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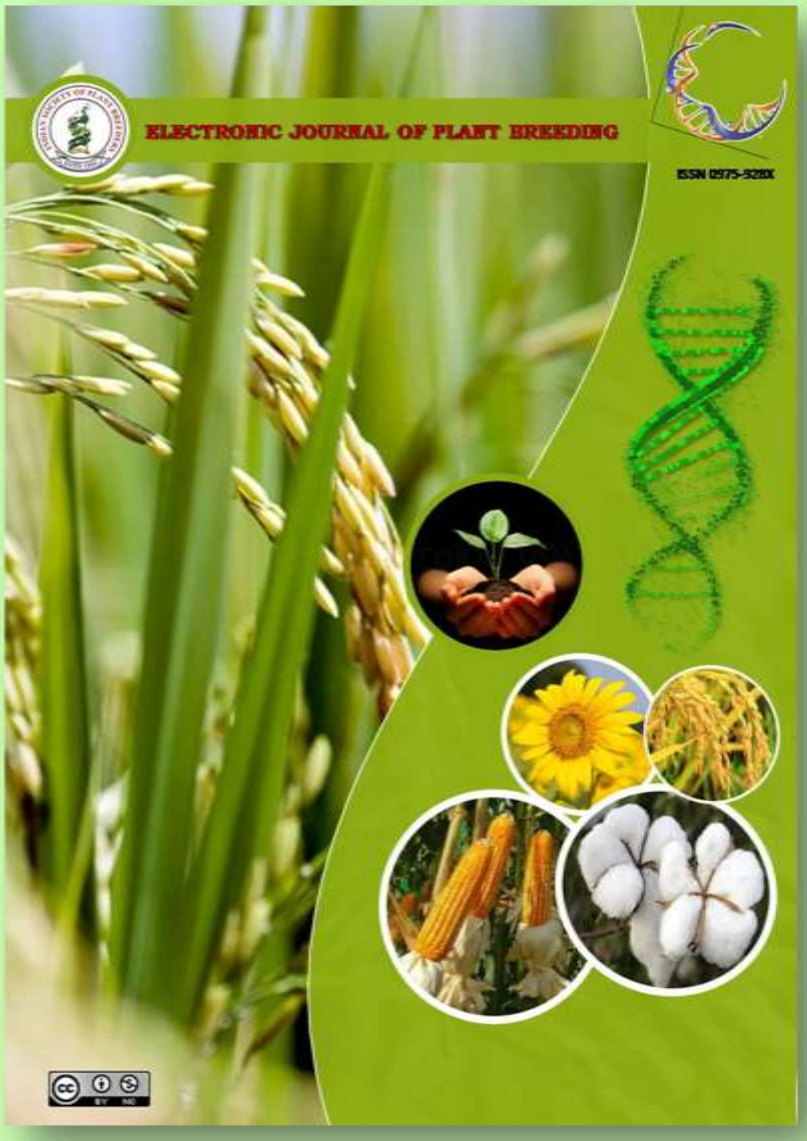

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Research Note

Evaluation of bitter gourd Hybrids

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Abstract
The experiment was conducted at the Department of vegetable science, College of Horticulture, Vellanikkara, Kerala Agricultural University during the year 2016-2017 to evaluate the performance of bitter gourd hybrids. The experimental material comprised of 16 hybrids and 5 check varieties collected from public (IARI, New Delhi and KAU, Thrissur) and private sectors. Observations were recorded for 14 characters and ranking of hybrids was done based on cumulative index worked out for the characters like, nodes to 1st female flower appearance, days to 1st picking, fruit weight (g), fruit length (cm), fruit diameter (cm), relative early yield (kg), yield/plant (kg) and number of fruits per plant. Significant difference was observed among the hybrids for the selected characters. Promising 5 F_1 hybrids selected based on the cumulative index were MC-142, MC-136, MC-139, MC-138 and MC-133.

