

Original Research Article

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## Symptoms and Management of White Rust/ Blister of Indian Mustard (*Albugo candida*)

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### ABSTRACT

#### Keywords

Rapeseed-Mustard, fungicide, *Albugo candida*, Biotic, Abiotic.

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Mustard (*Brassica juncea* L.) belongs to Family Brassicaceae (*Cruciferae*) and genus Brassica. *Albugo candida* the causal organism of the white rust/ blister of the rapeseed-mustard occurs in all parts of the world where cruciferous crops are grown. It is one of the important diseases of rapeseed-mustard in India causing a yield loss of 17-34 per cent. The use of resistant varieties is considered to be the best and cheapest method of managing the plant disease. Out of tested 30 genotype cultivars none was found free to this disease. Nine genotype viz., Bioysr and DRMRIJ-12-40, DRMR-2019, NDRE-08-14-01 and DRMRIJ-12-40, were observed to be moderately resistant to the disease. Disease management evaluation of different fungicides, chemical with different combination The maximum yield viz., Single spray propiconazole 25EC (0.5%), single spray metalaxyl 8% mencozeb 64% wp(0.2%), single spray of hexaconazole 25EC (0.05%), single spray of difenconazole 25EC (0.05%), single spray propiconazole 25EL (0.05%), T1 followed by T2, T1 followed by T1, followed by T4, and T1 followed by T5. The maximum yield was obtained from single spray propiconazole 25 EL (0.05%) treated plots.

### Introduction

In India Rapeseed-Mustard is most important and predominant source of edible oil and raw material for industrial products. Rapeseed-mustard is also world's third most important source of edible oil after soybean and oil palm. Mustard (*Brassica juncea* L.) belongs to family: Brassicaceae (*Cruciferae*) and genus Brassica. Total global area under rapeseed and mustard is about 26.09 m ha with total output of 571,880 tones of mustard at an average yield of 1-1.5 tons ha<sup>-1</sup> (FAO, 2015) India is the fourth producer of mustard contributing to around 11 % of world's total production. India produces around 65 lakh

tonnes of mustard and around 26 lakh tonnes of mustard oil and 35 lakh tones oil cake. Rajasthan alone contributes 43% of the total mustard production in India.

Rapeseed and mustard are crops of temperate climates, but these can also be cultivated at higher elevations in the tropics. Crop requires about 18-25<sup>0</sup>C temperature, low humidity, practically no rains especially at the time of flowering. The crop growth is optimum at <25<sup>0</sup>C. 1 or 2 pre-flowering rains help in boosting the grain yield. Excessive cold and frost are harmful to the crop. *Toria* is more

liable to suffer from frost and cold. Therefore, it is usually sown earlier, and harvested before the onset of frost. Rapeseed and mustard are long day in photo-periodic response. They require an annual precipitation of 40-100 cm. These crops also do not tolerate water logging. Many biotic and abiotic stresses are responsible for reducing the production of mustard. White rust caused by *Albugo candida* Kuntze and Alternaria blight caused by *Alternaria brassicae* (Berk.) Sacc. have been reported to be most wide spread and destructive fungal diseases of rapeseed-mustard throughout the world (Kolte, 1985).

In India, Symptoms of both these diseases on same leaves are quite common, while, combined infection of downy mildew and white rust on mustard have been observed rarely because of dry cool weather in this region. Yield losses from 23 to 54.5 per cent due to both phases (leaf and stag head) of white rust and from 17-48 per cent due to *Alternaria* blight have been reported from India (Saharan *et al.*, 1984 and Saharan, 1991).

