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Research Article

VBN 11 - A new high yielding and MYMV disease resistant blackgram variety

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Abstract
Blackgram variety VBN 11 (VBG 12-062) was derived from PU 31 x CO 6. It matures in 70 – 75 days. VBN 11 has a yield potential of 899 kg/ha. It is 14.8 and 11.8 % increased yield over VBN 6 (783 kg/ha) and VBN 8 (804 kg/ha) respectively. This variety has determinate plant type, medium duration with synchronized maturity and resistance to Mungbean Yellow Mosaic Virus (MYMV) disease and moderate resistance to powdery mildew disease. It is recommended for *Kharif, Rabi and Summer* seasons of Tamil Nadu. It was released by State Variety Release Committee during 2020 with the variety designation blackgram VBN 11.

Key words
Blackgram, VBN 11, yield, MYMV disease resistance

INTRODUCTION

Blackgram (*Vigna mungo* L.) is an important pulse crop in India. This crop has a short duration and self pollinated legume crop cultivated in almost all parts of India. India has the largest production and consumption of blackgram in the world. In India, blackgram is cultivated in 4.83 m ha with a production of 3.36 mt in Tamil Nadu, It is cultivated in 4.30 lakh ha with a production of 3.11 lakh t. (Annual report, 2019). It has protein (25 – 26%), carbohydrates (60%), fat (1.5%), minerals, amino acids and vitamins (Archana *et al.*, 2018; Rambabu *et al.*, 2018).

Mungbean Yellow Mosaic Virus (MYMV) is the most prevalent and destructive viral pathogen in blackgram. It causes yield loss of 80 to 100 % and also reduces the seed quality (Singh *et al.,* 1980; Sudha *et al.,* 2013). Therefore, breeding resistance cultivars is an important objective in most of the blackgram improvement programme in India. Therefore, attempts were made to evolve a blackgram variety (VBN 11) with high yield and resistance to MYMV disease.

MATERIAL AND METHODS

Hybridization was made between PU 31 and CO 6 during 2010. F_1 to F_5 generations were evaluated at National Pulses Research Centre, Vamban. A homozygous F_5 progeny was identified and given culture name as VBG 12-062. This culture was tested in various station trials between 2012 and 2015. Further, it was evaluated in MLT at various research stations in Tamil Nadu from 2016 to 2018. It was also evaluated in AICRP trials during *kharif* and *rabi* 2015-17. This culture was evaluated under Adaptive Research Trials. It was also tested in On Farm Trial during 2018-19. The culture VBG 12-062 was screened for major pests and diseases. Field and agro-inoculation technique was followed for MYMV disease

screening. Based on the various trial results the State Variety Release Committee has released this culture as VBN 11 during 2020.

RESULTS AND DISCUSSION

Culture VBG 12 - 062 is derived from the cross PU 31 x CO 6. It matures in 70-75 days. It is suitable for *Kharif, Rabi and Summer* seasons of Tamil Nadu. The culture VBG 12 - 062 has given an average yield of 899 kg/ha (**Table 1a**). It is 14.8 and 11.8 % increase than VBN 6 and VBN 8 respectively. VBG 12-062 recorded a mean yield of 940 kg/ha under irrigated situation (**Table 1b**). This was an increased yield of 18.7 and 12.0 % than VBN 6 and VBN 8 respectively**.** This culture recorded 865 kg/ha in the rainfed situation. It is 11.4 and 11.6 % increase than VBN 6 and VBN 8 respectively.

In various station trials *viz*., Preliminary row, Preliminary yield and Advanced yield trials, VBG 12-062 registered an average of 915 kg/ha and 997 kg/ha during *kharif* and *rabi* seasons respectively. It is 12.2 % and 35.5 % than VBN 6 and 10.2 % and 21.0 % than VBN 8 in *kharif* and *rabi* seasons respectively.

