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Artificial Screening of Yellow Mosaic Virus Causing YMV Disease in Blackgram and Green Gram During *Kharif* Season of Pudukottai District in Tamil Nadu, India

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ABSTRACT

Green gram (*Vigna radiata*) and black gram (*Vigna mungo*) are prominent pulse crops crucial for global food security and agricultural sustainability. However, these pulse crops face substantial yield losses due to YMV. Yellow Mosaic Disease (YMD), caused by the Mungbean yellow mosaic virus (MYMV), is a major biotic constraint affecting blackgram and greengram production. Field screening for YMD resistance is often unreliable, as plants may escape infection even under high inoculation pressure, making it challenging to accurately identify resistant lines. In this case, artificial Screening of Yellow Mosaic Virus Causing YMV Disease in Blackgram and Green Gram during *Kharif* Season was carried out to screen the YMV diseases in the glass house condition. The study was performed under glass house condition by following Completely randomized design with three replication. The aim of the study is to screen the entries for yellow mosaic virus disease under artificial condition. Among the forty-six entries tested, six entries—namely KUP 21-1, KUP 21-3, KUP 21-4, KUP 21-17, KUP 21-20, and KUP 21-21—were found to be highly resistant to MYMV. Additionally, one entry, KMP 21-1, was completely free from MYMV among the seventy-five entries screened. These resistant entries the potential to use these genotypes as donor sources for YMV resistance, facilitating indicate the development of high-yielding, MYMV-resistant varieties through backcross or marker-assisted backcross selection by introgressing resistance genes into agronomically superior but MYMVsusceptible genotypes.

Keywords Artificial screening, Blackgram, Greengram, YMV.

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INTRODUCTION

Blackgram (*Vigna mungo* (L.) Hepper) also known

as Urdbean, is one of the important pulse crops of India. India is the largest producer and also consumer of blackgram. It has surely marked itself as the most popular pulse and can be most consequently referred to as the "king of the pulses" due to its delicious taste and numerous other nutritional qualities. Blackgram is an excellent source of all nutrients, including minerals, vitamins, amino acids, proteins (25–26%), carbs (60%), and fat (1.5%). Due to its unique ability to fix atmospheric nitrogen in symbiotic association with Rhizobium bacteria found in the root nodules, it is a good leguminous crop that also functions as a mini-fertilizer depository (Ahmad *et al.* 2017). It is short duration pulse crop (Delic *et al.* 2009), usually flowering within 30–60 days of sowing and maturing within 60–90 days. Among various biotic and abiotic yield limiting factors, mungbean yellow mosaic disease (MYD) caused by mungbean yellow mosaic virus (MYMV) is the most destructive limiting factor in blackgram. Infection of MYMV may cause up to 85–100% yield loss in uradbean.

The virus is transmitted by white flies (*Bemisia tabaci*). Screening for MYMV resistance on field conditions has remained a failure due to environmental conditions, host nature and viral load. Field screening under diverse environmental conditions is the first step in identifying resistant lines. However, this approach is time-consuming, requires evaluation in 'hot spot' areas, and is often inefficient due to plants escaping infection even under heavy inoculation pressure (Selvi *et al.* 2006). MYMV symptoms may not always appear in the field due to factors such as environmental changes, whitefly genotypes, and host factors, leading to failed infections and making it difficult to identify truly resistant lines. Therefore, it is essential to screen genotypes using forced feeding methods, which ensure a 100% infection rate and standardized inoculum. Use of disease resistant varieties has been regarded as an economical and durable method for controlling the MYMV losses. Understanding how YMV resistance is inherited is essential for creating a breeding plan that incorporates beneficial genes that contribute to MYMIV resistance. Only a small number of conflicting studies on the resistance's gene and route of inheritance have been published. The most detrimental limiting factor in blackgram production is mungbean yellow mosaic disease (MYD), which is brought on by the mungbean yellow mosaic virus (MYMV), among other biotic and abiotic yield limiting factors. The main objective of this present study was to identify the resistant entries of blackgram an greengram against YMV under artificial condition.

