

Management of chrysanthemum white rust an intercepted quarantine disease for India, under green house condition

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ABSTRACT

The symptoms produced by the pathogen was most commonly appeared on young leaves and flower bract. Initially it shows numerous, light green to yellow spot, slightly raised appear on the upper surface of leaf. These spot become brown and necrotic with age. The maximum incidence and intensity of chrysanthemum white rust disease was observed at 25-27°C temperature and high relative humidity of 85-90 per cent in protected condition while in case of non protected condition no infection occurred due to high temperature and low humidity. The curative spray of propiconazole was most effective in controlling the CWR, followed by hexaconazole + mancozeb, tridemefon, captan + hexaconazol whereas, other fungicides viz., carbendazim, copper oxychloride, zineb were least effective against the chrysanthemum white rust. Among the 14 varieties screened under artificial epiphytotics in green house, no one was found to be resistant to white rust of chrysanthemum, while seven varieties were moderately resistant to CWR and these are PN-1 (29.33 %) PN-138 (30.33%), PN-6 (29.67 %), D-21 mix (25.00 %), New Dagger (30.00 %), D-No-9 (23.33%), and PN-16 (30.67 %), five were moderately susceptible. One was susceptible, and remaining one was highly susceptible to chrysanthemum white rust.

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INTRODUCTION

Chrysanthemum (*Chrysanthemum sinensis* L.) is one of the oldest flower crop grown in the world. It is known as 'Queen of East' in European countries. It is the top dollar earning flower in United States; also grown in India and Maharashtra as purpose of cut flower.

The chrysanthemum (*Chrysanthemum sinensis* L.) belongs to the family compositae. Recently the genus chrysanthemum has been reclassified to Dandranthema and the florist species is grandiflora (Anderson, 1987). The fungal

diseases are major threat in successful and profitable cultivation of chrysanthemum. Recently the disease like white rust of chrysanthemum in becoming sever in European countries and other countries like China, South Africa, Brazil and Australia. But it is quarantine disease for India. chrysanthemum white rust is recently observed at Chincholi Tal- Sinner Dist- Nashik from Maharashtra. In view of severity of disease, paucity of literature and need of growers, it was decided to under take the studies on chrysanthemum white rust and there fore attempts were made to study symptomatology, effect of protected and non protected

environment on chrysanthemum white rust, screening of varieties and evaluation of fungicides against chrysanthemum white rust under green house conditions. As this was the first report of introduction of chrysanthemum white rust (CWR) in to our country, no previous work/report on this disease is available and as the disease is of quarantine and economic important.

MATERIAL AND METHODS

Effect of protected and non protected environmental conditions on rust pathogen :

The effect of protected and non protected environmental conditions on rust were studied particularly the parameters like temperature, relative humidity were studied in the month of February, March, April and May and the comparison of the environmental characters were made during these month and correlated with appearance of rust disease.

Evaluation of fungicides :

An experiment was conducted under protected cultivations in a Randomized Block Design with twelve treatments including unsprayed control in chrysanthemum green house at Chincholi, Tal. Sinner, Dist. Nashik (M.S.) For the evaluation of fungicides under green house conditions as curative sprays, the susceptible chrysanthemum varieties are inoculated by spore suspension spray method. An appropriate quantity of required concentration of each fungicide was added in 1000 ml distilled water and shaken well to ensure uniform distribution of fungicides. Then the sprays were taken after 24 hrs of inoculation with the help of automizer. The sprayer was washed thoroughly every time before taking spray of next fungicide. An utmost care was taken to avoid the drift of spray from one treatment set to another. The inoculated plants without any fungicidal spray served as control. The observations for per cent disease incidence, per cent disease intensity were recorded 15 days after the spraying of fungicides. The per cent disease incidence and per cent disease intensity were calculated by using formula given by Kinney (1923).

Screening of chrysanthemum varieties against CWR :

In this experiment the fourteen chrysanthemum varieties were screened for their reaction against white rust pathogen. The chrysanthemum rooted plantlets were planted in green house having controlled environmental conditions. Six lines of varieties were planted in 10 m beds. The suspension of rust inoculum was sprayed thrice at an interval of four days. The atmospheric temperature of 23°C and relative humidity of 90 per cent was maintained. The appearance of rust pustules on leaves and the area of plant covered by rust pathogen in the plant were taken into consideration for the determination of reaction of chrysanthemum variety to rust pathogen (Table A).

