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SCREENING OF GENOTYPES AGAINST SESAME PHYLLODY DISEASE

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Abstract–Phyllody of sesame is an important disease caused by a pleomorphic phytoplasma and is transmitted by a leaf hopper called *Orosius albinctus*. The affected plants become stunted and floral parts are modified in to leafy structures bearing no fruits and seeds causing yield. In this view, a field experiment was conducted at PC unit Sesame and Niger farm field. Twenty genotypes were evaluated for various plant traits and screening against sesame phyllody disease in protected (Polyhouse) and unprotected (field) condition. Among the twenty genotypes, all genotype were found to be moderately resistant against phyllody under natural field condition. However no symptoms were observed in all 20 genotypes under protective (Polyhouse) condition. The yield contributing characters of sesame plants, i.e. plant height; number of capsules per plant, test weight was adversely affected due to phyllody. There was reduction in number of capsules, plant height, and yield and test weight in infected plant in comparison to healthy plants due to the phyllody disease.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is a significant oil seed crop in India that is valued for its high edible oil content (about 50%), wholesome protein content (about 23%), and enough carbohydrate (15%) content (Ranganatha *et al*., 2012). Because sesame seeds are a high source of linoleic acid, Vitamin E, A, B1 and B2, their medicinal benefit is acknowledged on a global scale (Brar and Ahuja, 1980). The antioxidants (seasmin, seasminol, and sesamolin) included in sesame seeds greatly boost their medicinal efficacy (Bedigian *et al.,* 1985; Moazzami, 2006; El-Bramway, 2010). The crop is grown in a variety of climates, from the semi-arid tropics and subtropics to temperate regions of the world (Raikwar and Srivastava, 2013).

India is the world's top producer of sesame seeds (FAO, STAT, 2016). Sesame cultivation covers 15.62 million hectares in India and yields 7.10 lakh tonnes at productivity of 502 kg/hectare (Anonyms, 2020). It is grown on 3.15 lakh hectares in Madhya Pradesh, where it produces 1.7 lakh tonnes at a productivity of 502 kg/ha (Anonyms, 2020). The crop is widely grown in Madhya Pradesh in Tikamgarh, Chhattarpur, Panna, Datia, Gwalior, Shivpuri, Bhind, and Murrena.

Sesame (*Sesamum indicum* L.) is continuously threatened by a number of diseases, including powdery mildew, leaf blight, wilt, stem blight, bacterial leaf spot, and phyllody. The most commercially significant disease affecting sesame is phyllody, which was once thought to be brought on by a virus but was later identified as mycoplasma-like organisms (MLO) and, more recently, as phytoplasma (Das and Mitra, 1998) and causes severe losses in yield. Phytoplasma have many host range. A new report of a phytoplasma with phyllody and little leaf disease of periwinkle in Madhya Pradesh (Gupta, 2015) and parthenium (*Parthenium hysterophorus*) (Gupta 2015 a) Phytoplasma (Mycoplasma-like organisms) are specialised bacteria that lack a cell wall and are present in plant sieve components and some insect vectors. They are obligate parasites. They are spread from one plant to another by psyllids, leafhoppers,

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plant hoppers, and insects that feed on phloem. Virus was once thought to be the source of the yellow plant illness, but the virus could not be seen in the damaged plants (Lee and Davis, 1992). The plant infections that cause yellow disease, called phytoplasma, were initially identified by Japanese researchers (Doi *et al*., 1967). Affected plants remain partially or completely sterile, resulting in total loss of yield. As much as 10-100 per cent incidence of the phyllody disease has been recorded in sesame crop in India (Brar and Ahuja, 1979). Prasad *et al.* (1997) reported up to 50% yield loss due to phyllody from Warangal and Karimnagar districts of Andhra Pradesh. Krishnaswamy and Jayarajan (1983) reported 30 per cent loss in seed yield of sesame due to phyllody infection in Coimbatore (Tamil Nadu).

Phytoplasma are sap-sucking insect vectors from the families Cicadellidea (leaf hopper) and Fulgoridea (plant hopper) that are surrounded by a single-unit membrane, lack a rigid cell wall, and are pleomorphic in shape with an average diameter of 0.2-0.8 m (Doi *et al*., 1967; McCoy *et al*., 1989). They can also be propagated vegetatively through graft (Lee and Davis, 1992). Contrary to viruses, they are not mechanically spread through the injection of phytoplasma containing sap from afflicted plants. Treatment of infected plants with tetracycline, weed destruction and use of systematic insecticide to control leafhopper has been unsuccessful. But, Use of resistant genotype is considered as an economical and durable method for controlling this disease

In view of the seriousness of the disease the present study was carried out to screen different genotypes of sesame against phyllody disease under natural field condition and protected condition.