MATERIALS AND METHODS

Whitefly transmission

Whitefly transmission study was conducted with *Bemisia tabaci* genera of whitefy and BG-14 germplasm of blackgram and greengram plants. Two genuine leaf stages were used for the study. The culture of whitefly (*Bemisia tabaci*) was maintained on disease free of blackgram and greengram plants. In an insect proof cage II, The blackgram and greengram plants were cultivated in earthen pots, and by swapping out the cotton plants, non-viruliferous whiteflies were kept alive throughout the year.

Collection of whiteflies and acquisition of virus

Whiteflies were collected using an aspirator. During the evening, the whiteflies were drawn into the aspirator from the cotton leaves' underside. After a while, the whiteflies were moved into the collection bottles. The collection container was prepared using a 25 cm long plastic bottle that tapered towards the mouth and had a 7.5 cm diameter at one end.

The bottom portion of the bottle was cut with a sharp knife, removed and covered with white muslin cloth. The other end was closed with a cotton plug so that the whitefly can't escape from it. A twig of infected blackgram and greengram plants plant showing mosaic and curling symptoms was inserted and held upright into the bottle containing whitefly and closed by the cotton plug immediately. Acquisition period of 24 h was given and after this period whitefly were again collected with the aspirator and used for transmission studies.

Inoculation of the virus

Plastic bottles 6.0 cm long with 4.0 cm in diameter were taken and the top and the bottom portion was

cut out using a sharp knife. White muslin cloth was pasted to one end to prevent whitefly from escaping and to avoid accumulation of excess moisture. The viruliferous white flies after acquisition period of 24 h were released into the bottle with the help of aspirator at the rate of 5–10 whiteflies per seedling. The seedlings were in two true leaf stage. After 24 h of inoculation feeding, the plastic bottle was sprayed with triazophos @ 0.15 per cent to kill the whitefly and prevent it from infecting other plants and plastic bottles were removed and plants were left undisturbed in insect proof cage III to observe appearance of symptoms.

Assessment of disease severity

It refers to degree of symptom expression and was assessed based on 1– 5 scale (Hahn *et al.* 1980) (Table 1) as follows.

Table 1. Score chart for YMV.

Grad	Description	Reaction
1	No. visible symptoms on leaves	Free
2	Small yellow specks with restricted spread covering 0.1–5% leaf area	Highly Resistant (HR)
3	Mottling of leaves covering 5.1–10% leaf area	Resistant (R)
4	Yellow mottling covering 10.1–15% leaf area	Moderately resistant (MR)
5	Yellow mottling and discolouration of 15.1–20% leaf area	Moderately susceptible (MS)
6	Yellow coloration of 20. 1–30% leaves and yellow pods	Susceptible (S)
7	Pronounced yellow mottling and discoloration of leaves and pods, reduction in leaf size and stunting of plants covering 30.1–50% of foliage	Susceptible (S)
8	Severe yellow discoloration of leaves covering 50.1–75% of foliage, stunting of plants and reduction in pod size	Highly susceptible (HS)
9	Severe yellowing of leaves covering above 75% of foliage, stunting of plants and no pod formation	HS

The number of plants under each grade was counted and multiplied with their representative grade and divided with total number of plant assessed for disease incidence. The plants scored with grade one (healthy) were not included for calculating the disease incidence (Sseruwagi *et al.* 2004).

RESULTS AND DISCUSSION

The forty six entries tested eight entries viz., KUP 21–1, KUP 21–3, KUP 21–4, KUP 21–17, KUP 21–20, KUP 21–21 were highly resistant to MYMV among the screened (Table 2 and Fig. 1). One entry

Table 2. Screening of IVT and AVT blackgram entries against virus diseases.