*Albugo candida* the causal organism of the white rust/ blister of the rapeseed- mustard occurs in all parts of the world where cruciferous crops are grown. It is one of the important diseases of rapeseed-mustard in India causing a yield loss of 17-34 per cent (Yadava *et al.*, 2014). The disease is characterized by both local and systemic symptom expression. Local infection appears as white or creamy yellow pustules or “blisters” on leaves and stems. Systemic infection results in abnormal growth and distortion of inflorescence and sterility of flowers, commonly called stag head formed as a result of hypertrophy and hyperplasia. The epidemic development of white rust caused by *A. candida* is dependent upon many factors, viz. aggressiveness of race, amount of available initial inoculum, time of first

appearance of the disease and prevailing weather conditions. *A. candida* isolates from different *Brassica* species/cultivar or from different geographical regions may be different in their incubation period, latent period and production of sporangia and zoospores, pustule size, shape and texture and aggressiveness (Lakra and Saharan, 1988; Gupta and Saharan, 2002; Patni *et al.*, 2005 and Mishra *et al.*, 2009).

## **Materials and Methods**

### **Symptomatology of the disease**

A survey was made at oil seed farm of university and three adjoining area of Kanpur viz. Ghatampur, Chaubepur and Sarsaul. In survey the affected fields were examined to know the disease severity in those locations. Observations were recorded on the basis of leaf area affected and severity of disease was noted. The shape, size, colour and arrangement of pustules were also noted on particular plants. The disease development was observed from starting of disease to severe condition, from local infection to systemic infection. The observations were made on different plant parts like leaf, stem and inflorescence. In this series observation were also made on impact of disease on growth and development of a plant internally and externally. Small creamy white spot on cotyledons can be seen. Downy growth of fungus appears on leaves, stem and on stage heads formed by white rust pathogen, *Albugo candida*. Mixed infection of white rust and downy mildew is common on stage heads.

### **Screening of mustard germplasm for disease resistance**

Thirty germplasm of rapeseed-mustard groups (*Brassica juncea*, *Brassica carinata*, *Brassica napus*, *Eruca sativa* and *B. rapa*) were carried out during Rabi 2015-2016 under artificial

conditions. In order to promote a severe natural epidemic of disease, the planting of 3m double line of highly susceptible variety “Varuna” was incorporated after each five rows. The genotypes were grown in two rows each of 3m length with spacing of 40x10 cm in R.B.D. The recommended agronomic practices were adopted for raising a good crop.

Scale (0-9) for rating reaction to white rust:

- 0- (Immune) = nil
- 1- (HR) = less than 5 %
- 3- (R) = 5-10%
- 5- (MR) = 11-25
- 7- (S) = 26-50%
- 9- (HS) = more than 50%

HR- Highly Resistant, R-Resistant, MR- Moderately Resistant, S- Susceptible, HS- Highly Susceptible.

It is clear from the Table 1 that out of 30 genotypes tested nine genotype viz., Bioysr, DRMRIJ 12-14, DRMRIJ 12-39, DRMRIJ 12-48, DRMRJA 35, DRMRIJ 12-44, DRMRIJ 12-26, DRMRIJ 12-28 and DRMRIJ 12-40, were found free from the disease. Remaining genotypes were found as moderately susceptible, susceptible and highly susceptible against the white blister.

### **Morphological characters of the pathogen**

The Albuginaceae includes the fungus known as white rust or blister. All of them are obligate parasites causing disease of vascular plants. Appearance of the pustules on the lower surface of the leaf as the deposition of the sporangium and sporangiophore which is creamy white in colour and hairy. Mycelium is endophytic, branched, hyaline and having knob shaped haustoria. Sporangiophores in the beginning are sub epidermal and are clavate and simple. Lateral wall of

sporangiophore is thickened but laterally they are free from the sporangia, which form in a basipetal chain and are attached with each other with a gelatinous pad known as disjunctor. As the sporangia mature, they become detached from the disjunctor and are free in the space between the sporangiophore and the epidermis of host. Upon the bursting of the epidermis, the sporangia are released and form a white crust on the surface of the host. Individually the sporangia are normally globose but pressure during their formation results in flattened sides so that some of them are cuboids or polyhedral. The sporangia of *Albugo* germinate by zoospore or by germ tubes depending on the temperature. When zoospores are produced, the sporangia extrude 4-12 zoospores.

### **Disease management**

The experiment was conducted at Oilseed Farm, Kalyanpur of the University during *Rabi* session 2015 - 2016. The Susceptible variety “Varuna” was sown at spacing of 40 x 10cm. between row and plant in 3m X 5m plot size. All recommended agronomical practices were adopted.

