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Assessment Of Parental Lines and F1 Hybrids for Yield and Associated Traits in Bitter Gourd (Momordica Charantia L.)

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Abstract

The present investigation was carried out to obtain information based on performances of parents and their combinations for genetic improvement in bitter gourd. thirteen (Ten line & three tester) promising genotypes were crossed in a line and tester manner (excluding reciprocals). Line & tester set of 30 F1's and 1 check VNR-Nvadhan in bitter gourd was evaluated in Randomized Block Design (RBD) with three replications for twelve traits during zaid 2023-24 (Y1) and 2024-25 (Y2). The study evidently showed highly significant differences being observed for most of the traits under study. Based on performance, the parent V-65-1 (2.42 q/ha) found maximum for fruit yield per plant among the parents which was followed by V-198 (2.31q/ha), V-26 (2.17q/ha), NDBG-8 (1.88q/ha) and NDBG-9 (1.46q/ha). The best F1 hybrid for fruit yield per plant was V-65-1 x Arka Harit (2.95 q/ha) followed by V-65-1 x Kashi Mayuri (2.94q/ha), V-198 x DARAL-43 (2.90q/ha), V-198 x Kashi Mayuri (2.88q/ha) and V-26 x Kashi Mayuri (2.73q/ha). Based on the results, genotypes viz., V-65-1, V-198 and V-26 may be selected as parents in further breeding programme to improve the crop in terms of yield and earliness.

1.INTRODUCTION

Bitter gourd (*Momordica charantia* L.; 2n=2x=22), a member of the family *Cucurbitaceae*, is a widely cultivated vegetable valued for both its nutritional and medicinal properties. It is grown as an annual or perennial climbing plant and is known by various names including bitter melon, karela, Casilla, balsam pear, and maidan apple (Asna *et al.*, 2020). The term "cucurbits" was coined by Liberty Hyde Bailey to describe cultivated species of this family. The *Cucurbitaceae* family includes around 100 genera and 750 species, almost equally distributed across the tropical regions of the New and Old Worlds (Mondal *et al.*, 2020). Bitter gourd is believed to have originated in the Indo-Burma region, with Eastern India and Southern China proposed as possible centers of domestication. The wild variety, *Momordica charantia* var. *abbreviata*, native to Asia, is considered a likely ancestor of the cultivated forms. The crop is extensively cultivated in tropical and subtropical regions such as Malaysia, China, Southeast Asia, Tropical Africa, and the Americas.

In India, bitter gourd is grown widely in states like Karnataka, Kerala, Maharashtra, Andhra Pradesh, Tamil Nadu, and Chhattisgarh. As of 2023-24, India cultivates the crop on approximately 0.107 million hectares, producing 1.335 million tonnes, with a productivity of 12.48 tonnes per acre (Anonymous, 2023-24). Bitter gourd thrives in temperatures above 18°C, with the optimal range for growth being 24°C to 27°C. It is sensitive to frost and low temperatures, which can hinder development. Flowering processes such as anthesis and anther dehiscence typically occur in the early morning. For controlled pollination, female buds about to bloom in 1–2 days are covered with paper bags, as are male buds set to open the following day. Cross-pollination is done by transferring pollen from freshly opened male flowers to the stigmas of protected female flowers, which are then recovered to ensure fertilization (Behera *et al.*, 2020).

Nutritionally, bitter gourd is the most valuable among cucurbits, rich in essential vitamins and minerals Vitamin A (210 IU/100g), Vitamin C (88 mg/100g), iron (1.8 mg/100g), phosphorus (55 mg/100g), calcium (20 mg/100g), and only 25 kcal per 100g. Regular consumption aids in managing hypertension, eye

disorders, neuritis, and metabolic issues, while also boosting immunity (Jat *et al.*, 2024).

There is a prime need for its improvement and to develop varieties or hybrids suited to specific agroecological conditions. A good approach for its improvement through assessment of genetic variability and exploitation of hybrid vigour has not been adopted so far in this crop in relation to its importance. Owing to the existence of wide variability, monoecious nature, conspicuous and convenient architecture of flowers for crossing and large number of seed per fruit, bitter gourd can serve as the most potent material for the exploitation of heterosis on commercial scale. Hence, in the present investigation, genotypes were evaluated to identify the best genotypes which can be utilized as parents in exploitation of heterosis to improve the crop.