MATERIALS AND METHODS

Field screening of sesame genotype lines

Screening of sesame genotypes against sesame phyllody caused by phytoplasma was carried out to identify the source or sources of resistance. Twenty genotypes were used for screening of phyllody disease in kharif- 2018 under natural field and green house condition. Control measures were not taken using protection chemicals to allow maximum inocula of phyllody. Per cent disease incidence indicates the amount of disease present in the block. Per cent disease incidence is the ratio of number of plants infected to the total number of plants multiplied by hundred. Formula given by (Akhtar *et al*., 2013)

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

Observations recorded for Field screening of phyllody disease

Appearance of symptoms

The symptoms appearing on the plants were recorded at both vegetative and reproductive crop growth stage and also at maturity stage, the symptoms dwarfing, streak on leaf, floral virescence, floral proliferation, bunchy appearance and phyllody was recorded.

Stage of crop

At different stages of the crop symptoms appearing on the plant were recorded at the interval of 45 days after sowing (DAS) and 65 (DAS) observations was recorded.

Screening method

Phyllody disease is screened by using the Disease scoring scale (0-6). This Scale is provided by (Akhtar *et al*., 2013).

Disease scoring scale (0-6) for phyllody disease

Rating	Percentage disease incidence (%)	Disease Reaction
0	No symptoms on any plant	Highly resistant
1	0.1-10	Resistant
2	10.1-20	Moderately resistant
3	20.1-30	Tolerant
4	30.1-40	Moderately susceptible
5	40.1-50	Susceptible
6	More than 50%	Highly susceptible

RESULTS AND DISCUSSION

Screening of genotypes against sesame Phyllody disease

During Kharif (2018) occurrence of phyllody was noted in the range of 11.32-20.50 per cent in different genotype lines under natural field conditions in scattered manner and spread of disease was very slow. The first affected plant was observed at 50 days and maximum affected plants at 65 days after sowing in field conditions.

All genotypes *viz*., RT-351, RT-346, RT-384, Rama, RT-103, RT-125, RT-127, TKG-306, TKG-22, TKG-21,

HT-1, DSS-9, PHULE TIL, MT-75, YLM-11, GT-10, AT-371, TKG-21, GT-8 and AKT-64 were found moderately resistant to the incidence of phyllody under natural condition (Table 1 and Plate 1). In the protective condition (Poly house) no symptoms were observed in all the genotypes (Table 1 and Plate 2). Several workers had previously reported about the resistance sources against phyllody of sesame. Palanna *et al*. (2015) reported GT-1 and DS-9 as resistant to phyllody. Similarly, forty two sesame germplasms were categorized for their reaction to phyllody by Gopal *et al*. (2005) and reported that six germplasm showed resistance, viz. Gopal *et al*. (2005) also reported screening of sesame germplasm lines Information on the sources of resistance to sesame phyllody disease is less. However, TMV-3, BT-892 and BAUT1 have shown partial resistance reaction to sesame phyllody disease. Gupta *et al*., (2018) also reported screening of sesame resistance genotypes on the sources of resistance to sesame phyllody disease is less.

In sesame phyllody affected plants there was reduction in number of capsule (Table 2, Figure 1), plant height (Table 5, Figure 3) and grain yield (Table 3, Figure 2) of phyllody affected plants, which ranged from 9.41 to 36.47, 68.99 to 113.1 cm and 0.21 to 3.81 g, respectively in comparison to healthy plants 46.48, 118.37cm and 4.43 g, respectively in healthy plant. However, the test weight (1000 grains weight) was ranged from 0.476 to 1.645 g in diseased plant in comparison to 2.773 g in healthy plant and thereby 40.67 to 82.85 per cent reduction in yield over healthy plant. It could be attributed due to phyllody (Table 6, Figure 4). Verma and Daftari (1985) and Kolte (1985) also reported 18 per cent reduction in oil content in case of phyllody affected sesame plants. Verma and Daftari (1985) also noted that sesame phyllody reduced plant yield, test weight, germination percentage and oil content of seeds. The 25 percent transformation of the productive growth of plant into phyllody, it caused 39.73 per cent loss in seed yield of infected sesame plants (Krishnaswamy and Jayarajan, 1983).

Table 1. Incidence of sesame phyllody in different genotype under natural field and protected condition.

Sr. No.	Genotype	Phyllody Incidence (%)	
		Natural condition	Protected
1	RT 103	12.92	0
2	RT 125	13.53	0
3	RT 127	14.38	0
4	TKG 306	14.00	0
5	TKG 55	13.53	0
6	TKG 22	12.40	0
7	TKG 21	11.66	0
8	RT 346	15.29	0
9	RT 351	17.65	0
10	RT 384	16.76	0
11	GT 8	11.32	0
12	HT 1	13.59	0
13	DSS 9	15.65	0
14	GT 10	11.52	0
15	AT 371	11.50	0
16	PHULE TIL	15.73	0
17	MT 75	15.54	0
18	RAMA	20.50	0
19	YLM 11	14.78	0
20	AKT 64	16.47	0
	CD (5%)	0.67	
	SE(m)	0.23	

Plate 1. Screening of genotype under natural field condition

Plate 2. Screening of genotype under protected condition

CONCLUSION

From the 20 genotypes screened against sesame phyllody in natural condition, the disease incidence ranged from 11.32 to 20.50 per cent. Whereas no genotype were found resistant. However all genotypes were found moderately resistant. In poly house condition no single genotype shows symptoms. All the genotypes under protective condition were disease free. The yield contributing

