



Screening of Tuberose Cultivars against Leaf Spot (*Alternaria polyanthi*) and its Management

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ABSTRACT

Background: Tuberose flower has been found to be affected by various fungal and viral diseases which affect growth and cause loss in flower yield. Among them, leaf spot incited by *Aternaria polianthi* is an important fungal disease in tuberose. The incidence of the disease is common in the both single and double-type tuberose varieties due to prevalence of high rainfall and humid conditions. During survey it was found that the disease incidence was increasing gradually causing economic losses in Assam.

Methods: The field trial was carried out during *kharif* seasons (2015 -18) to test the efficacy of six fungicides against leaf spot of tuberose (Var. Local single petal) caused by *Alternaria polyantha*. Four sprays with fungicides at an interval of seven days starting from the first appearance of the disease symptom were done. Per cent disease incidence (%) with growth parameters were recorded one week after the last spray. Another field experiment for screening the resistant genotypes was conducted using 11 tuberose genotypes during *kharif* seasons (2016-17 and 2017-18).

Result: Eleven tuberose cultivars (Bidhan Ranjani-1, Bidhan Ranjani-2, Arka Nirantara, GK-TC-4, Prajwal, Phule Rajani, Local Single, Local Double, Vaibhav, Suhashini and Shringer) were screened against leaf spot caused by *A. polyanthi* under natural field condition. None of the cultivars were found to be immune or resistant, while three cultivars viz., GK-TC-4, Bidhan Rajani-1 and Arka Nirantara showed moderate resistant reaction with recorded per cent disease incidence of 16.11, 18.17 and 18.71, respectively. Spraying with azoxystrobin, difenoconazole and a combo fungicide consisting of iprodione (25%) + carbendazim (25%), at 0.1% recorded lowest per cent disease incidence of 7.91, 9.83 and 11.85% compared to control (33.62 PDI) with per cent disease reduction of 70.59%, 64.61% and 76.31%, respectively.

Key words: *Alternaria polyanthi*, Chemical, Management, Screening, Tuberose.

INTRODUCTION

Tuberose (*Polianthes tuberosa* Linn.) is one of the most important ornamentals of tropical and sub-tropical areas (Biswas *et al.*, 2002). In India, the commercial cultivation of tuberose is generally practiced in West Bengal, Karnataka, Maharashtra, Tamil Nadu, Haryana, Punjab, Gujarat, Rajasthan, Andhra Pradesh including Assam (Biswas *et al.*, 2002; Khan and Pal, 2001). It is commercially cultivated for cut and loose flower trade and also for the extraction of its highly valued natural flower oil (Mishra *et al.*, 2008). This crop has been affected by various fungal and viral diseases which affect growth and cause loss in flower yield. Among them, leaf spot incited by *A. polianthi* is an important fungal disease (Mariappan *et al.*, 1977) in tuberose. The disease is manifested in the form of brown specks on leaf tip or margin which gradually attain round to oval shapes measuring 10-30 cm in length and 4-5 cm in diameter. Later, spots coalesce and develop typical blight symptom. In India, leaf spot in tuberose incited by *A. polyanthi* was first reported from the locality of Coimbatore (Mariappan *et al.*, 1977) and in the succeeding period once again from the same state, Tamil Nadu (Muthukumar *et al.*, 2007). Another type of leaf blight/tip burn due to *Phoma* spp has also been reported (Panja *et al.*, 2016). The incidence of the disease is common in the both single and double-type tuberose varieties due to prevalence of high rainfall and humid conditions. During survey it was found that the disease incidence was

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increasing gradually causing economic losses in Assam. As the available information on the source of resistance to this foliar disease and its management are very limited, hence, an attempt was made to investigate the efficacy of different fungicides and screening of tuberose cultivars for resistance sources for the management of leaf spot disease of tube rose under field condition.

MATERIALS AND METHODS

The field experiment was conducted in randomized block design with seven treatments and three replications during *kharif* seasons (2015 -18) at the experimental field of Horticultural Research Station AAU, Kahikuchi, in sick field where the leaf spot disease naturally occurs every crop season. The treatments were comprised of mancozeb 75%

WP (0.2%), chlorothalonil 75% WP (0.2%), tricyclazole 75% WP (0.1%), iprodione (25%) + carbendazim (25%) WP (0.1%), difenconazole 25% EC (0.1%), azoxystrobin 23% SC (0.1%) and control. Tuberose bulbs cv. Single Petal Local were planted during March in the plots of 2.0 m x 2.8 m at spacing 30 cm x 30 cm. The plants were sprayed with fungicides four times at an interval of seven days starting from the first appearance of the disease symptom, mostly at flower stalk initiation stage. Per cent disease intensity was recorded one week after the last spray. Six clumps from the center of each plot were considered to compute the per cent disease index (PDI) on the basis of 0-4 scales (Harsfall and Henbeeger, 1942). Flower stalk (no./m²), weight of the freshly harvested stalk (g) and the length of the flower stalk (cm) were also recorded. The data of per cent disease incidence were subjected to angular transformation and analysis of variance was calculated out (Snedecor and Cochran, 1967). Economic of fungicide application was computed on the basis of economic returns from flower yield and cost of fungicidal treatments (Hugar *et al.*, 2009-10).