2.MATERIALS AND METHODS

The experiment was conducted at Main Experimental Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya. Geographically, experimental site falls under humid sub-tropical climate and is located in between 24.47° and 26.56° N latitude, 82.12° and 83.58 ° E longitudes at an altitude of 113 m above the mean sea level. The soil type of experimental site was sandy-loam with average fertility level and Ph in the range of 7.5-8.5. The selected parental lines i.e. twelve lines Sel-1 (L_1), V-21-14 (L_2), V-65-1 (L_3), V-193 (L_4), V-198 (L_5), V-158 (L_6), V-26 (L_7), V-169 (L_8), Jhalari Special (L_9), Kathi Special (L_{10}) and three tester including Kashi Mayuri (T_1), Arka Harit (T_2) and Daral-43 (T_3) were raised and crossed in the all possible combinations, excluding reciprocals during *zaid*, to develop 30 F_1 hybrid seeds for the study of the mean performance of parental line and their resultant F_1. All 44 genotypes (ten parental lines, three tester and thirty F_1) were evaluated in Randomized Block Design (RBD) with three replications. The row to row spacing was kept 3.0 m and plant to plant spacing 0.50 m in both the season pooled. To raise a good crop, all agronomic techniques were followed. The data were recorded on thirteen quantitative traits *viz.*, days to first staminate flower anthesis, days to first pistillate flower anthesis, node number to first staminate flower appearance, node number to first pistillate flower appearance, vine length (m), number of primary branches per plant, fruit length (cm), fruit circumference (cm), fruit weight (Kg), number of fruits per plant, days to first harvest and fruit yield per plant (q/ha).

3. RESULTS AND DISCUSSION

Selecting appropriate parent lines and employing effective breeding techniques are essential steps for enhancing yield and transferring desirable traits. In this crossing program, parent lines were evaluated based on their individual performance, as selecting parents with strong individual traits is advantageous for developing superior hybrids. The following discussion presents the results of various yield-related attributes using pooled data, with particular emphasis on the most critical trait, fruit yield per plant.

