



Development of Yellow Mosaic Virus Resistant Genotypes in Urdbean TNAU blackgram VBN 6: A high yielding blackgram variety with resistant to Mungbean Yellow Mosaic Virus

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Development of Yellow Mosaic Virus Resistant Genotypes in Urdbean TNAU blackgram VBN 6: A high yielding blackgram variety with resistant to Mungbean Yellow Mosaic Virus

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Abstract

The Blackgram culture VBG04-014 is a cross derivative of Vamban 1 x *Vigna mungo* var. *silvestris* 1 released as variety TNAU Blackgram VBN(Bg)6, it is maturing in 65-70 days and suited for cultivation under both rainfed and irrigated conditions. It has an average yield potential of 871 Kg per hectare. This culture is resistant to Yellow Mosaic Virus, Leaf Curl Virus and less damage of pod borer. It possesses desirable characters like high protein content (21.1%). Grains are medium sized with black in colour. It is recommended for cultivation in Tamil Nadu.

Keywords: VBG04-014; Blackgram; Yellow Mosaic Virus; Rainfed; Irrigated

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Introduction

Blackgram *Vigna mungo* (L.) popularly known as urdbean in India. It is most important pulse crop in India. The varietal development in blackgram is necessary to fulfill the demand of people. Even

though India is the highest producer in the world still the production level is very low compare to the requirement. The most serious disease of blackgram is Mungbean Yellow Mosaic Virus. Sources of resistance to MYMV have been identified in wild progenitor (*Vigna mungo* var. *silvestris*) of urdbean and it was used in breeding

programmes to develop resistant varieties in urdbean [1,2]. The purpose of the study was to develop drought tolerant with yellow mosaic virus resistance. The objective of this programme was to develop mungbean yellow mosaic virus resistant variety since many of the available varieties were susceptible to MYMV disease which leads to heavy yield loss to the farmers. TNAU blackgram VBN 6 was developed and released as resistant variety against to MYMV with high yield potential to farming communities. The both parents of VBN 6 blackgram is different from VBN 7 blackgram variety. This variety having special feature is top podding nature after 50 per cent flowering of variety the pods are expose to top of the plants where as VBN 7 on par with the plant height or below the plants canopy.

Materials and Methods

Crossing programme was started during *Rabi* 2007 - 2008 between cultivated type with wild. The cultigene *Vigna mungo* Vamban 1 (*susceptible*) with wild gene *Vigna mungo* var. *silvestris* 1 wild type (*resistant*). The urdbean variety Vamban1 is wide adaptable variety is having a high yield potential with susceptible to yellow mosaic virus used as donor.

Plant materials

The experimental materials are male and female parents and derivatives of forwarded generations. Female parent is *Vigna mungo* Vamban 1 and male parent is *Vigna mungo* var. *silvestris* 1 and seven F₁s plants were raised. Collected seeds from selected F₁s plants raised as F₂ and forward F₃ generations and further generation.

Methods of Phenotyping of mapping population

In the field condition, the MYMV infection can be evaluated by infector row method as described by Selvi *et al.* [3], (2006). The test materials were scored after 80% of plants

showed MYMV incidence. The 203 individuals and progenies in the F₂ and F₃ generation respectively were scored for MYMV infection using 1-9 rating scale suggested by Singh *et al.* (1988) is adopted. Selected field resistant genotypes under agro inoculation.

Agro inoculation test

Agro inoculation study was conducted in the Centre for Plant Molecular Biology, Tamil Nadu Agricultural University, Coimbatore. The tandem viral constructs of MYMV, VA 221 (KA30 DNA A + KA22 DNA B) and VA 239 (KA30 DNA A + KA27 DNA B) mobilized in *Agrobacterium tumefaciens* strains Ach 5 and C 58 were collected from Madurai Kamaraj University, Madurai and used for further studies. Agroinoculation was done on surface sterilized overnight sprouted seeds of the parents VBG01-0014 and *Vigna mungo* var *silvestris* and F₂ individuals. *Agrobacterium tumefaciens* strains harbouring the appropriate partial tandem repeat clone were grown to 1 Optical Density at 600 nm in 2 mL AB minimal medium pH 7.0 containing the antibiotics like streptomycin (150 mg L⁻¹), spectinomycin (50 mg L⁻¹) and tetracycline (5 mg L⁻¹) at 28°C at 220 rpm. From this, 1 mL of the culture was taken to inoculate, another 50 mL of AB minimal medium (pH - 7.0) containing the above-mentioned antibiotics and grown to 1 OD aL 600 nm at 28°C at 220 rpm. The culture was spinned at 4000 rpm for 10 min at 25°C. Cells obtained were re-suspended in 50 mL of AB minimal medium (pH - 5.6) with 100 in acetosyringone (100 µm). Seed coat of the sprouted seeds was removed by using forceps and pricked around the hypocotyl region and were immediately immersed in the appropriate culture of *A. tumefaciens*. After the overnight incubation, seeds were washed with distilled water and sown in pots containing autoclaved sand and vermiculite in the ratio of 1:1. Agroinoculated plants were maintained in a growth chamber at 25°C, 60-70% relative humidity and a photoperiod of 16/18h. The

Hoagland's solution was applied twice in a week for proper growth of the plants and transferred to green house after 15 days for symptom observation [4,5].