		MYMV	
Sl. No.	Entrie	1-9 grade	Disease Reaction
1	KUP 21-1	1	F
2	KUP 21-2	2	HR
3	KUP 21-3	1	F
4	KUP 21-4	1	F
5	KUP 21-5	2	HR
6	KUP 21-6	2	HR
7	KUP 21-7	4	MR
8	KUP 21-8	5	MS
9	KUP 21-9	5	MS
10	KUP 21-10	3	R
11	KUP 21-11	2	HR
12	KUP 21-12	2	HR
13	KUP 21-13	3	R
14	KUP 21-14	3	R
15	KUP 21-15	4	MR
16	KUP 21-16	2	HR
17	KUP 21-17	1	F
18	KUP 21-18	2	HR
19	KUP 21-19	2	HR
20	KUP 21-20	1	F
21	KUP 21-21	1	F
22	KUP 21-22	2	HR
23	KUP 21-23	2	HR
24	KUP 21-24	3	R
25	KUP 21-25	2	HR
26	KUP 21-26	2	HR
27	KUP 21-27	3	R
28	KUP 21-28	2	HR
29	KUP 21-29	2	HR
30	KUP 21-30	3	R
31	KUP 21-31	3	R
32	KUP 21-32	2	HR
33	KUP 21-33	2	HR
34	KUP 21-34	2	HR
35	KUP 21-35	3	R
36	KUP 21-36	3	R

Table 2. Continued.

Sl. No.	Entrie	MYMV 1-9 grade	Disease Reaction
37	KUP 21-37	3	R
38	KUP 21-38	4	MR
39	KUP 21-39	3	R
40	KUP 21-40	3	R
41	KUP 21-41	3	R
42	KUP 21-42	3	R
43	KUP 21-43	2	HR
44	KUP 21-44	2	HR
45	KUP 21-45	3	R
46	KUP 21-46	3	R
	Co 5 (susceptible check)	9	HS

Free- Free HR- Highly resistance R- resistance S-suceptible HS-Highly suceptible.

viz., KMP 21-1were free from MYMV among the thirty Seventy five screened (Table 3 and Fig. 2).

The disease incidence was recorded at every 15 days interval from 15 days after sowing. After sowing, the susceptible check lines began to show signs of yellow mosaic 15–20 days later. It first creates mildly intense yellow flecks that are dispersed on young leaves on vulnerable lines. The first fully-formed trifoliate leaf had spots of green and yellow that alternated after a few days. As time went on, the condition became more severe. At the end of August, a severe infection caused all of the check lines to become entirely yellow and each plant had five to ten white flies. Peeta Gopi 2016 *et al*. found that Six genotypes feel in the category of moderately resistant (MR) with rating scale of 2.1 to 4.0, three were moderately susceptible (MS) with rating of 4.1 to 5.0 ; two genotypes were susceptible (S) with rating of 5.1 to 7, and 35 genotypes were highly susceptible (HS) with rating 7.1 to 9. Babu Kakumanu and Rosaiah Gorrepati. 2017 found that four genotypes namely RSU-06, Pant U-31, TU-22 and RSU-03 in the present study were YMV resistant and genotypes NDUK15-222 and KUG-718 as susceptible ymv. Raghu Prasad *et al.* (2025) reported that the percent disease index (PDI%) ranged from 4 to 88.56, with disease ratings on a scale of 1 to 9. Only three genotypes, GBG-1, VBN-6 and VBG 12–062 found to be resistant with 1 disease rating scale and low per cent disease index values (4%, 5% and 8.5%). Despite strong virus inoculum pressure and the presence of the efficient virus transmitting cryptic whitefly species, ASIA-I. This variation may be attributed to factors such as geographical location, weather conditions, genotype differences, virulent virus strains, existing whitefly cryptic species, and their feeding preferences