Days to first staminate flower anthesis ranged from 55.00 to 62.33 days for parents and 52.25 to 65.08 days for hybrids. Parent line V-65-1 (55.00) was found earliest for days to first staminate flower anthesis among the parents which was followed by V-198 (55.33), V-26 (55.50), Sel-1 (55.83) and V-21-14 (57.83). The best F1 hybrid for days to first pistillate flower anthesis was V-65-1 × Kashi Mayuri (52.25) followed by V-65-1 x Arka Harit (52.58), V-198 x Kashi Mayuri (54.08), V-198 x DARAL-43 (54.75) and V-26 x Kashi Mayuri (56.08). the average over the parental mean (59.15) and average over the F_1 hybrid mean (59.53) were more or less of the same order. The above results are in similar with the findings of Rani *et al.* (2014) and Talukdar *et al.* (2018). Days to first pistillate flower anthesis ranged from 60.33 to 70.17 days for parents and 58.25 to 71.25 days for hybrids. Parent Sel-1 (60.33) found earliest for days to first pistillate flower anthesis among the parents which was followed by V-65-1 (60.67), V-198 (61.00), V-26 (62.17) and V-21-14 (62.83). The best F1 hybrid for days to first pistillate flower anthesis was V-65-1 × Kashi Mayuri (58.25) followed by V-65-1 x Arka Harit (58.58), V-198 x Kashi Mayuri (59.92), Sel-1 x Arka Harit (60.75) and V-198 x DARAL-43 (61.58). The averages over the parental mean (64.98) and averages over the F1 hybrid mean (65.36) were more or less of the same order. These results are consistent with the findings reported by Singh *et al.* (2017), Gupta *et al.* (2015), and Vandana *et al.* (2013) in bitter gourd. Node number to first staminate flower appearance ranged from 3.91 to 6.08 nodes for parents and 4.27 to 8.81 nodes for hybrids. Parent V-193 (3.91) found earliest for node number to first staminate flower appearance among the parents which was followed by V-21-14 (4.45), V-169 (4.47), V-158 (4.47) and DARAL-43 (4.48). The best F1 hybrid for days to first staminate flower anthesis was V-193 x DARAL-43 (4.27) followed by NDBG-8 x DARAL- 43 (4.63), NDBG-9 x Arka Harit (4.66), V-21-14 x Kashi Mayuri (4.66) and V-158 x Kashi Mayuri (4.67). Averages over the parental mean (4.83) and averages over the F_1 hybrid mean (5.33) were more or less of the same order. Similar results are obtained by Saho (2015). Node number to first pistillate flower appearance ranged from 5.67 to 12.28 node for parents and 5.44 to 11.57 nodes for hybrids. Parent V-65-1 (5.67) found earliest for node number to first pistillate flower appearance among the parents which was followed by V-193 (6.05), V-198 (6.22), V-26 (6.90) and Kashi Mayuri (7.97). The best F_1 hybrid for days to first pistillate flower anthesis was V-65-1 x Arka Harit (5.44) followed by V-198 x Kashi Mayuri (5.68), V-65-1 x Kashi Mayuri (6.21), V-198 x DARAL-43 (6.43) and V-26 x Kashi Mayuri (6.77). Averages over the parental mean (8.44) and averages over the F_1 hybrid mean (8.43) were more or less of the same order. Similar observations have been reported by Singh *et al.* (2024), Prakash *et al.* (2021), Mounica *et al.* (2021) and Moharana *et al.* (2015), further substantiating the present findings in bitter gourd. Vine length ranged from 2.34 to 3.71 meter for parents and 2.45 to 3.83 meter for hybrids. Parent V-198 (3.71) found maximum for vine length among the parents which was followed by V-26 (3.59), V-21-14 (3.46), V-65-1 (3.22) and V-158 (3.21). The best F1 hybrid for vine length was V-198 x DARAL-43 (3.83) followed by V-198 x Kashi Mayuri (3.81), V-169 x Kashi Mayuri (3.69), V-65-1 x Kashi Mayuri (3.68) and V-26 x Kashi Mayuri (3.60). Averages over the parental mean (2.85) and averages over the F_1 hybrid mean (3.08) were more or less of the same order. Similar observations have been reported by Singh *et al.* (2024), Mounica *et al.* (2021), Prakash *et al.* (2021) and Moharana *et al.* (2015), further substantiating the present findings in bitter gourd. Number of primary branches ranged from 5.29 to 6.37 branches for parents and 5.28 to 6.38 branches for hybrids. Parent V-26 (6.37) found maximum for number of primary branches among the parents which was followed by V-65-1 (6.21), V-198 (6.20), V-21-14 (5.84) and V-158 (5.75). The best F_1 hybrid for number of primary branches was V-198 x Kashi Mayuri (6.38) followed by V-26 x Kashi Mayuri (6.37), V-198 x DARAL-43 (6.26), V-65-1 x Kashi Mayuri (6.12) and NDBG-9 x DARAL-43 (6.00). Averages over the parental mean (5.72) and averages over the F_1 hybrid mean (5.68) were more or less of the same order. Similar observations have been reported by Rajbhar *et al.* (2024), Thakur *et al.* (2018), singh *et al.* (2019) and Moharana *et al.* (2015), further substantiating the present findings in bitter gourd. Fruit length ranged from 7.28 to 17.22 cm for parents and 6.67 to 16.40 cm for hybrids. Parent V-158 (17.22) found maximum for fruit length among the parents which was followed by NDBG-9 (16.29), V-65-1 (16.16), NDBG-8 (15.40) and V-26 (14.12). The best F_1 hybrid for fruit length was V-65-1 x Arka Harit (16.40) followed by V-65-1 x Kashi Mayuri (16.39), V-193 x Kashi Mayuri (15.74), V-26 x Kashi Mayuri (15.44) and V-198 x DARAL-43 (15.40). Averages over the parental mean (12.74) and averages over the F1 hybrid mean (11.51)