Based on yield superiority in station trials, VBG 12-062 was nominated to Multi Location Trials. VBG 12-062 performed superiority with a yield of 791 and 827 kg/ha during *kharif* and *rabi* seasons respectively. It is 6.3 %

Table 1a. General performance of VBG 12-062 in different trials for seed yield (kg/ha)

Trial	No. of trials / Locations	VBG 12-062		VBN 6 (ch)		VBN 8 (ch)	
Station trial (*Kharif*)	6	915	(65)	816	(62)	830	(63)
Station trial (*Rabi*)	7	997	(65)	736	(62)	824	(63)
MLT (*Kharif*)	11	791	(70)	744	(60)	748	(65)
MLT (Rabi)	9	827	(75)	691	(65)	686	(70)
ART (*Kharif*)	101	880	(72)	792	(73)	790	(72)
ART (*Rabi*)	60	878	(72)	792	(71)	783	(72)
OFT (Summer irri.)	5	1745	(77)	-		1620	(72)
AICRP-IVT(Rabi 2015-16)*	8	1188	(70)	-	-	-	-
Weighted Mean (No. of Trials=199)		**899**	**(72)**	**783**	**(71)**	**804**	**(71)**
***Per cent* yield increase over**		-	-	**14.8**	-	**11.8**	-

Figures in parenthesis indicate duration in days.
*Not included in the mean

Table 1b. Abstract of performance of blackgram culture VBG 12-062 under irrigated and rainfed condition (seed yield kg/ha)

Trials	VBG 12-062		VBN 6 (ch)		VBN 8 (ch)	
Irrigated (no. of Trials=90)	940	(71)	792	(68)	839	(70)
Rainfed (no. of Trials=109)	865	(72)	776	(73)	775	(72)

Figures in parenthesis indicates duration

Table 2. Reaction of blackgram culture VBG 12-062 against MYMV disease score in MLT

Season and Year	VBG 12-062			VBN 6 (ch)			VBN 8 (ch)			CO 5 (SC)		
	VBN	CBE	CPMB*	VBN	CBE	CPMB*	VBN	CBE	CPMB*	VBN	CBE	CPMB*
Kharif 2017	1	1	1	1	1	1	1	1	1	9	3	-
Rabi 2017-18	1	-	-	1	-	-	1	-	-	5	-	-

*Agro inoculation method (Source: Report for CSM on Pulses 2018 Page No: 90)
*SC-Susceptible check VBN-Vamban; CBE-Coimbatore; CPMB-Centre for Plant Molecular Biology, Coimbatore

MYMV Disease Score:
1-Free from disease; 2-Highly Resistant; 3-Resistant; 4-Moderately resistant; 5-Moderately susceptible; 6 & 7-Susceptible; 8 & 9-Highly susceptible

and 19.6 **%** increase than VBN 6 and 5.7 % and 20.6 % than VBN 8 during *kharif and rabi* seasons respectively. Based on yield superiority in MLT, VBG 12-062 was included in Adaptive Research Trials. In *kharif* season (101 locations), VBG 12-062 had a higher yield of 880 kg/ha than VBN 6 and VBN 8 respectively. It is 11.1 and 11.3 % increase than VBN 6 and VBN 8 respectively. In *rabi* season (60 locations), VBG 12-062 had a higher yield of 878 kg/ha. It is 10.9 and 12.1 % higher than VBN 6 and VBN 8 respectively. Genotype VBG 12-062 was evaluated under On Farm Trials during summer 2019 at Thanjavur district. It recorded a mean yield of 1745 kg/ha. It is 7.7 and 15.4 % increase than VBN 8 and ADT 5 respectively.