Key words
Bitter gourd, hybrids, evaluation, cumulative index

Momordica charantia L. commonly known as bitter gourd, bitter melon, balsam pear, bitter cucumber, or karela is a popular vegetable throughout the tropics and subtropics of Asia. It belongs to family *Cucurbitaceae* (2n=2x=22). The crop originated probably in India and China was considered as the secondary centre of diversity (Grubben, 1977). Fruits of bitter gourd are good source of carbohydrate, protein, vitamins and minerals. Antioxidant, antimicrobial, antiviral, antihepatotoxic and antiulcerogenic properties are reported. They also exhibit the ability to reduce blood sugar (Raman and Lan 1996). F_1 hybrids are popular in bitter gourd. Hybrids in most of the vegetable crops offer the opportunity of earliness, high yield, and quality improvement besides the better capacity to face biotic and abiotic stresses. Being a cross pollinated crop, it is easier to realize the heterosis as practically feasible phenomena in bitter gourd. F_1 hybrids from the private sector are popular among farmers and white, long fruited types are ruling the market. The present investigation was undertaken to evaluate popular high yielding F_1 hybrids of bitter gourd from public and private sectors.

An investigation on the evaluation of popular high yielding F_1 hybrids in bitter gourd from public (IARI, New Delhi) and private sector (Table 1) was undertaken during the year 2016-2017 at the Department of vegetable science, College of Horticulture, Vellanikkara, Kerala Agricultural University. The experimental material comprised of 16 hybrids and 5 check varieties grown in a Randomized Bock Design with two replications. Details of genotypes used in the experiment presented in Table1. Recommended cultivation practices were followed as per the package of practices, KAU (KAU, 2016). Observations were recorded for 14 characters *viz*., days to first male flower anthesis, nodes to first male flower, days to first female flower anthesis, nodes to first female flower, days to first harvest, relative early yield (weight of immature fruits harvested during the first 3 harvests), average fruit weight (g), fruit length (cm), fruit diameter (cm), fruit girth (cm), flesh thickness, number of fruits per plant, yield/plant (kg) and number of harvests. Analysis of variance was done for each character for all the genotypes. Ranking of hybrids was done based on the cumulative index. Post hoc test was performed whereever necessary using DMRT for evolving a unique selection criterion based on the vector of characters under consideration, the method of Arunachalam and Bandyopadhyay (1984) was co opted for this study.

Analysis of variance revealed that genotypes were significantly different for all characters (Table 2). Mean performance of 16 hybrids and 5 varieties (control) were given in Table 3. Earliness is an important character in bitter gourd. It is required for realizing the potential economic yield in less time as possible, which is an important consideration for a farmer. Minimum number of days for first male flower appearance was observed

in variety MC-147 (36.17) followed by the hybrids, MC-134 (38.75), MC-140 (39.16) and MC-144 (39.50). Male flowering was delayed in variety MC-151(50.75 days) and the hybrid MC-133 (49.67 days). Rani *et al*. (2014) reported similar findings in bitter gourd hybrids. The male flower appeared in the lowest node in variety MC-147 (4.83) followed by hybrid MC-131 (7.58) and the highest node was observed in hybrid MC-135 (17.50) followed by variety MC-150 (17.00). MC-144 was found to be the earliest to open first female flower (37.75 days) and first harvest (48.00 days) followed by MC-141 which took 38.83 and 48.50 days respectively. Female flowering and days to first harvest were delayed in MC-145 (54.83 and 68.50 respectively) and MC-151 (54.33and 67.50 respectively). Jadhav *et al*. (2009) recorded similar range for days to first harvest in bitter gourd hybrids. Lowest node number to first female flower was recorded in variety MC-148 (7.00) followed MC-147 (13.00) and hybrid MC-142 (15.83). Earliness in bitter gourd is judged through the appearance of first female flower at lower node and minimum days required for first female flower opening and first harvest (Khan and Behera, 2011). The first female flower appeared in the highest node number in MC-138 (28.17) and MC-145 (28.00). The results are in consonance with the reports of Sundaram (2009) who observed the first female flower on the lowest position in the bitter gourd hybrid, Bikaneer 1 x IC 85643 (12.89). In the previous reports, first female flower at 3rd node was appeared in Gynoecious × monoecious hybrids**,** DBGy- 201 x S54 followed by DBGy- 201 x DBG 34 at 5^{th} node. Monoecious × monoecious hybrids like VNR 22 had first female flower at 11^{th} node and Pusa Hybrid 2 at 9^{th} node (Khan and Behera, 2011). The highest relative early yield was recorded by MC-138 (3.5 kg) and the least was in MC-131 (1.47 kg).