were more or less of the same order. Similar observations have been reported by Rajbhar *et al*. (2024), Thakur *et al*. (2018), singh *et al*. (2019) and Moharana *et al*. (2015), further substantiating the present findings in bitter gourd. Fruit circumference ranged from 7.13 to 11.73 cm for parents and 9.96 to 13.23 cm for hybrids. Parent V-26 (11.73) found maximum for fruit circumference among the parents which was followed by V-158 (11.71), V-65-1 (11.38), V-198 (11.05) and V-21-14 (10.63). The best F_1 hybrid for fruit length was V-65-1 x Arka Harit (13.23) followed by V-65-1 x Kashi Mayuri (12.94), V-198 x DARAL-43 (12.33), V-198 x Kashi Mayuri (12.23) and V-26 x Kashi Mayuri (11.62). Averages over the parental mean (9.38) and averages over the F_1 hybrid mean (8.89) were more or less of the same order. Similar observations have been reported by Patil *et al*. (2012), Rathod *et al*. (2008), Singh *et al*. (2019) and Moharana *et al*. (2015), further substantiating the present findings in bitter gourd. Fruit weight ranged from 44.05 to 80.73 gm for parents and 29.69 to 90.80 gm for hybrids. Parent V-65-1 (80.73) found maximum for fruit weight among the parents which was followed by V-198 (78.33), V-26 (72.80), NDBG-9 (71.52) and DARAL-43 (69.08). The best F_1 hybrid for fruit length was V-65-1 x Arka Harit (90.80) followed by V-65-1 x Kashi Mayuri (90.69), V-198 x DARAL-43 (89.88), V-198 x Kashi Mayuri (89.69) and V-26 x Kashi Mayuri (85.95). Averages over the parental mean (66.03) and averages over the F_1 hybrid mean (64.29) were more or less of the same order. Number of fruits per plant ranged from 10.83 to 26.48 for parents and 11.82 to 29.79 for hybrids. Parent V-65-1 (26.48) found maximum for number of fruits per plant among the parents which was followed by V-198 (25.97), V-26 (25.00), NDBG-9 (22.82) and NDBG-8 (20.07). The best F_1 hybrid for fruit length was V-65-1 x Arka Harit (29.79) followed by V-65-1 x Kashi Mayuri (29.71), V-198 x DARAL-43 (29.45), V-198 x Kashi Mayuri (29.33) and V-26 x Kashi Mayuri (28.86). Averages over the parental mean (18.44) and averages over the F_1 hybrid mean (20.37) were more or less of the same order. Similar observations have been reported by Rajbhar *et al*. (2024), Thakur *et al*. (2018) and Moharana *et al*. (2015), further substantiating the present findings in bitter gourd. Days to first harvest ranged from 70.78 to 82.79 days for parents and 70.45 to 86.79 days for hybrids. Parent V-198 (70.78) found earliest for days to first harvest among the parents which was followed by V-65-1 (71.12), V-26 (72.12), Arka Harit (76.13) and Kashi Mayuri (78.12). The best F1 hybrid for days to first harvest was V-65-1 x Kashi Mayuri (70.45) followed by V-65-1 x Arka Harit (71.12), V-198 x Kashi Mayuri (72.79), Sel-1 x Arka Harit (73.05) and V-198 x DARAL-43 (74.28). Averages over the parental mean (77.52) and averages over the F_1 hybrid mean (78.17) were more or less of the same order. Fruit yield per plant ranged from 0.46 to 2.42 for parents and 0.67 to 2.95 for hybrids. Parent V-65-1 (2.42) found maximum for fruit yield per plant among the parents which was followed by V-198 (2.31), V-26 (2.17), NDBG-9(1.88) and NDBG-8 (1.46). The best F_1 hybrid for fruit yield per plant was V-65-1 x Arka Harit (2.95) followed by V-65-1 x Kashi Mayuri (2.94), V-198 x DARAL-43 (2.90), V-198 x Kashi Mayuri (2.88) and V-26 x Kashi Mayuri (2.73). Averages over the parental mean (1.36) and averages over the F_1 hybrid mean (1.62) were more or less of the same order. Similar observations have been reported by Remi *et al*. (2012), Singh *et al*. (2016) and Dey *et al*. (2006), further substantiating the present findings in bitter gourd.

