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Research Article

FIELD EVALUATION OF HORSEGRAM GERMPLASM/ GENOTYPES AGAINST HORSEGRAM YELLOW MOSAIC VIRUS (HgYMV) DISEASE AND BIOLOGICAL TRANSMISSION OF HORSEGRAM YELLOW MOSAIC VIRUS TO DIFFERENT LEGUMINOUS HOSTS THROUGH WHITE FLIES

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Abstract- Evaluation of horsegram germplasm/ genotypes against Horsegram yellow mosaic virus (HgYMV) disease under field conditions showed that out of 110 horsegram germplasm lines screened during 2012, none were free from the disease. Five genotypes *viz.,* AK-38, HG-GP, DPI-2278, Paiyur-1 and Paiyur-2 recorded highly resistant reaction. Only three genotypes were resistant (PHG-9, AK-42, BGM-1) and two genotypes *i. e.,* AK-21, AK-26 showed moderately resistant reaction and the remaining were moderately susceptible, susceptible and highly susceptible. The biological transmission studies revealed that 100 per cent infection obtained in horsegram followed by pole bean, french bean, ring bean, lima bean and soybean with 90, 70, 60, 50 and 40 per cent infection respectively. The virus could not be transmitted to other plant species *viz*., greengram, blackgram, cowpea, pigeon pea, yard long bean, field bean, moth bean, rice bean and cluster bean.

Key words- Field evaluation, Resistance, Horsegram yellow mosaic virus (HgYMV), Biological transmission, White fly

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Introduction

Horsegram (*Macrotyloma uniflorum* (Lam.) Verdc.) commonly known as kulthi, is one of the hardiest and drought tolerant crops, grown extensively in peninsular India as poor man's pulse crop. Horsegram is an indigenous plant cultivated in India, other Asian countries and Africa [1]. Among viral diseases, yellow mosaic virus is one of the major constraints for its cultivation in peninsular India and was first observed in southern districs of Karnataka. Horsegram yellow mosaic disease transmitted by white fly, *Bemisia tabaci* (Gennadius) was prevalent in most parts of South India [2-4]. The disease incidence ranged from 50 to 100 per cent in both summer and early rainy season crops causing substantial loss in grain yield [5].

The disease causes yellow discoloration on the leaves that leads to irregular, small, greenish yellow mosaic symptoms. Severe infection led to stunted growth of the plant and reduction in the leaf size [6]. Isolation, purification, electron microscopic and serological studies of HgYMV have been studied.

The only way to overcome YMV problem is the development of disease resistant varieties. The control of this disease through pesticides is not feasible. Only alternate to overcome this devastating disease is development of resistant varieties against YMV. In the present investigations an effort has been made to evaluate horsegram germplasm lines to obtain sources of resistance against HgYMV. In order to find out the source of perpetuation of HgYMV, fifteen plant species belonging to Leguminaceae were inoculated with HgYMV from horsegram.

Material and Methods

Evaluation of germplasm

Studies were undertaken to test the resistance of horsegram germplasm/ genotypes cultivars against yellow mosaic virus disease. Field experiments were conducted at Zonal Agricultural Research Station, GKVK, Bangalore during 2012. Totally, 110 horsegram genotypes were screened against HgYMV under field condition during 2012. Each genotype was sown in five meter long rows. A susceptible genotype (HG-22) was planted after every five tester lines to serve as a source for disease (infector row technique). The per cent disease incidence in each genotype was recorded at fifteen days interval and they were grouped into different categories employing disease scoring scale as suggested by Borah *et al.* (1992) [7].

Per cent disease incidence (PDI) was calculated by using the following formula.

$$\text{Per cent disease incidence} = \frac{\text{Number of plants infected}}{\text{Total number of plants}} \times 100$$

The genotypes were later grouped into different categories based on 1 to 7 scale from immune to highly susceptible according to Borah *et al.* (1992).