Table 3. Reaction of blackgram culture VBG 12-062 against ULCV disease in MLT

Season and Year	VBG 12-062		VBN 6 (ch)		VBN 8 (ch)		CO 5 (SC)	
	VBN	CBE	VBN	CBE	VBN	CBE	VBN	CB E
Kharif 2017	0.0	0.0	1.8	0.0	0.0	0.0	15.8	18.6
Rabi 2017-18	3.9	2.1	3.7	1.4	0.0	3.6	13.6	18.6

(Source: Report for CSM on Pulses 2018 Page No: 90-91)

***SC-Susceptible check**

Leaf crinkle: 0-Highly Resistant; 1 to 5%- Resistant; 5.1 to 10%- Moderately resistant; 10.1 to 20% -Moderately susceptible; 20.1 to 40%-Susceptible and > 40% - Highly susceptible

Table 4. Reaction of blackgram culture VBG 12-062 against Powdery mildew disease in MLT

Season and Year	VBG 12-062		VBN 6 (ch)		VBN 8 (ch)		CO 5 (SC)	
	VBN	CBE	VBN	CBE	VBN	CBE	VBN	CBE
Rabi 2017-18	2	1	3	2	2	2	2	4

(Source: Report for CSM on Pulses 2018 Page No: 90-91)

Powdery mildew: 0-Free from disease; 1-Resistant; 2 -Moderately resistant; 3 -Moderately susceptible; 4-Susceptible and 5 -Highly susceptible

Culture VBG 12-062 was screened against major diseases from 2017 to 2018 (**Table 2, 3 & 4**). It recorded a highly resistant reaction to MYMV disease (**Fig. 1**.). It is resistant to Urdbean Leaf Crinkle Virus disease. It showed a moderate resistance to powdery mildew disease. The artificial screening through agro-inoculation technique showed a complete resistance to MYMV**.** VBG 12-062 has relatively less incidence of whitefly and less damage due to pod borer and pod bug than check variety (**Table 5**).

Culture VBG 12-062 contains 22.6% of protein while VBN 8 had 21.8 %**.** It has similar batter properties of VBN 8**.** The organoleptic parameters *viz*., colour and appearance, texture, taste, flavour, and over all acceptability are better than check variety VBN 8. The culture has medium sized seed with 100-grain weight of 4.5 – 5.0 g (**Table 6**.).

Key morphological characters are a) purple with green colour of stem and b) medium days to flowering. These traits are useful to distinguish VBG 12-062 from other varieties in seed production. The description of the variety as per the DUS characters is given in **Table 7.** It was registered with NBPGR, New Delhi as IC 617172.

Table 5. Performance of blackgram culture VBG 12-062 against major pests in MLT

Season and year	Whitefly / Plant				Pod borer damage (%)		Pod bug damage (%)	
	VBG 12-062		Pant U 19 (ch)		VBG 12-062	Pant U 19 (ch)	VBG 12-062	Pant U 19 (ch)
	VBN	CBE	VBN	CBE	VBN	VBN	VBN	VBN
Kharif 2017	2.9	1.7	2.6	1.8	6.9	12.4	6.2	9.6
Rabi 2017-18	1.8	1.2	2.3	1.6	3.3	5.8	-	-

(Source: Report for CSM on Pulses2018 Page No:98)

Table 6. Performance of blackgram culture VBG 12-062 for quality traits

	VBG 12-062	VBN 8 (ch)
Protein (%)	22.6	21.8
Batter volume before fermentation (ml)	476	483
Batter volume after fermentation (ml)	612	618
Organoleptic scores of *vada* on hedonic rating scale		
Characters	**VBG 12-062**	**VBN 8 (ch)**
Colour and appearance	8.5	8.5
Texture	8.5	8.5
Taste	9.0	8.5
Flavour	8.0	8.0
Overall acceptability	8.5	8.5

(Source: CSC& RI, Madurai)

Fig 1. Evaluation of MYMV disease resistance of blackgram culture VBG 12-062 with susceptible check CO 5 under infector row method at NPRC, Vamban during kharif 2017

The blackgram variety VBN 11 was differentiated from other popularly grown genotypes *viz.,* VBN 6 and VBN 8 using the molecular markers. A total of 10 SSR markers *viz.,* CEDGAAG002, CEDG225, CEDG298, CEDG154, CEDG003, CEDG091, CEDG048, CEDG220, CEDG173 and CEDG097 were taken for the study. Among these two SSR markers *viz.*, CEDGAAG002 and CEDG225 had differentiated the varieties (**Table 8 and Fig. 2**). Marker CEDGAAG002 had polymorphism between VBN 11 and VBN 8. Likewise, marker CEDG225 had polymorphism between VBN 6 and VBN 11.