Table.1 Mean performance of parents and testers in Bitter gourd genotypes

Sr. N	Genotypes	Days to first staminate flower anthesis	Days to first pistillate flower anthesis	Node number to first staminate flower appearance	Node number to first pistillate flower appearance	Vine length (cm)	Number of primary branches per plant	Fruit length (cm)	Fruit circumference (cm)	Fruit weight (gm)	Number of fruits per plant	Days to first harvest	Fruit yield (q/ha)
1	Sel-1(L1)	55.83	60.33	4.7	9.11	3.01	5.56	11.83	9.86	60.81	14.24	78.62	0.86
2	V-21-14(L2)	57.83	62.83	4.45	8.19	3.46	5.84	12.43	10.63	64.91	15.24	79.45	0.99
3	V-65-1(L3)	55	60.67	4.67	5.67	3.22	6.21	16.16	11.38	80.73	26.48	71.12	2.42
4	V-193(L4)	61.67	68	3.91	6.05	2.34	5.48	11.9	8.66	66.49	18.84	78.79	1.32
5	V-198(L5)	55.33	61	5.53	6.22	3.71	6.2	13.82	11.05	78.33	25.97	70.78	2.31
6	V-158(L6)	60.17	66.83	4.47	8.77	3.21	5.75	17.22	11.71	66.73	16.24	80.79	1.08
7	V-26(L7)	55.5	62.17	5.7	6.9	3.59	6.37	14.12	11.73	72.8	25	72.12	2.17
8	V-169(L8)	59	64.33	4.47	12.28	2.74	5.55	10.78	7.45	56.09	16.13	78.28	0.9
9	NDBG-8(L9)	62.33	67.67	4.5	10.54	2.79	5.45	15.4	8.97	67.86	20.07	82.37	1.46
10	NDBG-9(L10)	62.08	67.25	4.49	8.64	2.61	5.62	16.29	7.4	71.52	22.82	82.79	1.88
11	Kashi Mayuri(T)	60.08	65.92	5.28	7.97	2.56	5.41	10.74	8.35	59.02	15	78.12	1
12	Arka Harit(T)	62.08	67.58	6.08	9.11	2.69	5.62	7.68	7.13	44.05	12.82	76.13	0.46
13	DARAL-43(T)	62.08	70.17	4.48	10.25	2.37	5.29	7.28	7.55	69.08	10.83	78.38	0.81
	Mean	59.15	64.98	4.83	8.44	2.95	5.72	12.74	9.38	66.03	18.44	77.52	1.36
	Min	55	60.33	3.91	5.67	2.34	5.29	7.28	7.13	44.05	10.83	70.78	0.46
	Max	62.33	70.17	6.08	12.28	3.71	6.37	17.22	11.73	80.73	26.48	82.79	2.42

