Received: 12 Oct 2020 | Revised: 17 Aug 2021 | Accepted: 21 Aug 2021

Electronic Journal of Plant Breeding

Research Note

Manjari: A Cowpea Aphid Borne Mosaic Virus (CABMV) tolerant yard long bean (*Vigna unguiculata ssp. sesquipedalis* (L) Verdc) variety suited for problem zone of Kerala

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Abstract
Cowpea is an important vegetable crop worldwide and it contributes to nutritional security, income generation and soil fertility enhancement. The production of cowpea is limited by several biotic and abiotic stresses. Among the biotic stresses, cowpea aphid-borne mosaic virus (CABMV) is a major virus disease that results in substantial yield loss to the crop. The development and release of resistant varieties is the most viable option in the management of this disease. The objective of the study was to develop CABMV resistant cowpea varieties without compromising yield and quality which are suited for intercropping as well as pure crops. Backcross breeding for imparting disease resistance was performed in which CABMV resistance was transferred from the cultivar CO6. KMV1 is a superior variety suited for intercropping in coconut gardens and well suited to the special problem zone of Kerala but susceptible to virus disease. The segregating generations up to BC_4F_3 were evaluated for disease resistance and economically important traits. The economically superior selection having CABMV resistance was released as variety Manjari. The variety possesses the characteristics of tolerance to mosaic disease, shade tolerance, ideal for intercropping and very good culinary characters.

Key words: Yard long bean, CABMV resistance, *Vigna ungiculata ssp. Sesquipedalis*

Cowpea is an important vegetable and legume crop and is rich in high quality dietary protein. It is a typical warm season crop adapted to the tropics. The crop is used in a variety of ways. Tender pods are used as a vegetable and dry beans as a pulse. Due to its nutritive value and soil improving properties, it is also used as fodder, green manure and cover crop. Being a legume crop, cowpea fits well in inter-cropping system. In Kerala, it is grown as a floor crop in coconut gardens, as an inter-crop in tapioca, fringe crop in rice field bunds and as a pure crop in garden lands and rice fallows. The crop is an integral part of sustainable agriculture. Even though cowpea is bestowed with tolerance to abiotic factors like drought, they are susceptible to biotic stresses. Among the diseases, virus diseases are more devastating and are known to bring yield losses ranging from 10-100 per cent (Rachie, 1985). The most economical and effective method of control of legume viruses is through the use of resistant varieties (Taiwo, 2003).

The variety KMV 1 released from RARS, Kumarakom in 1996 was an ideal variety for the special zone of problem areas especially in Kuttanad, where coconut is the pivotal crop in garden lands. This can perform well under partially shaded conditions when grown as an intercrop of coconut in the region. But occasionally it was found to be susceptible to mosaic disease transmitted by aphids. Hence, a back cross breeding programme was

undertaken at RARS, Kumarakom with a view to evolve high yielding cowpea varieties resistant to Cowpea Aphid Borne Mosaic Virus (CABMV) with two recurrent parents, KMV 1 and Sarika and three donor parents CO 2, CO 6 and VCP 4.

The breeding programme was performed at the Regional Agricultural Research Station, Kumarakom. The initial programme was the identification of donor parents for mosaic tolerance. The parent selected for the breeding programme were KMV 1, Sarika, CO 2, CO 6 and VCP 4. Among these , CO 2, CO 6 and VCP 4 were selected as donor parents having resistance to CABMV. The back cross method of breeding was followed for the introgression of the resistance character. The screening was performed in the BC_1 generation for characters contributing towards higher yield. KMV 1 x CO 6 back crossed with KMV 1 was advanced to further generations for evaluation since maximum pod setting was observed for the cross KMV 1 x CO 6 compared to other crosses during artificial pollination.

Backcrossing was performed to generate the BC_2 generation and screened for CABMV resistance. The screening was performed in pot culture and under field conditions. Mechanical inoculation of the virus on genotypes was performed for screening. The susceptible variety Jyothika was used as a check variety for field experiments. The tolerant lines were selected and backcrossing of mosaic tolerant lines with the donor parent was performed to raise the BC_3 generation. The selection of disease tolerant plants in the BC_3 generation was performed based on yield and other economic parameters. The segregating population was raised to BC_4 F_3 and the segregants were evaluated for yield characters. Thirteen lines were advanced for preliminary field level evaluation which showed encouraging yield performance. The evaluations were performed for three consecutive years for the same season. Screening for mosaic resistance was continued with the selected lines as described earlier.