Table A : Disease reactions for CWR caused by *Puccinia horiana*

Grade	Per cent disease intensity (PDI)	Reaction
0.	0-0	Immune
1.	1-20	Resistant (R)
2.	21-40	Moderately resistant (MR)
3.	41-60	Moderately susceptible (MS)
4.	61-80	Susceptible (S)
5.	81-100	Highly susceptible (HS)

The disease severity (PDI) was recorded by adopting 0-5 grade score card (Peterson *et al.*, 1948).

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads :

Symptoms of CWR :

Initially numerous, light green to yellow spot, slightly raised appeared on the upper surface of leaf. The size of spots was up to 5 mm in diameter. These spots became brown and necrotic with age, raised being to pink. The pustules were on the underside of leaves, they became white with age. The pustules were most common on young leaves and flower bracts but formed on any green tissue or the petals, with the advancement of disease. The size of pustules and number of pustules per leaf was increased. The initial round, yellowish spot turned into irregular or angular coalescing, raised white mass to cover large portion of upper leaf surface.

In later stage of disease, the pustules matured and produces teliospores. The teliospores are in the pustules on the underside of leaves and remain on the pustules. Teliospore produced basidiospore under favourable conditions. The secondary infection carried out through infected plant material. This rust infects only chrysanthemum and has the potential to result in 100 per cent loss in infected green house.

Effect of protected and nonprotected environment on development of CWR :

The results presented in Table 1 shows that, the disease started to appear in month of February and leads to increase in intensity during month of March and intensity decreases in month of April and ceases in the month of May due to high temperature and low humidity in protected condition. This shows that, the pathogen grow at 23-25°C temperature and 90-92 per cent relative humidity in protected conditions.

Evaluation of fungicides for management of chrysanthemum white rust caused by *Puccinia horiana* under green house conditions :

The studies on evaluation of fungicides *in vitro* (Table

Table 1 : Effect of protected and non-protected environment on development of CWR

Sr. No.	Month	Protected conditions		Disease observed/ not observed	Non-protected conditions		Disease observed / not observed
		Temp. (°C)	RH (%)		Temp. (°C)	RH (%)	
1.	February	23-25	90-92	Start of appear	28-30	90-92	Not observed
2.	March	25-27	85-90	Maximum intensity	30-32	75-80	Not observed
3.	April	26-28	80-85	Less intensity	32-35	70-75	Not observed
4.	May	27-28	75-80	Decreasing intensity	35-37	65-70	Not observed

Table 2 : Evaluation of fungicides against white rust of chrysanthemum under green house conditions

Sr. No.	Name of fungicides	Conc (%)	Per cent disease		Per cent disease control (PDC)
			Incidence	Intensity	
1.	Hexaconazole	0.1	28.33 (32.03)	17.33 (24.58)	64.39
2.	Propiconazole	0.1	20.33 (26.70)	13.00 (21.00)	73.29
3.	Tridemefon	0.25	24.33 (29.51)	14.00 (21.87)	71.23
4.	Captan + Hexaconazol	0.2 + 0.1	29.67 (32.88)	21.33 (27.45)	56.17
5.	Hexaconazol + Mancozeb	0.1 + 0.2	21.67 (27.66)	13.33 (21.36)	72.61
6.	Propineb	0.25	34.67 (36.04)	30.33 (33.40)	37.68
7.	Carbendazim	0.1	32.00 (34.41)	29.33 (32.69)	39.73
8.	Captan	0.2	38.33 (38.19)	35.33 (36.46)	27.41
9.	Mancozeb	0.2	30.67 (31.84)	27.67 (31.70)	43.15
10.	Copperoxychloride	0.2	31.33 (34.02)	29.00 (32.57)	40.42
11.	Zineb	0.2	35.67 (36.64)	34.00 (35.65)	30.14
12.	Control		50.00 (45.00)	48.67 (44.24)	-
	S.E. ±		1.058	0.851	
	C.D. (P = 0.05)		3.099	2.496	
	C.V. (%)		5.42	4.87	