Fruit length, fruit diameter and fruit girth are important yield contributing traits. There was a wide range in the hybrid mean value for fruit length from 11.15 cm (MC-144) to 33.60 (MC-138). MC-139 was the second best hybrid for fruit length. MC- 144 and MC-141 produced small fruits. Similar range for fruit length was reported by Aruna and Swaminathan (2012) and Rani *et al*. (2014) in bitter gourd. The maximum fruit diameter was observed in the hybrid MC-138 (6.43cm) and the minimum in MC-144 (3.84 cm). This is in accordance with findings of Behera *et al*. (2009) and Alhariri *et al*. (2018) who reported similar range for this trait. Fruit girth was also observed as the highest in MC-138 (20.53 cm) and minimum in MC-144 (11.94 cm). Sundaram (2009) recorded that the girth of fruit ranged from 8.83 cm (MDU 1 x Vadipatti Local) to 13.89 cm (Bikaneer 1 x Bikaneer 3) among the bitter gourd hybrids. Rani *et al*. (2014) observed that fruit girth of bitter gourd hybrids varied from 10.98 (IC-033227 × IC-045339) to (IC-045339 × IC-470560) 13.89 cm. So the present study clearly indicated that fruit girth observed was high compared to previous study.

Fruit flesh thickness is an important fruit quality trait and an essential determinant of yield in bitter gourd. The thicker the fruit flesh, the higher the edible portion of the fruit. Flesh thickness varied from 0.55 (MC-148 and MC-150) to 1.00 (MC-140) cm. Similar range for flesh thickness was observed in findings of Mohan (2005) and Alhariri *et al*. (2018) in bitter gourd hybrids. Yield per plant is highly dependent on average fruit weight and the number of fruits per plant. The highest average fruit weight was exhibited by MC-138 (311.67 g) followed by MC-139 (219.83 g). These hybrids performed extremely well in fruit weight. The next best genotype for fruit weight was the variety MC-151 (215.28 g) followed by hybrid MC-133 (182.50g) and variety MC-149 (174.25 g). Varieties MC-150 (121.35 g) and MC-148 (100.30g) produced light weight fruits. Reduced fruit weight was observed in hybrid MC-144 (50.23 g) followed by MC-141 (54.50 g). Rani *et al*. (2014) and Alhariri *et al*. (2018) observed that the average fruit weight ranged from 58.82 to 98.57g and 56.33 to 78.57 g respectively in a study conducted among 28 F_1 hybrids of bitter gourd. The highest number of fruits per plant was observed in the hybrid MC-144 (123.50) followed by MC-141 (121.50). Reduced number of fruits per plant was reported in MC-131, MC-132 and the control MC-147 (29).

Yield per plant is the ultimate and the most important trait. Top five hybrids recorded highest *per se* performance were MC-138 (10.03 kg), MC-136 (9.00 kg), MC- 142 (8.49 kg), MC-139 (8.06 kg) and MC-133 (7.08 kg). Majority of the hybrids showed considerably higher performance compared to the control varieties. Number of harvests varied from 5.50 (MC-148) to 12.33 (MC-136).