Scale	Description	Category
1	0.0 Per cent disease incidence	Free (F)
2	Less than 10 Per cent disease incidence	Highly Resistant (HR)
3	10-20 Per cent disease incidence	Resistant (R)
4	20-30 Per cent disease incidence	Moderately Resistant (MR)
5	30-50 Per cent disease incidence	Moderately Susceptible (MS)
6	50-70 Per cent disease incidence	Susceptible (S)
7	70 and above Per cent disease incidence	Highly susceptible (HS)

Biological transmission

Virus culture was maintained by inoculating healthy horse gram (Var. HG-22) plants using viruliferous adult *B. tabaci*. The culture of indigenous whiteflies (*B. tabaci* Genn.) used for transmission were maintained on cotton, *Gossypium hirsutum cv.* Varalakshmi. 15 different leguminous hosts were tested for their susceptibility to yellow mosaic virus. Seeds of these species were raised in an insect proof glass house. Plants at the two to three-leaf stage were inoculated with 20-25 viruliferous whiteflies with a 24-h acquisition access period (AAP) and 48-h inoculation access period (IAP).The inoculated seedlings were kept in insect proof glasshouse for development of symptoms.

Results and Discussion

Evaluation of germplasm

During 2012, a total of one hundred and ten horsegram germplasm lines were screened for yellow mosaic virus disease of horsegram resistance under field conditions [Plate-1 and 2]. The incidence of HgYMV disease ranged between 4.34-94.73 per cent. Out of one hundred and ten horsegram germplasm lines screened, none of the lines were free from the disease. Five genotypes *viz.,* AK-38, HG-GP, DPI-2278, Paiyur-1 and Paiyur-2 recorded highly resistant reaction. Only three genotypes were resistant to horsegram yellow mosaic virus disease (PHG-9, AK-42 and BGM-1). Only two genotypes *i. e.,* AK-21, AK-26 showed moderately resistant reaction. Two genotypes were moderately susceptible (TCR-587, TCR-66A) to the virus. About ten genotypes were susceptible to horsegram yellow mosaic virus (TCR-288-A, TCR-28-A, TCR-584-A, TCR-232-A, TCR-524, TCR-543-A, TCR-179-A, TCR-29-A, TCR-170-A and TCR-580). Remaining eighty eight genotypes TCR-636, TCR-425-A, TCR-489-A, TCR-450-A, TCR-724-A, TCR-216, TCR-59-A, TCR-356-A, TCR-757, TCR-562, TCR-806, TCR-766, TCR-434-A, TCR-201, TCR-773, TCR-307-A, TCR-777, TCR-594, TCR-557-A, TCR-6, TCR-230, TCR-282-A, TCR-813, TCR-432-A, TCR-51-A, TCR-522-A, TCR-843, TCR-795, TCR-620, TCR-592, TCR-200, TCR-803, TCR-243-A, TCR-544, TCR-713-A, TCR-193-A, TCR-566, TCR-568, TCR-784, TCR-779, TCR-184, TCR-225, TCR-603, TCR-565-A, TCR-151-A, TCR-167-A, TCR-722, TCR-731-A, TCR-841, TCR-577, TCR-239-A, TCR-47, TCR-116-A, TCR-558, TCR-606, TCR-782, TCR-643, TCR-278-A, TCR-838, TCR-202, TCR-392-C, TCR-134-A, TCR-537, TCR-466-A, TCR-179-B, TCR-74-A, TCR-549, TCR-224-A, TCR-117-A, TCR-171-A, TCR-564, TCR-532, TCR-222-A, TCR-206-A, TCR-179-B, TCR-266-A, TCR-189-A, TCR-526, TCR-809, TCR-726, TCR-588A, TCR-244-A, TCR-720-A, TCR-453-A, TCR-780, TCR-610, TCR-627, TCR-215-A and TCR-797 showed highly susceptible response. Different horsegram germplasm lines that fall in each category were grouped in [Table-1 and 2].

