	10.8	- 4.2
M 225 x P 252	72.0	- 5.6*	4.47	- 22.9**	2.63	5.2	10.0	- 11.5
W 321 x M 222	64.3	- 15.7**	10.64	79.4**	2.40	- 4.0	8.7	- 23.3**
W 321 x N 233	63.3	- 17.0**	9.20	58.6**	2.60	4.0	10.8	- 4.2
Punjab Hybrid	75.3	—	5.80	—	2.50	—	11.3	—

*,**Heterosis significantly superior over the respective character values of the check variety.

W 321 x N 233 has good potential for commercial exploitation. This cross should be commercially viable as it involves gynoecious female parent which can be conveniently maintained by inducing maleness with the help of growth regulators, as suggested by [12, 13].

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