The trial was conducted with 10 treatments of different combination of different fungicides as foliar spray. The fungicides were collected from Department of Plant Pathology of the university. Details of treatments have been presented as follows:-

T1 - Single spray of mancozeb (0.2%).

T2 - Single spray of metalaxyl. 8% + mancozeb 64% WP (0.2%).

T3 - Single spray of Hexaconazole 25EC (0.05%).

T4 - Single spray of Difenoconazole 25EC (0.05%).

T5 - Single spray of Propiconazole 25EC (0.05%).

T6 - T1 followed by T2.

T7 - T1 followed by T3.

T8 - T1 followed by T4.

T9 - T1 followed by T5.

T10 - Control (water spray).

Data presented in the table 2 revealed that all the treatments were found significantly effective in reducing the disease intensity and increasing the yield over the control during the year (2015-2016). Single spray of propiconazole dose was superior over all the treatments, resulting in to lowest disease (17%) and given maximum yield (1361.033).

T9-T1 fallowed by T5 was second best treatments over control which decreases the disease up to 20% and increase the yield 1266.60 kg/ha. Other treatment followed similar way of disease intensity and yield in decreasing order, which were significantly higher over control.

### **Effect of different combination on yield**

The average yield data which is presented in Table-3 indicates that, the maximum yield 1361.033 kg/ha was obtained from single spray of propiconazole 25 EL (0.05%) treated plots. The average yield from others treatments such as T<sub>1</sub> followed by T<sub>5</sub>, T<sub>1</sub> followed by T<sub>3</sub>, single spray propiconazole 25 EC (0.5%), yield was obtained 1266.60 kg/ha, 1255.50kg/ha, 1244.36kg/ha. Field, respectively the yield obtained from T<sub>3</sub> and T<sub>8</sub> was 1177.70 kg/ha and 1155.50 kg/ha field, respectively which is significantly differ from T<sub>2</sub>, T<sub>4</sub> and T<sub>6</sub> gave 1088.33 kg/ha, 1033.26 kg/ha, and 1033.266 kg/ha, respectively over

the control (811.06 kg/ha.).

### **Results and Discussion**

Keeping in view the importance of this fungus, the present investigation on symptoms and management of white blister (*Albugo candida*) of Indian mustard was carried out to investigate more suitable, ecofriendly substances for the effective management of this disease. During the investigation botanicals, organic amendment, bio-agents and metalaxyl were used in field experiment for white blister management.

Among the disease management approaches, the use of resistant varieties is considered to be the best and cheapest method of managing the plant disease. The present study was therefore, carried out for finding out the source of resistance against white blister of rapeseed- mustard caused by *Albugo candida*, under artificial conditions and results are presented. It is clear then the results that out of 30 genotype cultivars were tested, none was found free to this disease. Nine genotype viz., Bioysr and DRMRIJ-12-14, DRMRIJ 12-39, DRMRIJ-12-48, DRMRJA 35, DRMRIJ 12-44, DRMRIJ 12-26, DRMRIJ 12-28 and DRMRIJ 12-40 were observed to be moderately resistant to the disease. Remaining genotypes were found as moderately susceptible, susceptible and highly susceptible, against the white blister.

Evaluation of different fungicides, chemical and bio-agent with different combination viz., Single spray of propiconazole 25EC (0.5%), single spray metalaxyl 8% mencozeb 64% wp (0.2%), single spray of hexaconazole 25EC (0.05%), single spray of Difenconazole 25EC (0.05%), single spray propiconazole 25EL (0.05%) T<sub>1</sub> followed by T<sub>2</sub>, T<sub>7</sub>- T<sub>1</sub> followed by T<sub>3</sub> T<sub>8</sub>- T<sub>1</sub> followed by T<sub>4</sub>, T<sub>9</sub>-T<sub>1</sub> followed by T<sub>5</sub>, T<sub>10</sub> - Control.

