International Journal of Bio-resource and Stress Management 2011, 2(3):341-344

Evaluation of Sesame Genotypes for Powdery Mildew Resistance

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Article History

Manuscript No. 121
Received in 20th February, 2011
Received in revised form 3rd August, 2011
Accepted in final form 3rd September, 2011

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Keywords

Sesame, powdery mildew, screening, resistance

Abstract

Powdery mildew is a devastating disease in Sesame throughout India, causing considerable yield loss. Use of host plant resistance is the cheapest and effective disease management strategy. In the present investigation 37 genotypes along with a susceptible check Swethatil were screened against powdery mildew under natural conditions during *rabi*, 2010-11. Twenty four genotypes showed susceptible and 11 showed tolerant reaction. Only three genotypes (TKG-22, NSKMS-260 and G-55) showed resistant reaction. None of the genotypes recorded immune response. The resistant genotypes can be utilized in breeding program to evolve resistant varieties.

1. Introduction

Sesame (*Sesamum indicum* L.) is regarded as 'Queen of oilseeds' as the quality of its oil is of high nutritional and therapeutic value. High stability of its oil with distinct sweet flavor and oil meal rich in protein, have made it ideal for domestic and confectionary uses, respectively. Sesame is inherently low yielding plant type. Its yield is further limited by various biotic and abiotic stresses. Among them, powdery mildew is a devastating disease in all the sesame growing states in general, and Andhra Pradesh and Tamil Nadu in particular. It is caused by many species of fungi, viz. *Erisiphe cichorecearum* (Reddy and Haripriya, 1990), *Erisiphe orontii* (Rajpurohit, 1993), *Sphaerothica fuliginea* (Lawrence, 1951; Gemawat and Verma, 1972), *Leveillula taurica* (Patel et al., 1949), *Oidium erysiphoides* (Mehta, 1951; Roy, 1965), *Oidium* sp. (Venkatakrishnaiya, 1958), and *Oidium sesami* (Puzari et al., 2006). It occurs on epidemic scale in areas of high rainfall and humidity coupled with low night temperature. The disease causes yield loss between 25 and 50% depending on the level of severity. Application of pesticides to control the disease will increase the cost of cultivation and is hazardous to the human health as sesame is a food crop. Apart from this, it is also detrimental to the exports. Host plant resistance although is recognized as the reliable and permanent disease management strategy, very little is known on gene sources and their level of tolerance. Though few wild sources like *S. malabaricum* and *S. mulayanum* seems to possess tolerance to powdery mildew and phyllody, difficulties encountered in recombining such gene sources from wild relatives and lack of reliable screening/selection techniques had taken us no where near the targeted goal. In the present investigation efforts were made to identify sources of resistance to powdery mildew under field conditions.

2. Materials and Methods

Thirty seven genotypes comprising germplasm accessions, Indian bred improved varieties and advanced breeding lines, and a susceptible check Swethatil constituted the experimental material for screening of resistance against powdery mildew. The experimental material was screened during *rabi*, 2010-11 at Regional Agricultural Research Station at Palem of Andhra Pradesh sate in India. Each of the genotypes was sown in two rows of 3 m length with 30 x 15 cm^2 spacing. Late sowing

PRINT ISSN: 0976-3988; 0NLINE ISSN: 0976-4038

was done on 1st November, 2010 deliberately as the disease appears in severe form in late planted crop under natural field conditions. The crop was raised adopting the recommended package of practices. Three rows of the susceptible check were raised all around the experimental plot to provide the disease inoculum facilitating screening of the entries under field conditions. The entries were challenged artificially by treating with the inoculum of mycelial spores prepared from the diseased susceptible check for effective screening. The screening was done at 50 days after sowing (DAS) when the disease incidence was maximum on the susceptible check. Observation on disease reaction was made on five randomly selected plants in each entry. Nine leaves were scored in each plant, three each from the apical, middle and basal regions, and all of them were graded. The disease intensity was scored (Table 1) adopting the following 0-9 grade (TNAU, 1980).

Table 1: Grading of powdery mildew disease intensity

Disease grade	Description
0	No lesions or specks
1	Small sized powdery specks infecting less than 1% leaf area
3	Enlarged irregular powdery growth covering 1-5% leaf area
5	Powdery growth to form big patches covering 5-25% leaf area
7	Powdery growth covering 25-50% leaf area followed by yellowing
9	100% leaf area covered with powdery growth, yellowing and dropping of infected leaves

Level of resistance/susceptibility of the entries to the disease was determined by Percent Disease Index (PDI) following the formula of Mc Kinney (1923).

$$PDI = \frac{\text{Sum of grades}}{\text{Total number of leaves analyzed x maximum disease grade}} \times 100$$

Sum of grades is the sum of disease grade on nine leaves on which observation was recorded and maximum disease grade was nine in 0-9 scale (Table 2). On the basis of the PDI, the entries were grouped into four categories (Raja Ravindran, 1990).