Segregating generations were evaluated for economic parameters and mosaic resistance for eight consecutive generations. Selected superior 14 lines having mosaic tolerance were advanced for CYT (Comparative Yield Trial). The screening for mosaic tolerance and yield was performed in a randomized block design with three replications for consecutive three years for two seasons (*rabi* and summer) along with the parents and the popular released varieties Jyothika (CABMV susceptible and high yielding in open condition) and Lola (CABMV resistant and high yielding in open condition) as standard checks. All the agronomic practices of raising the crop were followed according to the package of practices recommendations. Scoring for disease incidence was done based on 0-5 scale proposed by Rajamony *et al*.(1990) and vulnerability index (VI) was calculated.

Score	Symptoms
0	No symptom
1	Slight vein clearing in young leaves
2	Leaves with light and dark patches
3	Blisters and mottling on the leaves
4	Severe mottling and distortion of leaves
5	Stunting of plants with negligible or no flowering and fruiting

$$VI = \frac{(0n_0 + 1n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5)}{n_t\,(n_c - 1)}$$

where n_0,n_1,n_2,n_3,n_4,n_5 are the number of plants in the category 0,1,2,3,4,5 respectively
n_t is total number of plants
nc is total number of categories

Genotypes were categorized into 5 grades based on the vulnerability index values namely R-Resistant (0), T-Tolerant (1-15), MR-Moderately Resistant (16-30), MS-(Moderately susceptible (31-50), S- Susceptible (> 50).
Based on the performance in CYT, 4 lines were selected for on farm trials in six locations during the summer season in Kottayam and Alappuzha districts along with a variety Lola as check. The variety Lola was used as a check variety in farm trials since it was the most preferred variety by the farmers due to its high market demand in the region. The resistant line having superior yield performance compared to check variety was selected and proceeded for variety release.

In the CYT, it was observed that the recurrent parent KMV 1 was superior for a mean number of pods/plot (462.33) which was followed by the selection 16/5-1-1-4-5 (420.42). The selection 16/5-1-1-4-5 also produced maximum green pod yield (5345.5 g/plot) which was followed by the check variety Jyothika (5150.00). The highest value for pod length was recorded by the check variety Jyothika and was on par with all the tested lines except 16/5-1-1-4-5, KMV1, CO 6 and Lola. The number of seeds per pod was the highest for Lola followed by the line 11/4-7-5-4. Based on the vulnerability index, the reaction was the highest for line 11/4/-19-1-4 (60.00) followed by the check variety Jyothika (50.00) which indicates that these were highly susceptible to the CABMV. The reaction was the lowest for the male parent CO 6, Lola and line 7/9-10-2-4. However, the values for green pod yield and mean a number of pods/plot was low for line 7/9-10-2-4. Line 11/4-7-3-4 reported a value of 6.67 which is lower than all the other lines except CO 6, Lola and 7/9-10-2-4. Hence, it was selected for onfarm trials as it recorded on par values for the mean number of pods/plot, green pod yield, pod length and the number of seeds/pod with the lines/variety which recorded the highest values for the above characters. The lines 16/5-1-1-4-5, 16/5-1-1-5-4, 16/5-1-15-3-5 were also selected for onfarm trials

based on their yield data and reactions with CABMV (**Table 1**).The organoleptic evaluation of these selected lines was also performed at the station involving all classes of employees and farmers.

Table 1. Performance of selections in comparative yield trial (pooled data of three years)

S. No.	Promising lines	Mean Number pods /plot	Green pod yield (g/plot)	Pod length (cm)	Number of Seeds per pod	Reaction to CABMV VI Reaction (0-50 scale)		Phyllody
1	16/5-1-1-4-5	420.42	5345.50	40.67	16.50	30.00	MR	T
2	16/5-1-1-5-4	399.00	5138.33	42.68	18.47	13.30	T	T
3	11/4-7-3-4	371.58	4951.67	43.17	18.58	6.67	T	T
4	16/5-1-15-3-5	387.25	4945.00	41.10	17.80	10.00	T	T
5	11/4-7-5-4	366.92	4898.33	43.77	18.89	40.00	MS	T
6	16/5-1-1-2-2	343.58	4620.83	43.30	18.88	40.0	MS	T
7	16/5-1-15-2-1	347.33	4603.17	41.32	17.81	26.60	MR	T
8	16/5-1-15-4-5	333.50	4515.00	40.64	17.63	13.30	T	T
9	11/4-7-2-7	326.83	4422.50	41.56	18.29	30.00	MR	T
10	11/4-19-1-4	316.58	4403.17	44.32	18.06	60.00	S	T
11	8/3-18-2-5	317.33	4008.00	42.66	18.38	40.00	MS	T
12	7/9-10-1-6	320.67	3928.33	41.61	17.18	40.00	MS	T
13	7/9-10-2-4	285.08	3479.83	42.01	17.60	-		S
14	7/9-10-3-4	277.08	3351.67	42.30	17.70	8.00	T	S
15	KM V-1	462.33	4195.00	39.26	17.72	13.30	T	T
16	Co-6	346.42	2189.17	15.77	13.68	-	R	T
17	Jyothika (check)	316.00	5150.00	50.24	18.23	50.00	S	T
18	Lola (check)	328.00	4312.00	35.93	19.39	0	R	T
	Pooled CD(0.05)	141.57	1154.85	2.386	1.073			
	CV(%)	8.60	9.46	2.09	2.14			