To make an effective ranking for higher yield, it is necessary to determine the cumulative index. It helps to sift out suitable genotypes from germplasm based on reliable and effective traits. Ranking of hybrids was done based on cumulative index worked out for characters like, node to 1^{st} female flower appearance, days to 1^{st} picking, fruit weight (g), fruit length (cm), fruit diameter (cm), relative early yield (kg), yield/plant (kg) and number of fruits per plant (Table 4). Top 5 F_1 hybrids ranked

based on the cumulative index were MC-142, MC-136, MC-139, MC-138 and MC-133. In bitter gourd, selection index prepared on the basis of major yield components is effective in ranking of genotypes which was followed in an earlier study of 13 bitter gourd genotypes (Parhi *et al*., 1993). Ram *et al*. (2006) stated that emphasis was given for the number of fruits/plant and average fruit weight in selecting high yielding genotypes in bitter gourd.

Thus the study revealed that the hybrids MC-142, MC-136, MC-139, MC-138 and MC-133 as the most superior ones with respect to yield and other economic characters. These hybrids can be selected to develop high yielding varieties or can be exploited for crop improvement programme through conventional or non conventional approaches.

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References

Alhariri, A., Behera, T. K., Munshi, A. D., Bharadwaj C. and Jat, G. S. 2018. Exploiting gynoecious line for earliness and yield traits in bitter gourd (*Momordica charantia* L.). *Int. J. Curr. Microbiol. App.Sci*., **7(**11): 922-928.

Aruna, P. and Swaminathan, V. 2012. Evaluation of hybrids with high yield and yield attributes in bitter gourd (*Momordica charantia* L.). *Asian J. Hort*., **7**(2): 624-625.

Arunachalam, V. and Bandyopadhyay, A., 1984. *Indian J. Genet*., **44**(3): 419-424.

Behera, T. K., Dey, S. S., Munshi, A. D., Gaikwad, A. B., Pal, A., and Singh, I. 2009. Sex inheritance and development of gynoecious hybrids in bitter gourd (*Momordica charantia* L.). *Sci. Horticulturae* **,120**: 130–133.

Grubben, G. J. H. 1977. Tropical Vegetable and their Genetic Resources. IBPGR, Rome. p. 51–52.

Jadhav, K. A., Garad, B. V, Dhumal, S. S., Kshirsagar, D. B., Patil, B. T., and Shinde, K. G. 2009. Heterosis in bitter gourd (*Momordica charantia* L.). *Agric. Sci. Digest*, **29**(1): 7–11.

KAU (Kerala Agricultural University) 2016. *Package of Practices Recommendations*: *Crops* (15 th Ed.). Kerala Agricultural University, Thrissur, 393p.

Khan, S. and Behera, T. K. 2011. Performance of gynoecious × monoecious hybrids of bitter gourd (*Momordica charantia* L.). *Cucurbit Genet. Coop. Rep*., **33**-34: 65–66.

Mohan, L. 2005. Heterosis and combining ability studies in bitter gourd (*Momordica charantia* L.). M.Sc. (Ag) thesis, University of agricultural sciences, Dharwad, 104p.

Parhi, G., Mishra, H.N. and Tripathy, P. 1993. Genetic divergence in bitter gourd (*Momordica charantia* L.). *S. Indian Hort*., **41** (6): 344-349.

Ram, D., Rai, M., Singh, H. K., Verma A., Sudhakar P., and Kumar, A. 2006. Cause and effect analysis of yield in off-season bitter gourd (*Momordica charantia* L.). *Veg. Sci*., **33**(1): 63-64.

Raman, A., and C. Lau. 1996. Anti-diabetic properties and phytochemistry of *Momordica charantia* L. *(Cucurbitaceae). Phytomedicine*, **2**:349-362.

Rani, K. R., Raju, C. S., and Reddy, K. R. 2014. A study on heterosis for yield and earliness in bitter gourd. *Ind. J. Sci. Res. and Tech*., **2**(3): 89-97.

Sundaram, V. 2009. Evaluation of bitter gourd (*Momordica charantia* L.) hybrids under salinity. *Agric. Sci. Digest*, **29**(1): 63–65.