Screening of tuberose cultivars under field condition

The field experiment for screening the resistant genotypes was conducted during *kharif* seasons (2016-17 and 2017-18) at the experimental field of Horticultural Research Station AAU, Kahikuchi. A total of eleven tuberose cultivars were grown in randomized block design with three replications in the plots of 1.8 m x 1.5 m at spacing 30 cm x 30 cm. The observation on per cent disease index (PDI) was calculated as above, at harvest when the disease was developed to its maximum extent. Further, the degree of resistance of tuberose cultivars was ascertained by placing the cultivars in different categories of resistance and susceptibility as per the method proposed by Pathak *et al.* (1986) as follows.

Scale to indicate degree of resistance against leaf spot of tuberose.

Disease severity	Category	Reaction
< 5	0	Immune
5-10	I	Resistance
11-20	II	Moderately resistance
21-40	III	Moderately susceptible
41-60	IV	Susceptible
> 61	V	Highly susceptible

RESULTS AND DISCUSSION

Data presented in (Table 1) indicated that the fungicidal spray could manage the disease adequately. Timely initiation of fungicidal spray schedule, starting the first spray at the appearance of disease symptom was found to be effective in reducing leaf spot of tuberose significantly. Although, disease control as high as 76.31% was achieved in azoxystrobin (0.1%) but it proved to be costlier as compared to the other treatments which recorded third highest benefit cost ratio (6.75). Maximum flower stalk production (51.20/m²),

flower stalk length (85.93 cm) and effective number of bulbs (103.53/m²) were obtained in the plots treated with azoxystrobin (0.1%) as compared to 33.03/m², 80.70 cm and 68.15 nos./m² in case of control and showed 55.05% increase in flower stalk yield over control (Table 2). Effectiveness of azoxystrobin (0.1%) against *Alternaria* leaf spot of tuberose were also reported (Anonymous, 2012; Mazumder *et al.*, 2016). In *in-vitro* study it was reported that Azoxystrobin (1000 ppm) could inhibit about 86.81 % mycelia growth of *A. Polianthi* inciting leaf spot in tuberose (Naga Lakshmi *et al.*, 2018). Singh and Singh (2006) also reported about the effectiveness of azoxystrobin against *A. alternata* causing blight of tomato. Good control of *Alternaria* leaf spot of Chinese cabbage by the application of azoxystrobin was observed by Robak (1998).

On the other hand, considering the economic analysis, spraying of difenconazole and a combo fungicide consisting of iprodione (25%) + carbendazim (25%) at the rate of 0.1% were found most effective since they registered higher benefit cost ratio of 7.28 and 7.03 with higher per cent disease control of 70.59% and 64.61%, respectively. The effectiveness of difenconazole (0.1%) and iprodione (25%) + carbendazim (25%) (0.1) in reducing leaf spot of tuberose was reported earlier (Sharma and Bhattacharjee, 2002; Anonymous, 2004 and Mazumder *et al.* (2016). In tomato, early blight (*A. solani*) was effectively managed by the application of Iprodione (0.2%) (Prasad and Naik, 2003). Significant differences in the production of number of flower stalk (per sq. m), number of bulb (m²) and length of flower stalk (cm) had been observed as influenced by different treatments (Table 2). Flower yield (49.55 and 41.19/m²), number of bulb (95.90 and 93.60/m²) and flower stalk length (85.90 and 84.81 cm) were recorded from the plots treated with difenconazole and iprodione (25%) + carbendazim (25%) and which also showed 50.01 and 24.70% increase in flower yield over the control. Increase in flower yield and other qualities have been assumed to be due to the effective control of the pathogen and further spread of the disease.