The F₁ s to F₇ generation was raised at National Pulses Research Centre, Tamil Nadu Agricultural University, Vamban. Tamil Nadu, South India. Primary and Advanced Yield Trials (PYT & AYT) were conducted in Randomized Block Design with three replications along with local check variety (Vamban 5) at National Pulses Research Centre, TNAU, Vamban from 2005-2006. The culture VBG04-014 was further tested under multilocation trial (MLT) at different research stations of the Tamil Nadu Agricultural University during *Kharif* 2007. It was promoted to Adaptive Research Trial (ART) during *Kharif* 2008 - 09 and was tested under farmers holdings in collaboration with State Department of Agriculture. Laboratory studies were conducted to evaluate the quality traits viz. protein (Kelplus) available at Home Science College, AC&RI, Madurai.

Results and Discussion

Using crossed seeds, the true F₁s of seven plants were tagged among 25 plants and 90 seeds were collected from seven plants and used for segregants and screening study. From 90 F₁ seeds and 90 F₂ individual plants were recovered, all the 90 plants were raised as plant to row methods from F₃ generations onwards. Selection was made for MYMV screening at F₂ stage 3 lines are not having single spot of MYMV susceptible plant at the same time uniform and higher yield than other lines. Forwarding the plants as a single plant selection methods upto fifth generations. The same three lines consistently showing yellow mosaic resistant for all generation. Out of three lines, one line was selected which was higher yield with yellow mosaic virus resistant. This line was bulked and given name as VBG04-014 and forwarded to Primary Yield Trail, Advaced

yield Trials, Multi location trials and Adaptive Research Trials.

This culture is tested in research station for three years (3 nos), multilocation trials (12 nos) for two years in various TNAU research stations, entire Tamil Nadu 30 districts adaptive research trials (100 nos) for two years and farmers field on farm trials (22 nos) for two years. The overall average yield for VBG04-014 is 871 kg/ha which is 21.30 and 15.82 percent increased yield over Vamban 4 (718 kg/ha) and Vamban 5 (752 kg/ha) respectively (Table 1). Under irrigated condition the above culture has recorded the yield of 890 kg/ha which is 25.17 and 16.33 per cent over the above check varieties Vamban 4 (711 kg/ha) and VBN (Bg) 5 (765 kg/ha) respectively (Table 2) and rainfed condition recorded yield of 850 kg/ha with 18.23 and 15.02 per cent yield increase over the check varieties Vamban 4 (724 kg/ha), and VBN (Bg) 5 (739 kg/ha) respectively (Table 3).

The Blackgram culture VBG04-014 is a cross derivative of Vamban 1 (susceptible) x *Vigna mungo* var. *silvestris*1 (resistant) were crossed. It has shorter duration and synchronized maturity of 65-70 days with top podding nature. The special features of this variety TNAU Blackgram VBN(Bg)6 is high yield, highly resistant to yellow mosaic virus (Table 6), pod borer, Powdery mildew (Table 4) and Leaf crinkle virus table 5 [6-8].

In Station trials the culture VBG04-014 has recorded 1100 kg/ha which is 36.81 and 28.35 per cent increased yield over the checks Vamban 4 (804 kg/ha) and VBN (Bg) 5 (857 kg/ha) respectively. In Multilocation trial the culture VBG04-014 has recorded 681 kg/ha which is 10.19 and 1.20 per cent increased yield over the checks Vamban 4 (618 kg/ha) and Vamban 5 (673 kg/ha). In Adaptive Research Trials (100 trials) the culture VBG04-014 has recorded an average yield of 759 kg/ha which is 18.22 (642 kg/ha) and 18.59 (640 kg/ha) per cent increased

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yield over the checks Vamban 4 and VBN (Bg)5 respectively. The above trials during kharif seasons, the culture has recorded the higher mean yield more than 1000 kg/ha over the check varieties in five districts viz., Villupuram, Karur, Namakkal, Sivagangai and Tiruvannamalai, with

highest yield of 1525 kg/ha in Nalluranpatti of Karur district. Under rabi season, the performance was good in Erode and Villupuram with highest yield of 1348 kg/ha at Koliyanur of Villupuram district [6-8].

Table 1: Abstract for the performance of blackgram culture VBG04-014 in various trials.