Plate-1 Horsegram plants showing typical symptoms of yellow mosaic virus

Plate-2 General view of field screening of available horsegram genotypes for reistance to HgYMV during during 2012

Table-1 *Field evaluation of horsegram germplasm/ genotypes against Horsegram yellow mosaic virus (HgYMV) disease during 2012*

Sl. No.	Genotypes	Percent disease incidence at 15 days interval					
		15	30	45	60	75	Reaction
1.	TCR-636	20	45	60	75	85	HS
2.	TCR-425-A	22.72	50	63.63	77.27	86.36	HS
3.	TCR-489-A	14.28	38.09	57.14	71.42	80.95	HS
4.	TCR-450-A	29.16	50	58.33	83.33	91.66	HS
5.	TCR-724-A	0	22.22	38.88	55.55	72.22	HS
6.	TCR-216	17.39	34.78	52.17	65.21	78.26	HS
7.	TCR-59-A	13.63	31.81	45.45	59.09	72.72	HS
8.	TCR-356-A	10.52	31.57	52.63	68.42	84.21	HS
9.	TCR-288-A	9.09	27.27	40.90	54.54	68.18	S
10.	TCR-757	15.38	34.61	53.84	69.23	80.76	HS
11.	TCR-28-A	10.71	28.57	42.85	53.57	64.28	S
12.	TCR-562	14.28	38.09	57.14	71.42	85.71	HS
13.	TCR-806	11.11	27.77	44.44	66.66	83.33	HS
14.	TCR-766	25	42.85	57.14	67.85	75	HS
15.	TCR-434-A	0	28.57	57.14	71.42	85.71	HS
16.	TCR-584-A	15.38	26.92	38.46	53.84	69.23	S
17.	TCR-201	0	22.22	55.55	66.66	77.77	HS
18.	TCR-773	23.33	33.33	50	63.33	73.33	HS
19.	TCR-307-A	29.16	50	62.50	75	87.50	HS
20.	TCR-777	29.03	48.38	58.06	67.74	77.41	HS
21.	TCR-594	23.52	41.17	58.82	76.47	88.23	HS
22.	TCR-557-A	21.73	34.78	52.17	65.21	78.26	HS
23.	TCR-6	22.52	44.44	66.66	88.88	88.88	HS
24.	TCR-230	26.08	56.52	60.86	73.91	82.60	HS
25.	TCR-282-A	25	40	60	90	90	HS
26.	TCR-813	27.77	55.55	77.77	83.33	88.88	HS
27.	TCR-432-A	26.08	56.52	73.91	82.60	91.30	HS
28.	TCR-51-A	26.92	46.15	53.84	73.07	80.76	HS
29.	TCR-522-A	26.92	46.15	61.50	76.92	84.61	HS
30.	TCR-843	23.07	46.15	69.23	76.92	84.61	HS
31.	TCR-795	22.22	33.33	50	66.66	83.33	HS
32.	TCR-620	7.14	28.57	50	71.42	85.71	HS
33.	TCR-592	23.80	42.85	57.14	71.42	85.71	HS
34.	TCR-200	16.66	50	55.55	61.11	77.77	HS
35.	TCR-803	11.11	33.33	50	66.66	77.77	HS
36.	TCR-243-A	27.27	54.54	72.72	81.81	90.90	HS
37.	TCR-544	28	52	28	68	80	HS
38.	TCR-232-A	15.78	31.57	36.84	52.63	68.42	S
39.	TCR-713-A	13.63	27.27	63.63	77.27	90.90	HS
40.	TCR-193-A	14.81	29.62	51.85	81.48	92.59	HS
41.	TCR-566	22.72	45.45	54.54	68.18	81.81	HS
42.	TCR-568	10	25	50	59.09	80	HS
43.	TCR-784	23.07	53.84	69.23	84.61	84.61	HS
44.	TCR-779	22.72	45.45	63.63	77.27	90.47	HS
45.	TCR-184	20	53.33	66.66	93.33	93.33	HS
46.	TCR-225	11.76	35.29	64.70	76.47	88.23	HS
47.	TCR-603	20	50	60	80	90	HS
48.	TCR-565-A	25	45	60	70	85	HS
49.	TCR-151-A	26.08	52.17	65.21	78.26	86.95	HS
50.	TCR-167-A	24	36	52	64	76	HS
51.	TCR-524	23.07	34.61	46.15	57.69	69.23	S
52.	TCR-722	27.27	68.18	77.27	90.90	90.90	HS
53.	TCR-543-A	17.24	34.48	44.82	55.17	65.51	S
54.	TCR-731-A	16.66	50	66.66	79.16	87.50	HS
55.	TCR-841	25	33.33	66.66	75	87.50	HS
56.	TCR-577	28.57	52.38	66.66	80.95	90.47	HS
57.	TCR-239-A	26.92	46.15	57.69	76.92	88.46	HS
58.	TCR-47	17.39	34.78	60.86	78.26	86.95	HS
59.	TCR-116-A	26.08	47.82	56.52	69.56	82.60	HS
60.	TCR-558	26.92	46.15	53.84	80.76	88.46	HS
61.	TCR-606	26.08	47.82	65.21	78.26	91.30	HS
62.	TCR-782	17.64	47.05	70.58	82.35	88.23	HS
63.	TCR-643	12.50	31.25	50	75	87.50	HS
64.	TCR-278-A	15.78	47.36	63.15	73.68	84.21	HS
65.	TCR-838	11.76	29.41	47.05	70.58	88.23	HS
66.	TCR-202	28.57	52.38	61.90	71.42	85.71	HS
67.	TCR-392-C	15.38	26.92	46.15	76.92	84.61	HS
68.	TCR-134-A	11.76	29.41	70.58	88.23	94.11	HS
69.	TCR-537	20.83	37.50	58.33	79.16	87.50	HS