Table1. Details of bitter gourd genotypes used in the experiment with their source of collection

Sl. No.	Code	Hybrids	Source	Fruit colour
1	MC-131	PH-1	IARI, New Delhi	Glossy green
2	MC-132	PH-2	IARI, New Delhi	Dark green
3	MC-133	Monalisa	Sakata	White
4	MC-134	Euro	Rizwan Seed	Green
5	MC-135	US 33	US Agri seeds	White
6	MC-136	Aakash	VNR	Dark green
7	MC-137	VNR 22	VNR	Dark green
8	MC-138	Palee	East West Seed International	Dark green
9	MC-139	Maya	East West Seed International	Greenish white
10	MC-140	Prachi	East West Seed International	Dark green
11	MC-141	Racer	Bayer Nunhems	Dark green
12	MC-142	Aman Shree	Nunhems	Dark green
13	MC-143	Super Katai	Denmark Agri Sciences	Dark green
14	MC-144	Chottu	Fito	Dark green
15	MC-145	Indam Taj	Indo American Hybrid Seeds	White
16	MC-146	Shiva	Keyonic Seeds	White
Checks				
17	MC-147	Pusa Rasdar	IARI, New Delhi	Green
18	MC-148	Pusa Ausadhi	IARI, New Delhi	Green
19	MC-149	Preethi	KAU, Thrissur	Greenish white
20	MC-150	Priya	KAU, Thrissur	Green
21	MC-151	Priyanka	KAU, Thrissur	Greenish white

Table 2. Analysis of variance for different characters in bitter gourd genotypes

Sl. No.	Characters	Replication mean sum of squares	Genotype mean sum of squares	Error mean sum of squares
1	Days to first male flower anthesis	23.455	31.44*	10.919
2	Nodes to first male flower	2.065	28.388**	2.912
3	Days to first female flower anthesis	20.931	38.63*	16.994
4	Nodes to first female flower	9.524	47.88**	6.579
5	Days to first harvest	18.229	53.12**	12.864
6	Relative early yield	0.808	0.48**	0.142
7	Average fruit weight	243.154	6723.99**	56.681
8	Fruit length	8.95	71.51**	0.695
9	Fruit diameter	0.001	1.006**	0.037
10	Fruit girth	1.081	10.61**	0.358
11	Flesh thickness	0.002	0.03**	0.001
12	Number of fruits/plant	38.222	1473.77**	57.815
13	Yield/plant	0.659	9.14**	0.519
14	Number of harvests	0.081	3.92**	0.148

* Significant at 5 % level
** Significant at 1 % level

Table 3. Mean performance of hybrids

Sl. No.	Hybrids	Days to first male flower anthesis	Nodes to first male flower	Days to first female flower anthesis	Nodes to first female flower	Days to first harvest	Relative early yield (kg)	Average fruit weight (g)
1	MC-131	41.00	7.58	42.75	17.33	56.00	1.47	122.25
2	MC-132	41.67	10.17	45.25	20.17	57.00	1.57	120.40
3	MC-133	49.67	14.75	49.00	20.10	61.17	2.62	182.50
4	MC-134	38.75	9.17	42.50	23.50	53.00	2.10	92.50
5	MC-135	44.83	17.50	45.99	24.17	58.50	2.50	151.00
6	MC-136	44.99	16.50	41.00	18.83	52.50	2.88	120.67
7	MC-137	48.83	16.50	46.00	18.50	58.50	1.93	125.50
8	MC-138	44.30	16.33	50.00	28.17	60.33	3.51	311.67
9	MC-139	47.45	13.84	47.65	22.17	61.34	2.66	219.83
10	MC-140	39.16	10.50	45.50	24.83	57.50	2.30	130.00
11	MC-141	41.66	15.17	38.83	20.33	48.50	2.30	54.50
12	MC-142	41.17	8.17	42.99	15.83	54.67	2.80	168.00
13	MC-143	46.67	16.00	48.33	23.00	62.00	1.72	120.00
14	MC-144	39.50	11.00	37.75	19.00	48.00	2.75	50.23
15	MC-145	48.67	14.00	54.83	28.00	68.50	2.35	160.00
16	MC-146	45.83	16.16	47.83	21.33	61.00	1.90	124.50
	Control							
17	MC-147	36.17	4.83	41.50	13.00	57.50	2.55	152.50
18	MC-148	41.67	7.67	44.75	7.00	56.00	1.80	100.30
19	MC-149	44.82	13.83	47.83	23.17	61.50	2.35	174.25
20	MC-150	43.50	17.00	44.50	21.17	57.50	2.15	121.35
21	MC-151	50.75	14.50	54.33	25.67	67.50	2.10	215.28
	Mean	43.86	12.91	45.67	20.73	58.02	2.30	143.67
	C.D. (5%)	6.89	3.56	8.59	5.35	7.48	0.79	15.71
	C.D. (1%)		4.86		7.29	10.20	1.07	21.42
	CV (%)	7.53	13.21	9.02	12.38	6.18	16.39	5.24