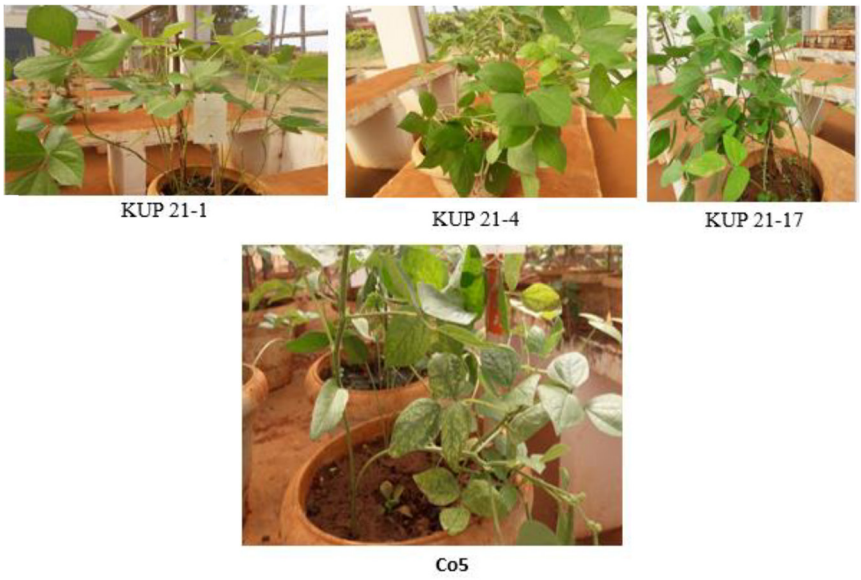

Fig. 1. Symptom expression on resistant blackgram of yellow mosaic disease at National Pulses Research center,Vamban.

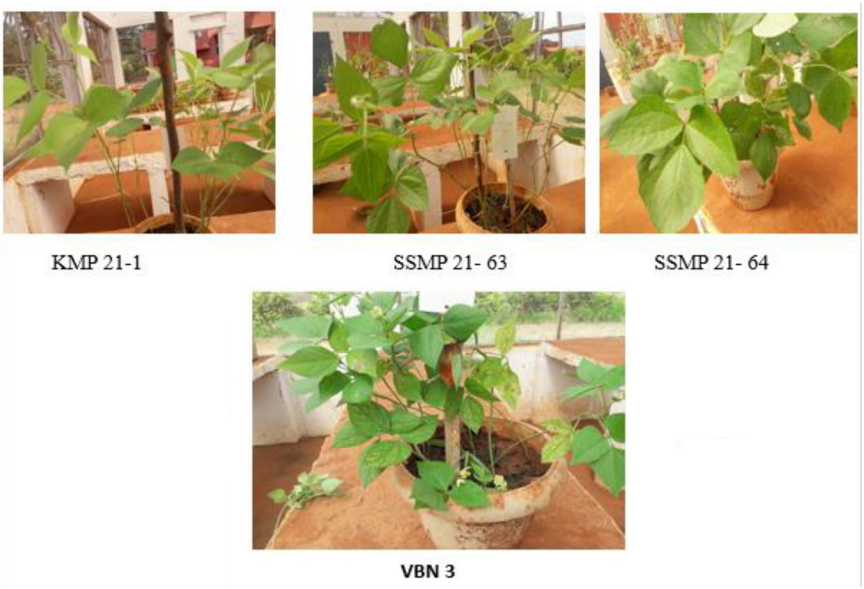

Fig. 2. Symptom expression on resistant greengram of yellow mosaic disease at National Pulses Research center,Vamban.

Table 3. Screening of IVT and AVT Greengram entries against virus diseases.