Table.2 Mean performance of hybrids and check in Bitter gourd genotypes

S. N	Hybrid	Days to first staminate flower anthesis	Days to first pistillate flower anthesis	Node number to first staminate flower appearance	Node number to first pistillate flower appearance	Vine length (cm)	Number of primary branches per plant	Fruit length (cm)	Fruit circumfer ence (cm)	Fruit weight (gm)	Number of fruits per plant	Days to first harvest	Fruit yield (q/ha)
1	Sel-1 x Kashi Mayuri	63.75	71.75	4.71	8.16	2.74	5.55	10.49	8.99	65.87	16.15	79.63	1.26
2	Sel-1 x Arka Harit	58.58	60.75	5.27	8.36	2.85	5.48	10.83	9.63	69.21	11.82	73.05	1.07
3	Sel-1 x DARAL-43	63.92	68.5	5.42	9.33	2.84	5.69	9.5	9.08	64.39	17.12	78.88	1.35
4	V-21-14 x Kashi Mayuri	58.08	65.25	4.66	8.57	3.44	5.28	13.71	8.75	47.26	16.83	74.38	1.18
5	V-21-14 x Arka Harit	63.58	68.75	5.55	9.22	2.47	5.46	10.36	7.46	34.96	14.52	81.05	0.75
6	V-21-14 x DARAL-43	62.75	67.17	5.23	10.26	3.07	5.61	8.98	9.12	51.96	13.6	79.55	0.96
7	V-65-1 x Kashi Mayuri	52.25	58.25	4.8	6.21	3.68	6.12	16.39	12.94	90.69	29.71	70.45	2.94
8	V-65-1 x Arka Harit	52.58	58.58	6.11	5.44	2.99	5.47	16.4	13.23	90.8	29.79	71.12	2.95
9	V-65-1 x 10DARAL-43	65.08	67	8.81	11.57	2.45	5.82	12.09	7.79	63.8	22.59	81.95	1.69
10	V-193 x Kashi Mayuri	57.08	63.92	5.68	9.82	3.52	5.45	15.74	7.37	29.69	14.45	76.79	0.67
11	V-193 x Arka Harit	60.75	67.92	5.97	10.36	3.3	5.36	7.47	7.47	51.36	15.39	77.95	1.04
12	V-193 x DARAL-43	64.12	68.08	4.27	8.16	2.64	5.48	13.26	8.14	54.21	14.79	81.79	1.05
13	V-198 x Kashi Mayuri	54.08	59.92	5.98	5.68	3.81	6.38	15.39	12.23	89.69	29.33	72.79	2.88
14	V-198 x Arka Harit	59.08	68.58	5.43	7.26	2.97	5.62	12.08	8.6	81.89	24.14	80.79	2.23
15	V-198 x DARAL-43	54.75	61.58	6.85	6.43	3.83	6.26	15.4	12.33	89.88	29.45	74.28	2.9
16	V-158 x Kashi Mayuri	57.08	63.25	4.67	8.77	2.6	5.61	7.15	6.63	68.79	17.38	76.12	1.44
17	V-158 x Arka Harit	59.25	65.83	5.29	8.1	3.27	5.82	9.9	8.23	63.29	28.39	77.62	2.02
18	V-158 x DARAL-43	58.75	64.83	5.44	9.82	3.37	5.92	8.62	8.12	52.82	23.89	77.45	1.52
19	V-26 x Kashi Mayuri	56.08	62.17	5.35	6.77	3.6	6.37	15.44	11.62	85.95	28.86	74.79	2.73
20	V-26 x Arka Harit	58.75	64.83	5.26	8.28	3.19	5.42	9.62	8.2	72.3	18.59	77.45	1.59
21	V-26 x DARAL-43	63.42	70.58	5.15	8.57	3.3	5.61	9.17	7.77	69.89	20.69	84.12	1.7
22	V-169 x Kashi Mayuri	58.08	63.83	5.38	7.66	3.69	5.49	12.24	7.77	71.78	23.89	76.45	1.95
23	V-169 x Arka Harit	64.92	70.42	5.11	10.37	2.64	5.54	8.82	8.26	52.22	18.39	86.79	1.21
24	V-169 x DARAL-43	61.42	68.58	4.68	8.24	2.83	5.8	14.11	10.18	69.99	15.08	84.95	1.32
25	NDBG-8 x Kashi Mayuri	62.33	68.5	4.78	7.51	2.54	5.47	8.1	8.08	52.79	18.39	84.79	1.23
26	NDBG-8 x Arka Harit	58.08	63.83	4.66	8.01	2.52	5.49	14.22	5.96	64.76	18.77	77.62	1.46
27	NDBG-8 x DARAL-43	61.75	66.5	5.23	8.5	3.2	5.53	15.25	6.82	65.74	23.88	80.12	1.82
28	NDBG-9 x Kashi Mayuri	57.42	62.5	4.79	9.27	2.9	5.79	8.28	8.57	53.08	18.39	77.45	1.23
29	NDBG-9 x Arka Harit	59.42	64.5	4.79	9.16	2.74	5.49	9.55	8.39	62.69	16.89	78.12	1.34
30	NDBG-9 x DARAL-43	58.75	64.58	4.63	8.98	3.32	6	6.67	8.93	46.98	19.98	76.79	1.19
31	VNR (check variety)	59.08	66.75	3.85	10.04	2.81	5.61	9.89	8.51	71.78	28.69	77.79	2.06
	Mean	59.53	65.36	3.99	8.43	3.08	5.68	11.51	8.89	64.29	20.37	78.17	1.62
	Min	52.25	58.25	2.91	5.44	2.45	5.28	6.67	5.96	29.69	11.82	70.45	0.67
	Max	65.08	71.75	7.54	11.57	3.83	6.38	16.4	13.23	90.8	29.79	86.79	2.95
	SE(d) ±	1.54	1.71	0.34	0.38	0.14	0.21	0.37	0.27	2.06	0.36	2.18	0.05
	C.D.at 5%	3.06	3.41	0.67	0.75	0.28	0.41	0.74	0.53	4.1	0.73	4.33	0.09
	C.V. (%)	3.17	3.21	10.74	5.46	5.69	4.43	3.83	3.62	3.88	2.23	3.42	3.68

4. CONCLUSION

The present study revealed significant genetic variability among bitter gourd genotypes for key traits. Among the parents, V-65-1, V-198, and V-26 showed superior fruit yield per plant. The top-performing hybrids were V-65-1 × Arka Harit, V-65-1 × Kashi Mayuri, and V-198 × DARAL-43, all surpassing the standard check. These combinations exhibited strong yield potential, suggesting the presence of heterosis. Therefore, V-65-1, V-198, and V-26 can be considered promising parents for future breeding programmed aimed at improving yield and earliness in bitter gourd.

Interpretation

The study highlights the significance of quantitative in *Momordica charantia* and explores practical approaches for enhancing these attributes through hybrid breeding techniques. It underscores the potential of genetic improvement in developing superior pumpkin varieties with improved health benefits and consumer appeal.

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