70.	TCR-466-A	26.31	52.63	63.15	84.21	94.73	HS
71.	TCR-179-A	14.28	28.57	42.85	53.57	64.28	S
72.	TCR-74-A	28	48	64	72	84	HS
73.	TCR-549	20	45	70	85	90	HS
74.	TCR-224-A	16.66	38.88	55.55	66.66	83.33	HS
75.	TCR-117-A	16.66	37.50	50	62.50	75	HS
76.	TCR-171-A	25	45	50	70	80	HS
77.	TCR-564	22.22	50	72.22	88.88	88.88	HS
78.	TCR-532	20.83	41.66	58.33	75	87.50	HS
79.	TCR-222-A	22.22	55.55	77.77	77.77	88.88	HS
80.	TCR-206-A	29.62	51.85	66.66	74.07	85.18	HS
81.	TCR-179-B	28	52	64	76	84	HS
82.	TCR-266-A	30	60	75	90	90	HS
83.	TCR-189-A	20.8	41.66	66.66	75	87.50	HS
84.	TCR-526	22.72	45.45	68.18	81.81	90.90	HS
85.	TCR-809	15	35	50	65	80	HS
86.	TCR-29A	12.5	29.16	41.66	54.16	66.66	S
87.	TCR-726	13.33	46.66	66.66	86.66	93.33	HS
88.	TCR-588A	25	50	65	80	90	HS
89.	TCR-170-A	20.83	33.33	41.66	54.16	62.50	S
90.	TCR-244-A	20	35	50	65	80	HS
91.	TCR-720-A	0	42.85	71.42	85.71	85.71	HS
92.	TCR-453-A	27.27	68.18	72.72	90.90	90.90	HS
93.	TCR-780	25	40	60	75	90	HS
94.	TCR-610	31.81	45.45	63.63	77.27	86.36	HS
95.	TCR-587	0	0	4.54	18.18	31.81	MS
96.	TCR-66A	0	0	7.69	19.23	30.76	MS
97.	TCR-580	0	0	31.57	47.36	63.15	S
98.	TCR-627	0	0	35.71	57.14	85.71	HS
99.	TCR-215-A	0	0	42.85	64.28	85.71	HS
100.	TCR-797	0	0	20	50	80	HS
101.	AK-21	0	0	0	13.33	26.66	MR
102.	AK-26	0	0	0	13.33	26.66	MR
103.	AK-38	0	0	0	0	5.88	HR
104.	HG-GP	0	0	0	0	4.54	HR
105.	PHG-9	0	0	0	0	16.66	R
106.	DPI-2278	0	0	0	0	4.34	HR
107.	Paiyur-1	0	0	0	0	7.69	HR
108.	Paiyur-2	0	0	0	0	5.55	HR
109.	AK-42	0	0	0	0	18.75	R
110.	BGM-1	0	0	0	0	16.66	R