Figures in parenthesis indicates arc sin transformed values

Table 3 : Reaction of different chrysanthemum varieties to CWR under green house conditions

Sr. No.	Variety	Per cent disease		Reaction
		Incidence	Intensity	
1.	PN-1	35.00 (36.14)	29.33 (32.78)	MR
2.	PN-5	50.33 (45.10)	45.67 (42.51)	MS
3.	PN-138	28.67 (32.18)	30.33 (33.41)	MR
4.	PN-9	38.33 (38.10)	48.00 (43.85)	MS
5.	PN-25	36.67 (37.17)	52.33 (46.34)	MS
6.	PN-13	43.33 (41.08)	41.00 (39.76)	MS
7.	PN-10	40.33 (41.08)	50.00 (45.01)	MS
8.	PN-8	56.67 (48.07)	71.67 (57.96)	S
9.	PN-2	58.67 (48.90)	80.67 (63.95)	HS
10.	D-21-mix	30.00 (31.43)	25.00 (29.94)	MR
11.	New Dagger	35.00 (36.37)	30.00 (33.16)	MR
12.	D-No-9	31.67 (34.06)	23.33 (28.67)	MR
13.	PN-6	33.33 (35.18)	29.67 (32.94)	MR
14.	PN-16	36.67 (37.19)	30.67 (33.59)	MR
	S.E. ±	0.878	1.606	
	C.D. (P = 0.05)	2.551	4.665	
	C. V. (%)	3.94	6.91	

Figures in parenthesis indicates arc sin transformed value

2) shows that, the curative spray of propiconazole (0.1%) was superior to all other treatments in controlling CWR and showed highest disease control of 73.29 per cent over the untreated control. The present findings are in conformity with results reported by Benagi (1991) who reported that, the propiconazole was effective against uredospore germination of *Puccinia arachidis* and observed maximum reduction in per cent index with propiconazole at 0.1 per cent concentration. Nazeer *et al.* (1993) observed that the fig rust was effectively controlled by propiconazole. Also Patil (1997) reported that amongst the systemic fungicides propiconazole was effective even at lower concentration against uredospore germination of *Puccinia helianthi*.

The fungicides in order to superiority were the combination of hexaconazole + mancozeb (0.2 + 0.1%), tridemefon (0.25%), hexaconazole (0.1%) and captan + hexaconazole (0.1 + 0.2) which recorded per cent disease control by 72.61, 71.23, 64.39 and 56.17 per cent, respectively. The present findings are in agreement with Lam *et al.* (1993) who reported that the hexaconazole (50 µg/ml), tridemefon (125 µg/ml), hexaconazole + captan (1:17.5) were highly effective for controlling white rust chrysanthemum. Dickens (1990) reported that the fungicides mancozeb (1.49/lit), propiconazole (100 mg/lit), tridemefon (250 mg /lit) were effective against white rust pathogen.

The results presented in Table 3 reveals that, none of the chrysanthemum variety was found highly resistant or immune to CWR. Among the fourteen varieties screened seven varieties were found to be moderately resistance *viz.*, PN-1 (29.33 %), PN-138 (30.33 %), PN-6 (29.67 %), D-21 mix (25.00 %), New Dagger (50.00 %) D-No-9 (23.33 %) and PN-16 (30.67 %) while the five varieties *viz.*, PN-5 (45.67 %), PN-25 (52.33 %), PN-9 (48.00 %), PN-10 (50.00%), PN-13 (41.00 %) have shown moderately susceptible reactions and the variety PN-8 (71.67 %) and PN-2 (80.67 %) have shown susceptible and highly susceptible reactions respectively to CWR. These findings are more or less similar to Punithalingam (1998) who described twelve species of chrysanthemum shows susceptible reaction against CWR. In same way Sandoval *et al.* (1997) reported three groups as highly susceptible,

susceptible and resistant by screening of 15 cultivars against CWR pathogen. Joshi *et al.* (2013); Anderson (1987); Lam and Lam (1993) and Dickens (1990) also worked on the related topic.

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