Sl. No.	Entries	MYMV 1-9 grade	Disease Reaction
1	KMP 21-1	1	F
2	KMP 21-2	2	HR
3	KMP 21-3	3	R
4	KMP 21-4	3	R
5	KMP 21-5	3	R
6	KMP 21-6	2	HR
7	KMP 21-7	2	HR
8	KMP 21-8	3	R
9	KMP 21-9	3	R
10	KMP 21-10	2	HR
11	KMP 21-11	2	HR
12	KMP 21-12	2	HR
13	KMP 21-13	3	R
14	KMP 21-14	4	MR
15	KMP 21-15	3	R
16	KMP 21-16	3	R
17	KMP 21-17	3	R
18	KMP 21-18	4	MR
19	KMP 21-19	4	MR
20	KMP 21-20	4	MR
21	KMP 21-21	3	R
22	KMP 21-22	4	MR
23	KMP 21-23	4	MR
24	KMP 21-24	3	R
25	KMP 21-25	4	MR
26	KMP 21-26	3	R
27	KMP 21-27	4	MR
28	KMP 21-28	3	R

Table 3. Continued.

Sl. No.	Entries	MYMV 1-9 grade	Disease Reaction
29	KMP 21-29	4	MR
30	KMP 21-30	4	MR
31	KMP 21-31	5	MS
32	KMP 21-32	3	R
33	KMP 21-33	3	R
34	KMP 21-34	3	R
35	KMP 21-35	4	MR
36	KMP 21-36	4	MR
37	KMP 21-37	4	MR
38	KMP 21-38	4	MR
39	KMP 21-39	3	R
40	KMP 21-40	3	R
41	KMP 21-41	3	R
42	KMP 21-42	3	R
43	KMP 21-43	3	R
44	KMP 21-44	3	R
45	KMP 21-45	2	HR
46	KMP 21-46	2	HR
47	KMP 21-47	3	R
48	KMP 21-48	3	R
49	KMP 21-49	3	R
50.	KMP 21-50	3	R
51	KMP 21-51	3	R
52	KMP 21-52	2	HR
53	KMP 21-53	3	R
54	KMP 21-54	2	HR
55	KMP 21-55	2	HR
56	KMP 21-56	2	HR
57	KMP 21-57	3	R

Table 3. Continued.

Sl. No.	Entries	1-9 grade	MYMV Disease Reaction
58	KMP 21-58	2	HR
59	KMP 21-59	2	HR
60	KMP 21-60	2	HR
61	KMP 21-61	3	R
62	KMP 21-62	3	R
63	KMP 21-63	2	HR
64	KMP 21-64	2	HR
65	KMP 21-65	2	HR
66	KMP 21-66	3	R
67	KMP 21-67	3	R
68	KMP 21-68	3	R
69	KMP 21-69	3	R
70	KMP 21-70	3	R
71	KMP 21-71	3	R
72	KMP 21-72	4	MR
73	KMP 21-73	4	MR
74	KMP 21-74	3	R
75	KMP 21-75	3	R
76	Co5 (Suceptible check)	9	HS

Note: F- Free HR- Highly resistance R- resistance S-suceptible HS- Highly suceptible.

for specific germplasm. Under field conditions, higher temperatures lead to increased whitefly populations, whereas high rainfall and humidity negatively affect whitefly build-up. Due to these environmental constraints, natural field screening may not accurately differentiate resistance levels. In contrast, under screen house conditions, resistant genotypes may show moderate resistance, and moderately resistant genotypes may exhibit susceptibility or high susceptibility. (Deepa *et al.* 2017) This variation is attributed to factors such as the presence of highly infective cryptic whitefly species, strong disease inoculum pressure, and the forced feeding of viruliferous whiteflies on specific genotypes. Screen house conditions eliminate the chance of avoiding whitefly feeding, allowing for a true expression of resistance or susceptibility to YMD. The forced feeding method is an effective tool for validating resistance sources or confirming resistance in field-screened genotype.

CONCLUSION

The entries KUP 21-1, KUP 21-3, KUP 21-4, KUP 21-17, KUP 21-20, KUP 21-21 were highly resistant to MYMV in Blackgram . One entry viz., KMP 21-1 were free from MYMV in green gram under glass house conditions, these genotypes can be used in resistance breeding programme against yellow mosaic virus disease. High Yield, yellow mosaic virus disease resistance and other agronomic characters can be considered to develop varieties suitable for different agro ecological zones.

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