F- Free, HR- Highly resistant, R- Resistant, MR- Moderately resistant, MS- Moderately susceptible, S- Susceptible, HS- Highly susceptible.

Evaluation of germplasm lines for disease resistance is a crucial step in controlling plant diseases host plant resistance. The resistant genotypes or the germplasm lines identified through field screening helps in the management of the YMV disease. Earlier studies indicated that identification of resistant sources to YMV is a reliable option for controlling YMV disease. However, critical investigations are necessary to ascertain the resistance level in the germplasm lines and to further confirm them to finally include in breeding programmes. Similar types of genotypic evaluations were previously documented by several workers [8-15].

The chemical methods recommended for the management of HgYMV are not economical and practicable because of very low yield potential of the crop. The only feasible and economical method for the control of HgYMV disease is the development of resistant varieties. For this purpose, there is a need to screen large number of germplasm lines to identify the resistant source to HgYMV. In the present study, the available horsegram lines have been evaluated under field conditions with a view to identify resistant sources for HgYMV. The genotypes identified in the present study can be used in breeding programme for developing tolerant varieties.

Biological transmission

In order to know the susceptibility to yellow mosaic virus, 15 different species of Leguminaceae were inoculated using 20-25 viruliferous *Bemisia tabaci* giving 24 hour AAP and 48 hour IAP. Fifteen plant species belonging to Leguminaceae were inoculated with HgYMV by using viruliferous vector (whiteflies) under insect proof glass house. The percentage of transmission of horsegram yellow mosaic virus ranged from 40-100 per cent. Horsegram showed 100 per cent infection followed by pole bean, french bean, ring bean, lima bean and soybean with 90, 70, 60, 50 and 40 per cent infection, respectively. The results studied presented in [Table-3], indicated that the virus causing horsegram yellow mosaic could infect horse gram, pole bean, french bean, ring bean, lima bean and soybean whereas, the virus could not be transmitted to other plant species *viz*., greengram, blackgram, cowpea, pigeon pea, yard long bean, field bean, moth bean, rice bean and cluster bean. The virus induced typical yellow mosaic patches on horsegram, pole bean, french bean, ring bean, lima bean and soybean 10-15 days after inoculation [Plate-3]. However, virus transmission rates or percent infection varied from host to host. This difference in transmission rates and expression of virus symptoms on crops could be due to preference and also host biochemical compositions of *B. tabaci*, which may interfere with virus multiplications [16,17].

The host range of most of the yellow mosaic viruses of legume restricted to Leguminaceae or Fabaceae species [18, 19]. The bright yellow patches on leaves and reduced pod size were recorded by Capoor and Varma (1948), Yaraguntaiah and Govindu (1964) in lima bean infected with yellow mosaic virus [20,21]. Muniyappa *et al*. (1976) reported that out of 18 leguminous species inoculated with HgYMV through whiteflies, 11 leguminous species were found to infected, showing clear yellow mosaic symptoms. The percentage of transmission ranged from 20-100 per cent whereas incubation period in most of the tested plants was found to be 7-15 days, except for *Cajanus cajan*, *Centrosema* sp. and *Phaseolus atropurpureus*. The percentage of transmission and incubation period in the test plant varied depending on the host inoculated. Maramorosch and Muniyappa (1981) reported bright yellow mosaic patterns on the leaves, downward rolling of leaves and stunted growth in french bean plants infected with yellow mosaic virus disease [22].