**Table.1** Screening of Brassica germplasm and breeding material against white rust /blister of mustard under artificial condition

Sr. No.	Entries	White rust Disease intensity (%)
1	Bioysr	0.000(0.284)
2	Rohini	55.200(47.987)
3	DRMRIJ 12-51	20.400(26.824)
4	DRMRIJ 12-02	18.800(26.664)
5	DRMRIJ 12-27	29.500(32.810)
6	RH 1231	38.400(38.288)
7	DRMRIJ 12-41	41.500(40.105)
8	DRMRIJ 12-14	0.000(0.284)
9	DRMRIJ 12-39	0.000(0.284)
10	DRMRIJ 2035	43.200(41.085)
11	DRMRIJ 12-48	0.000(0.284)
12	DRMRIJ 12-06	33.200(35.165)
13	RMWR-09-05-01	43.300(41.135)
14	DRMRJA 35	0.000(0.284)
15	DRMRIJ 12-44	0.000(0.284)
16	DRMRIJ 12-03	51.00(45.755)
17	RH 305	15.500(23.091)
18	DRMRIJ 12-21	58.200(49.827)
19	DRMRIJ 12-37	56.400(48.689)
20	NPJ 181	15.500(23.178)
21	DRMRIJ 12-26	0.000(0.284)
22	RMWR-09-05	20.400(26.824)
23	DRMR-2019	45.500(42.468)
24	DRMRIJ 12-50	48.500(44.130)
25	RH 1234	18.500(25.447)
26	DRMRIJ 12-28	0.000(0.284)
27	NDRE-08-14-01	50.100(45.053)
28	DRMRIJ 12-65	33.500(35.341)
29	DRMRIJ 12-43	16.600(24.002)
30	DRMRIJ 12-40	0.000(0.284)
	<b>CV</b>	<b>11.696</b>
	<b>CD at 5%</b>	<b>6.1</b>

**Table.2** Effect of different combination of the fungicide for the management of white blister

Treatment	White blister disease (%)	Yield kg/ha.	1000 seed wt.
T1	31.800(34.226)	1244.366	4.388
T2	34.000(35.646)	1088.833	4.341
T3	28.400(32.194)	1177.700	4.812
T4	29.733(33.027)	1033.266	4.814
T5	17.000(24.347)	1361.033	4.90
T6	30.333(33.398)	1033.266	4.336
T7	21.266(27.434)	1255.500	5.082
T8	28.400(32.172)	1155.500	4.628
T9	20.533(26.921)	1266.600	4.728
T10	59.866(50.699)	811.066	4.024
<b>CV</b>	<b>5.303</b>	<b>10.280</b>	
<b>CD at 5%</b>	<b>3.001</b>	<b>212.24</b>	

**Table.3** Effect of different combination of fungicide yield data

Treatment	Yield kg/ha.	Increase percent in yield
T1	1244.366	53.42
T2	1088.833	34.24
T3	1177.700	45.20
T4	1033.266	27.39
T5	1361.033	67.80
T6	1033.266	27.39
T7	1255.500	54.79
T8	1155.500	42.46
T9	1266.600	56.17
Control	811.066	
CV	<b>10.280</b>	
CD	<b>212.24</b>	

The efficacy of different combination against white blister, all the treatments were found significantly effective in reducing the disease intensity and increasing the yield over the control against white blister of mustard (*Albugo candida*) in field condition. Among the treatments T1 followed by T5 showed maximum improvement in plant growth parameter (disease severity and percent disease control) and reduction of the white blister of mustard. At the maximum disease severity (20.533) and (21.266) was observed data T1 followed by T5 followed by T1 followed by T3. The maximum yield (1266.600 kg/ha) was obtained from T1 followed by T5, followed by T1 followed by T3 (1255.500 kg/ha).

The present study was therefore, carried out for finding out the source of resistance against white blister of rapeseed- mustard caused by *Albugo candida*, under artificial conditions and results are presented. It is clear then the results that out of 30 genotype cultivars were tested, none was found free to this disease. Remaining genotypes were found as moderately susceptible, susceptible and highly susceptible, against the white blister. Evaluation of different fungicides, chemical and bio-agent with different combination the

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