Table 3. Mean performance of hybrids

Sl. No.	Hybrids	Fruit length (cm)	Fruit diameter (cm)	Fruit girth (cm)	Flesh thickness (cm)	Number of fruits/plant	Yield/plant (kg)	Number of harvests
1	MC-131	19.58	4.65	14.67	0.77	29.00	2.50	7.00
2	MC-132	20.72	4.52	13.79	0.79	29.00	2.45	6.63
3	MC-133	29.02	5.08	14.91	0.80	42.67	7.08	9.83
4	MC-134	16.75	4.33	13.52	0.75	51.10	3.40	8.50
5	MC-135	28.03	4.64	14.41	0.76	44.00	5.95	8.83
6	MC-136	22.24	4.34	13.57	0.85	84.83	9.00	12.33
7	MC-137	20.54	4.81	15.21	0.70	55.50	6.15	9.66
8	MC-138	33.60	6.43	20.51	0.95	36.83	10.03	10.00
9	MC-139	32.42	5.07	15.72	0.71	41.33	8.06	9.33
10	MC-140	18.81	5.00	15.79	1.00	52.30	6.05	9.10
11	MC-141	12.10	4.21	12.89	0.68	121.50	5.70	8.50
12	MC-142	29.50	4.38	14.43	0.86	53.17	8.49	9.50
13	MC-143	19.96	4.91	15.18	0.82	57.50	6.15	9.67
14	MC-144	11.15	3.84	11.94	0.56	123.50	5.40	9.00
15	MC-145	25.85	5.24	15.48	0.75	42.15	5.85	8.67
16	MC-146 Control	24.10	4.60	15.00	0.76	57.50	5.90	9.33
17	MC-147	19.29	5.99	19.06	0.95	29.00	4.15	8.00
18	MC-148	18.19	4.34	13.90	0.55	34.50	2.69	5.50
19	MC-149	23.40	6.10	19.41	0.82	31.10	4.15	9.27
20	MC-150	21.28	4.19	13.19	0.55	37.25	3.30	7.63
21	MC-151	27.09	6.01	18.94	0.95	29.50	5.20	9.32
	Mean	22.55	4.89	15.31	0.78	51.58	5.60	8.84
	C.D. (5%)	1.74	0.40	1.25	0.07	15.86	1.50	0.80
	C.D. (1%)	2.37	0.55	1.70	0.09	21.63	2.05	1.09
	CV (%)	3.69	3.96	3.91	4.39	14.74	12.86	4.35

Table 4. Ranking of hybrids based on cumulative index

Sl. No.	Hybrid	Cumulative index	Rank
1	MC-142	3.00	1
2	MC-136	3.16	2
3	MC-139	3.50	3
4	MC-138	3.84	4
5	MC-133	3.87	5
6	MC-144	4.09	6
7	MC-141	4.18	7
8	MC-135	4.20	8
9	MC-137	4.59	9
10	MC-147	4.99	10
11	MC-146	5.16	11
12	MC-145	5.25	12
13	MC-143	5.30	13
14	MC-134	5.32	14
15	MC-140	5.37	15
16	MC-151	5.68	16
17	MC-149	5.71	17
18	MC-148	5.86	18
19	MC-150	5.91	19
20	MC-131	6.14	20
21	MC-132	6.18	21

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