Table-2 *Grouping of horsegram genotypes/ germplasm lines into different degree of resistance against Horsegram yellow mosaic virus(HgYMV) disease during 2012 under field condition*

Scale	Reaction	Genotypes	Total
1	Free (F)	-	0
2	Highly Resistant (HR)	AK-38, HG-GP, DPI-2278, Paiyur-1, Paiyur-2	5
3	Resistant (R)	PHG-9, AK-42, BGM-1	3
4	Moderately Resistant (MR)	AK-21, AK-26	2
5	Moderately Susceptible (MS)	TCR-587, TCR-66A	2
6	Susceptible (S)	TCR-288-A,TCR-28-A, TCR-584-A, TCR-232-A, TCR-524, TCR-543-A, TCR-179-A, TCR-29-A, TCR-170-A, TCR-580	10
7	Highly susceptible (HS)	TCR-636, TCR-425-A, TCR-489-A, TCR-450-A, TCR-724-A, TCR-216, TCR-59-A, TCR-356-A, TCR-757, TCR-562, TCR-806, TCR-766, TCR-434-A, TCR-201, TCR-773, TCR-307-A, TCR-777, TCR-594, TCR-557-A, TCR-6, TCR-230, TCR-282-A, TCR-813, TCR-432-A, TCR-51-A, TCR-522-A, TCR-843, TCR-795, TCR-620, TCR-592, TCR-200, TCR-803, TCR-243-A, TCR-544, TCR-713-A, TCR-193-A, TCR-566, TCR-568, TCR-784, TCR-779, TCR-184, TCR-225, TCR-603, TCR-565-A, TCR-151-A, TCR-167-A, TCR-722, TCR-731-A, TCR-841, TCR-577, TCR-239-A, TCR-47, TCR-116-A, TCR-558, TCR-606, TCR-782, TCR-643, TCR-278-A, TCR-838, TCR-202, TCR-392-C, TCR-134-A, TCR-537, TCR-466-A, TCR-74-A, TCR-549, TCR-224-A, TCR-117-A, TCR-171-A, TCR-564, TCR-532, TCR-222-A, TCR-206-A, TCR-179-B, TCR-266-A, TCR-189-A, TCR-526, TCR-809, TCR-726, TCR-588A, TCR-244-A, TCR-720-A, TCR-453-A, TCR-780, TCR-610, TCR-627, TCR-215-A, TCR-797	88

F- Free, HR- Highly resistant, R- Resistant, MR- Moderately resistant, MS- Moderately susceptible, S- Susceptible, HS- Highly susceptible

Table-3 *Biological transmission of horsegram yellow mosaic virus to different leguminous hosts through white flies under glasshouse condition*

Sl. No.	Host plants	Scientific name	Number of plants infected	Per cent infection (%)	Type of symptom
1.	Horse gram	*Macrotyloma uniflorum*	10	100	YL, SG
2.	Pole bean	*Phaseolus vulgaris* L.	9	90	BYP, SG and YL
3.	French bean	*Phaseolus vulgaris*	7	70	BYP, SG and YL
4.	Soybean	*Glycine max*	4	40	BYP and YL
5.	Lima bean	*Phaseolus lunatus*	5	50	BYP, SG and YL
6.	Ring bean	*Phaseolus* Sp.	6	60	BYP, SG and YL
7.	Green gram	*Vigna radiata*	0	0	-----
8.	Black gram	*Vigna mungo*	0	0	-----
9.	Cow pea	*Vigna unguiculata*	0	0	-----
10.	Pigeon pea	*Cajanus cajan*	0	0	-----
11.	Yard long bean	*Vigna unguinculata* sub sp. *sesquipedalis*	0	0	-----
12.	Field bean	*Lablab purpureus*	0	0	-----
13.	Moth bean	*Vigna aconitifolia*	0	0	-----
14.	Rice bean	*Vigna umbellata*	0	0	-----
15.	Cluster bean	*Cyamopsis tetragonoloba*	0	0	-----