Table 2: Classification of the entries based on Percent Disease Index (PDI)

PDI	Disease reaction
0	Immune (I)
1-30	Resistant (R)
31-50	Moderately resistant (MR)/tolerant (T)
>51	Susceptible (S)

3. Results and Discussion

A set of 37 entries of sesame comprising germplasm accessions, Indian bred improved varieties and advanced breeding lines, and a susceptible check Swethatil were screened for powdery mildew reaction under field conditions using inoculum from the susceptible check, Swethatil. Out of the 37 entries tested, 24 genotypes were found to be susceptible to powdery mildew (PDI 53.08-89.62%), eleven were tolerant (PDI 29.56-47.32%), while, three were resistant (TKG-22, NSKMS-260 and G-55) (PDI 27.35-28.43%) (Table 3).

The level of resistance and susceptibility varied with the genotypes. Among the susceptibles wherein level of disease incidence was more than 70%, susceptible check Swethatil was found to be highly susceptible with the incidence level exceeding 80%. Interestingly, none was found immune suggesting lack of strong sources of resistance to the disease. While the findings broadly agree with many earlier reports by pathologists and breeders that no reliable source of resistance/immunity could be found (Karunanithi et al., 1993; Rajpurohit, 1993; Karunanithi and Dinakaran, 1996), a few have reported existence of resistant sources (Hiremath, 1976; Dinakaran et al., 1989; Shadakshari et al., 1989; Suresh et al., 1991; Ganesh et al., 1992). The contradictory findings could be due to differences in the disease rating methodology, screening method, species/and race spectrum.

The difference in disease rating may be attributed to stringent screening method (spreader row + dusting of spore inoculum artificially) in the present case as against natural infection adopted by Gopal et al. (2005). Also, general perception among breeders and pathologists is what the present study concluded on the existence of truly resistant sources against the disease. The differential reaction of genotypes to the pathogen at different regions, however, need to be studied by pathologists for racial/species differences. PDI at peak disease level distinguished well the resistant from tolerant ones as tolerant types were characterized by slow mildewing. As such additional parameters are required to discriminate resistant from tolerant.

Studies by Shaner (1973) and Berger (1981) revealed growth rate of plant to be useful in differentiating genotypes with regard to infection rate and disease build up. Duration of the crop is yet another factor that influences the level of susceptibility/tolerance reaction. It was observed in the present study that early maturing genotypes were relatively more susceptible to the disease as compared to the late maturing in conformity with the earlier reports by Kolte (1985) and Hiremath (1976). Also, some agro-botanic traits appear to influence the disease spread. For instance, genotypes having horizontal leaf angle were found to be more susceptible to the disease as compared to those with acute leaf angle. This might be due to large exposure of leaf area to conidial spores unlike that of genotypes with acute leaf angle. Same observations were

Table 3: Reaction of 37 genotypes and a susceptible check Swethatil to powdery mildew

No.	Genotype	PDI	Reaction
1	G-55	27.35	Resistant
2	NSKMS-260	27.78	Resistant
3	TKG-22	28.43	Resistant
4	NSKMS-12	29.56	Tolerant
5	PKDS-37	31.22	Tolerant
6	Paiyur-1	32.56	Tolerant
7	VRISV-1	32.59	Tolerant
8	TMV-6	37.03	Tolerant
9	Co-1	38.27	Tolerant
10	TMV-4	39.25	Tolerant
11	JLT-26	39.75	Tolerant
12	RT-54	41.21	Tolerant
13	OSC-36/2002	47.15	Tolerant
14	NSKMS-124	47.32	Tolerant
15	KMR-20	53.08	Susceptible
16	I-57	55.56	Susceptible
17	NSKMS-264	57.03	Susceptible
18	NSKMS-128	57.53	Susceptible
19	VRI-1	57.79	Susceptible
20	KMR-77	58.02	Susceptible
21	TMV-3	58.35	Susceptible
22	KAS-06/97	59.25	Susceptible
23	KMR-28	59.25	Susceptible
24	KMS-4/258	62.22	Susceptible
25	NSKMS-126	62.46	Susceptible
26	KMR-79	62.71	Susceptible
27	Hima	65.431	Susceptible
28	KKS-9804937	66.91	Susceptible
29	DSC-207	72.81	Susceptible
30	Madhavi	73.37	Susceptible
31	KMR-13	74.07	Susceptible
32	YLM-17	74.56	Susceptible
33	KMR-8	75.80	Susceptible
34	Rajeswari	76.31	Susceptible
35	Chandana	79.38	Susceptible
36	YLM-11	82.46	Susceptible
37	Gouri	83.70	Susceptible
38	Swethatil	89.62	Susceptible

made in the present study also.

4. Conclusion

In the present investigation, none of the genotypes recorded immune response, and only three genotypes (TKG-22, NSKMS-260 and G-55) registered resistant reaction. Such resistant genotypes can be utilized in breeding program to evolve resistant varieties.

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