Trials	No. of trials	Yield (Kg/ha)			% increase over	
		VBG 04-014	VBN (Bg) 4	VBN(Bg)5	VBN (Bg) 4	VBN (Bg) 5
Station	3	1100	804	857	36.81	28.35
MLT	2	681	618	673	10.19	01.20
ART	100	759	642	640	18.22	18.59
OFT	22	942	806	837	16.87	12.54
Mean		871	718	752		
Over all per cent increase					21.30	15.82

Table 2: Abstract for the performance of blackgram culture VBG04-014 under irrigated condition.

Season	Yield (kg/ha)		
	VBG 04-014	VBN(Bg)4	VBN(Bg)5
Station trials	1100	804	857
MLT	681	618	673
Mean	890	711	765
% increase over Checks		25.17	16.33

Table 3: Abstract for the performance of blackgram culture VBG04-014 under rainfed condition.

Season	Yield (kg/ha)		
	VBG 04-014	VBN(Bg)4	VBN(Bg)5
ART	759	642	640
OFT	942	806	837
Mean	850	724	739
% increase over Checks		18.23	15.02

Table 4: Reaction of blackgram culture VBG 04-014 against Powdery Mildew Disease at Vamban.

Sl. No	Season & Year	VBG04-014	Vamban 4	Vamban 5
1.	Rabi 2006-2007	1*	1*	1*
2.	Rabi 2007-2008	1*	1*	1*

Powdery Mildew Disease (Scale):
 0 - Immune 1 - Resistant 3 - Moderately resistant 5 - Moderately susceptible 7 - Susceptible
 9 - Highly susceptible

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Table 5: Reaction of blackgram culture VBG04-014 to pod borer and LCV during kharif and summer season.

Year	Culture / variety	Pod borer (%)	Leaf Crinkle Virus (LCV)
Kharif season	VBG 04-014	2.1	No incidence in all the entries
	Vamban 4	5.6	
	Vamban 5	2.3	
Summer season	VBG 04-014	1.4	No incidence in all the entries
	Vamban 4	4.5	
	Vamban 5	2.5	

Table 6: Reaction of blackgram culture VBG04-014 against Yellow Mosaic Virus Disease.

Sl. No	Season & Year	VBG 04-014		Vamban (Bg)4		Vamban (Bg)5	
		Vamban	Panpozhi	Vamban	Panpozhi	Vamban	Panpozhi
1.	Kharif season	1	1	1	1	1	1
2.	Summer season	1	1	1	1	1	1
3.	Rabi season	1	-	1	-	1	-

Yellow Mosaic Virus (Grade):

0 - Immune 1 - Resistant 3 - Moderately resistant 5 - Moderately susceptible
7 - Susceptible 9 - Highly susceptible

In the On-Farm Trials (22 Nos.) conducted at Pudukkottai and Ariyalur districts, the culture VBG04-014 has recorded 942 kg/ha which is 16.87 and 12.54 per cent increased yield over checks Vamban 4 (806 kg/ha) and VBN(Bg)5 (837 kg/ha) respectively [6-8].

The Blackgram culture VBG04-014 contains protein content of 21.1% as against 20.5 of VBN (Bg) 4 and 20.2 of VBN (Bg) 5 (Table 7). The length, breadth and thickness of whole grain is maximum in the culture VBG04-014 and their distinct characters recorded in Table 8.

Table 7: Protein content.

Culture/Entry	Per cent
VBG 04-014	21.1
VBN (Bg) 4	20.5
VBN (Bg) 5	20.2

Table 8: Descriptor of TNAU Blackgram VBN 6.

Sl. No.	Characters	Descriptions
1	Name of the variety	: TNAU Blackgram VBN 6
2	Pedigree	: Vamban 1 x <i>Vigna mungo</i> var. <i>Silvestris</i> I
3	Plant growth habit	: Erect upright
4	Plant habit	: Determinate
5	Stem colour	: Green with purple wash
6	Stem pubescence	: Present
7	Shape of leaf pinnae	: Lanceolate

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8	Colour of the leaf	: Green
9	Leaf pubescence	: Present
10	Petiole colour	: Green with purple wash
11	Pod colour: intensity of colour of premature pods	: Uniform green
12	Pod pubescence	: Present
13	Pod colour at maturity	: Black located in top of the plant
14	Seed colour	: Black
15	Seed lusture	: Dull
16	Seed shape	: Oval
17	Days to 50% flowering	: 40 days
18	Days to maturity (days)	: 70 days
19	Plant height (cm)	: 15 cm
20	Seeds per pod	: 4 - 5
21	100 seed weight (g)	: Medium (4g)
22	Disease reaction	: Resistant against MYMV and LCV

Based on the high yield coupled with resistance to MYMV. This culture VBG04-014 is identified as a new variety (TNAU Blackgram VBN 6) for cultivation in Tamil Nadu by State varietal Release committee [6-8].

BENEFIT COST RATIO	
ITEM	AMOUNT IN RUPEES
Cost of cultivation/ha	15,772
Revenue/ha	37,500
Net profit	21,728
Benefit cost Ratio	1:2.3

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