BYP-Bright yellowish patches, SG - stunted growth, YL- Yellowing of leaves

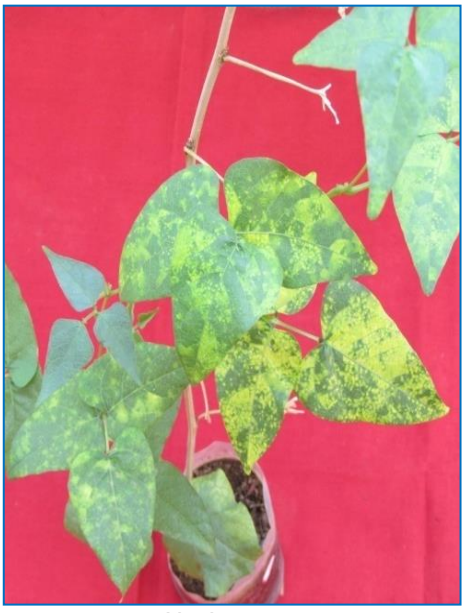
No. of plants inoculated: 10 No. of viruliferous whiteflies used: 20 -25

AAP: 24 hrs IAP: 48 hrs

Polebean

Ringbean

Frenchbean



Limabean

Horsegram

Soybean

Plate-3 Leguminous host plants showing symptoms of HgYMV inoculated using whiteflies

Only two (*L. purpureus*and *L. purpureus var. typicum*) of the 36 plant species inoculated with DoYMV produced symptoms in the glasshouse. None of the other 11 species of the family fabaceae developed symptoms. The seven *Nicotiana* spp. also failed to show symptoms indicating that Dolichos yellow mosaic virus was distinct also by having a narrow host range [23]. Deepa *et al.* (2017) revealed that the causal virus of the yellow mosaic disease of greengram disease was successfully transmitted from greengram to greengram (*Vigna radiata*), *Nicotiana benthamiana*, Blackgram (*V. mungo*), Horsegram (*Macrotyloma uniflorum*), Pigeonpea (*Cajanus cajana*) Soybean (*Glycine max*), Cowpea (*V. ungiculata*) and weed hosts *viz*., *Acalypha indica*, *Malvestrunm coromandelium, Croton bonplandianum, Euphorbia geniculata, Alternenthera sessile* and *Phyllanthus madraspatensis*, while *Parthenium hysterophorus* did not show any symptoms [24].

It is obvious that there will be no virus problem if the crop is free of virus when planted and when there is no source of infection in the field, or none near enough to allow it to spread into the crop. The extent to which it will be worthwhile to attempt to eliminate sources of infection in the field can only be decided on the basis of a detailed knowledge of such sources and of the ways in which the virus spreads. The plant viruses survive on several weed hosts which may be perennial or annual, or on other crop plants or on the volunteer plants. So, the biological transmission study was conducted to find out the probable alternate hosts which helps in the survival of yellow mosaic virus inoculum which is essential for the further spread of the disease.

Conclusions

At present the screening is done under natural infestation, the intensity of disease is very high. However, screening will help in breeding for durable resistance against YMV in horsegram. Identification of resistant genotypes is one of the most important aspects in the management of viral diseases, which will be the best possible solution to the viral disease problems. In an attempt to study the possible role of the other cultivated crops in perpetuation of this virus, this study was conducted with fifteen crop plants belonging to Leguminosae. The insect vector plays a major role in determining the natural host range of these viruses. This also shows that these crops grown in and around horsegram fields may act as reservoir for virus and *B. tabaci* would help in spread and severity of disease in horsegram.

Application of research: The present research helps in breeding resistant varieties against HgYMV and also suggests to remove the alternate hosts of HgYMV.

Research Category: Agriculture/Plant Pathology/Plant Virology

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Abbreviations:

HgYMV-Horsegram yellow mosaic virus
AAP-Acquisition access period
IAP-Inoculation access period
F-Free
HR-Highly resistant
R-Resistant
MR-Moderately resistant
MS-Moderately susceptible
S-Susceptible
HS-Highly susceptible
BYP-Bright yellowish patches
SG -Stunted growth
YL- Yellowing of leaves

Conflict of Interest: None declared

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