Based on the better performance of VBG 12-062, it was released as VBN 11 by the 50th State Variety Release Committee during 2020. It is recommended for cultivation during *Kharif, Rabi and Summer* seasons in all districts of Tamil Nadu except Kanyakumari and Nilgiri districts.

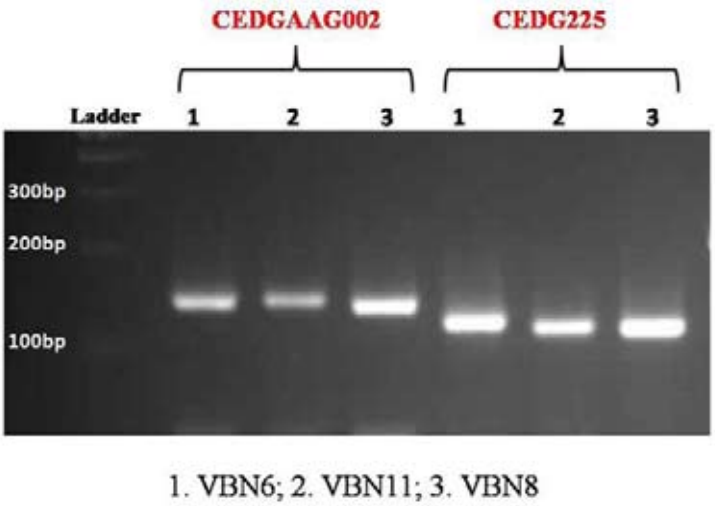

Fig 2. SSR profiling of blackgram varieties VBN 11, VBN 6 and VBN 8

Table 7. Descriptor of blackgram culture VBG 12-062

1	General		
1.1	Name of the variety	:	**VBG 12-062**
1.2	Pedigree	:	PU 31 X CO 6
1.3	Year of development	:	2010
2	Habit		
2.1	Plant growth habit	:	Semi erect
2.2	Plant habit	:	Determinate
3	Stem characters		
3.1	Stem colour	:	Purple with green
3.2	Stem pubescence	:	Present
4	Leaf characters		
4.1	Terminal leaflet Shape	:	Lanceolate
4.2	Foliage colour	:	Dark green
4.3	Leaf Vein colour	:	Green
4.4	Petiole colour	:	Purple
5	Pod characters		
5.1	Pod colour: intensity of colour of premature pods	:	Green
5.2	Pod pubescence	:	Present
5.3	Pod length (cm.)	:	4.5-5.5
5.4	Pod colour at maturity	:	Black
6.	Seed characters		
6.1	Seed colour	:	Black
6.2	Seed lusture	:	Dull
6.3	Seed shape	:	Oval
7	Agronomic traits		
7.1	Days to 50% flowering (days)	:	40-45
7.2	Days to maturity (days)	:	70-75
7.3	Plant height (cm)	:	30-40
7.4	Seeds per pod	:	6 to7
7.5	100 seed weight (g)	:	4.0 to 5.0
8	Disease reaction	:	Resistant to Mungbean Yellow Mosaic Virus, urdbean leaf crinkle virus and moderately resistant to powdery mildew diseases

Table 8.Details of the polymorphic SSR markers with sequences

SSR marker	Forward/ Reverse	Primer Sequence 5' to 3'	Product size (bp)		
			VBN 6	VBN 11	VBN 8
CEDGAAG002	F	GCAGCAACGCACAGTTTCATGG	150	150	140
	R	GCAAAACTTTTCACCGGTACGACC			
CEDG225	F	GAGGAAGTGTTGCAGCACC	120	110	110
	R	GTAGACTCTGCAGAGGGATG			

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