R-Resistant (0), T-Tolerant (1-15), MR-Moderately Resistant (16-30), MS-(Moderately susceptible (31-50) , S- Susceptible (> 50)

Table 2. Performance of pre release selection in onfarm trials

Selections	Number of pods/ plot	Pod yield (kg/plot)	Yield per ha(t/ha)	Pod length(cm)	Incidence of CABMV (visual observation)	Days to flowering	Days to first harvest
16/5-1-1-4-5	3144.33	35.748	8.937	44.31	Absent	42.00	54.00
16/5-1-1-5-4	2890.33	37.359	9.339	42.53	Absent	42.00	54.00
16/5-1-15-3-5	2718.00	35.653	8.913	42.43	Absent	44.00	56.00
11/4-7-3-4	3235.33	43.737	0.934	44.17	Absent	41.00	53.00
Lola (Check)	1391.00	20.200	5.050	47.31	Absent	55.00	66.00

Table 3. Organoleptic evaluation of selected lines

Selections	Taste	Appearance	Colour of cooked dish
16/5-1-1-4-5	Fairly good	Acceptable	Greenish
16/5-1-1-5-4	Good	Acceptable	Greenish
16/5-1-15-3-5	Very good	Acceptable	Greenish
11/4-7-3-4	Very good	Acceptable	Greenish
Lola (Check)	Good	Acceptable	Light green

In the onfarm trials at six locations, the selection 11/4-7-3-4 recorded the highest value for the number of pods/ plot, pod length and yield/ha, while the selection 16/5-1-1-4-5 showed the highest value for pod length. The earliness in flowering and harvesting was also recorded for the selection 11/4-7-3-4. The CABMV incident was not observed in any of the selections. (**Table 2**). This line also exhibited very good taste and acceptance in

Table 4. Salient features of the released variety

S. No.	Characters	
1	Average pod length	43.17 cm
2	Mean pod weight	20.30 g
3	Number of pods/ plant	37.16
4	Mean number of seeds/pod	18.58
5	Pod colour (mature)	Light Green
6	Seed colour (ripe)	Red
7	Days to first flowering	35- 37 days after planting
8	Days to first harvest	48 -50 days
9	Yield of vegetable pods /plant	0.495 kg
10	Reaction to mosaic	Tolerant to CABMV
11	Reaction to pest and diseases	Mild infestation of pod borer and leaf minor are observed
12	Moisture	86.06%
13	Dry matter content	13.04%
14	Protein	8.60% (Dry wt. basis)
15	Fibre	10.4% (Dry wt. basis)
16	Special attributes	Tolerant to mosaic disease, Shade tolerant and hence ideal for intercropping situations. Very good culinary characters

terms of appearance and colour of the cooked dish in the organoleptic evaluation (**Table 3**). Bariana (2003) opined that for transferring disease resistance to desired agronomic backgrounds, backcrossing and/or convergent backcrossing can be used. Back crossing and selection can be used for the introgression of plant resistance (Fritz, 2004). In a study by Meenatchi *et al.* (2019), the characters *viz*., number of pods per plant, number of seeds per pod and single plant yield were identified as heritable characters contributing towards yield. In the present study, also selection for yield in the segregation generations were based on these parameters. Thedevelopment of a variety suitable to a particular location is significant in the case of special climatic zones. Similarly, a high yielding short duration variety of cowpea was developed for the summer fallows of the Onattukara region was released by Bindu *et al.* (2011).

Based on the above superior parameters for the line 11/4-7-3-4, it was recommended for release as a variety by the State variety release committee and named as Manjari. The salient features of the variety are depicted in **Table 4**. Hence, this mosaic resistant high yielding and acceptable variety for culinary purposes will be well suited for the special zone of problem areas in Kerala.

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