Healthy plant Phyllody infected plant

Table 2. Effect of phyllody appearance at different growth stages on number of capsules per plant

Age at symptoms appear (days)	Number of capsules(*)	Reduction in no. of capsule over healthy (%)
50	9.41	79.75
55	18.52	60.15
60	26.57	42.83
65	36.47	21.53
Healthy	46.48	0.00

(*) Average of five plants

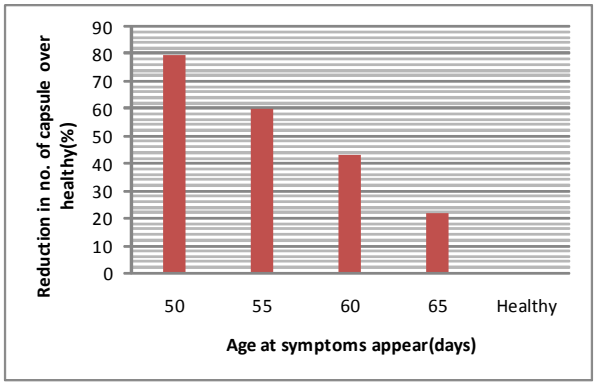

Fig. 1. Effect of phyllody appearance at different crop growth stages on number of capsules per plant.

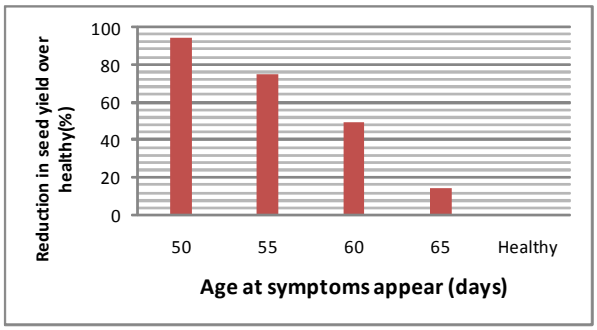

Fig. 2. Effect of phyllody appearance at different crop growth stages on seed yield per plant.

Table 3. Effect of phyllody appearance at different growth stages on seed yield per plant.

Age at symptoms appear (days)	Seed yield (g)	Reduction in seed yield over healthy (%)
50	0.21	95.25
55	1.10	75.16
60	2.26	48.98
65	3.81	13.99
Healthy	4.43	0.00

Table 4. Effect of phyllody appearance at different growth stages on plant height.

Age at symptoms appear (days)	Plant height (*)(Cm)	Reduction in height over healthy (%)
50	68.99	41.71
55	90.30	23.71
60	104.12	12.09
65	113.1	4.45
Healthy	118.37	0.00

(*) Average of five plants

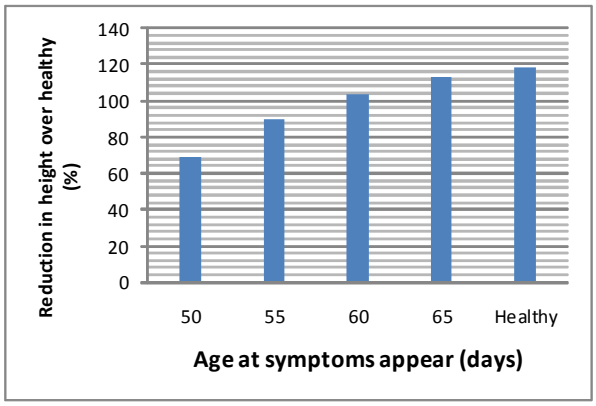

Fig. 3. Effect of phyllody appearance at different crop growth stages on plants height

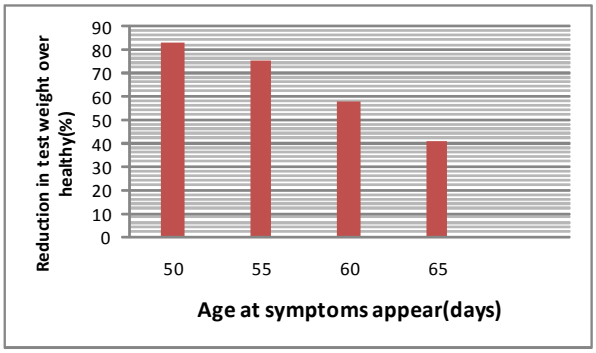

Fig. 4. Effect of phyllody appearance at different crop growth stages on test weight per plant

Table 5. Effect of phyllody appearance at different growth stages on test weight of seed.

Age at symptoms appear (days)	Test weight (g)(*)	Reduction in test weight over healthy (%)
50	0.476	82.85
55	0.670	75.83
60	1.175	57.62
65	1.645	40.67
Healthy	2.773	0.00

(*) Average of five plants

characters of sesame plants, i.e. plant height; number of capsules per plant, test weight was adversely affected due to phyllody.

Future scope

Studies on various aspects of disease spread of sesame phyllody may be intensified**.**

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