Data on leaf spot severity showing the relative reaction of different tuberose cultivars are presented in (Table 3). All the cultivars screened against the *Alternaria* leaf spot were found to be infected by the disease. None of the eleven cultivars were free from the disease. Therefore, no cultivar could be placed under the category immune or resistant (category 0 and I). However, three cultivars viz., GK-TC-4, Bidhan Rajani-1 and Arka Nirantara recorded per cent disease incidence of 16.11, 18.17 and 18.71, respectively and were placed under moderately resistant reaction (category II). The remaining eight tuberose cultivars viz., Local Single (35.89%), Shringer (33.35%), Bidhan Ranjani-2 (31.86%), Vaibhav (30.24%), Suhashini (29.62%), Prajwal (26.61%), Phule Rajani (23.03) and Double Local (20.49%) were found moderately susceptible (category III). Similar results on screening tuberose cultivars on *Alternaria* leaf spot were reported by Naga Lakshmi *et al.* (2018).

Table 1: Efficacy of fungicides on the leaf spot disease of tuberose cv. Single local.

Treatments	Per cent disease incidence					Per cent disease control over check				Benefit cost ratio
	2015-16	2016-17	2017-18	pooled		2015-16	2016-17	2017-18	Mean	
Mancozeb (0.2%)	20.37 (26.82) *	20.67 (27.03) *	21.41 (27.57) *	20.81 (27.20)		38.37	36.94	37.98	37.76	6.15
Chlorothalonil (0.2%)	15.25 (22.98)	15.08 (22.64)	15.73 (23.37)	15.59 (22.90)		53.85	53.99	54.43	54.09	5.89
Tricyclazole (0.1%)	21.17 (27.39)	19.67 (26.32)	19.75 (26.38)	20.20 (26.70)		35.94	34.00	42.78	37.58	5.80
Iprodione (25 %) + Carbendazim (25 %) (0.1%)	10.25 (16.81)	12.33 (20.55)	12.96 (23.10)	11.85 (20.84)		68.99	62.39	62.46	64.61	7.03
Difenoconazole (0.1%)	8.91 (17.37)	9.41 (17.87)	11.15 (19.59)	9.83 (18.94)		73.04	71.30	67.41	70.59	7.28
Azoxystrobin (0.1%)	7.85 (16.24)	7.67 (16.06)	8.25 (16.43)	7.91 (16.32)		76.24	76.60	76.10	76.31	6.79
Control	33.05 (35.09)	32.78 (30.73)	34.53 (35.98)	33.62 (35.25)		-	-	-	-	4.96
SED (±)	1.28	2.24	1.33	0.48		-	-	-	-	
CD (P=0.05)	2.68	4.71	2.39	1.00		-	-	-	-	

*Figures in parenthesis are angular transformed value.

Table 2: Effect of different fungicidal treatment on flower and bulb yield of tuberose cv. Single local.

Treatments	No of flower stalk per m ²				No of bulbs per m ²				Length of flower stalk (cm)				Increase in flower yield over control (%)
	2015-16	2016-17	2017-18	Pooled	2015-16	2016-17	2017-18	Pooled	2015-16	2016-17	2017-18	Pooled	
Mancozeb (0.2%)	34.44	40.83	43.42	39.90	87.53	90.72	102.13	93.46	83.28	83.275	84.78	84.79	20.789
Chlorothalonil (0.2%)	30.09	40.35	38.82	36.41	80.25	80.85	93.77	84.95	83.75	83.75	84.45	84.49	10.79
Tricyclazole (0.1%)	30.65	39.47	43.04	37.20	79.20	85.80	93.53	86.17	84.50	84.50	83.35	83.33	12.62
Iprodione (25 %) + Carbendazim (25 %) (0.1%)	38.90	43.90	46.31	41.19	94.05	93.14	93.61	93.60	85.15	85.15	84.41	84.81	24.70
Difenoconazole (0.1%)	44.07	48.70	55.74	49.55	92.95	92.65	102.16	95.90	87.00	87.00	85.90	85.90	50.01
Azoxystrobin (0.1%)	45.00	55.17	53.42	51.20	109.33	93.07	108.21	103.53	87.45	87.45	85.93	85.93	55.05
Control	27.97	33.70	37.40	33.03	62.17	67.10	75.62	68.15	81.52	81.55	80.70	80.70	-
SED (±)	1.30	2.59	2.60	4.98	5.78	7.05	4.80	6.80	0.83	0.45	5.42	0.46	-
CD (P=0.05)	3.78	5.43	5.46	10.07	12.13	14.81	10.07	14.81	1.77	0.95	11.40	0.95	-

Table 3: Reaction of tuberose varieties against *Alternaria polyanthi* causing leaf spot under field condition.

Varieties	Per cent disease incidence (%)			Reaction
	2016-17	2017-18	Mean	
Bidhan Rajani-1	16.11 (23.55)*	20.22 (26.60)*	18.17	Moderately resistance
Bidhan Rajani-2	31.61 (33.87)	32.11 (34.58)	31.86	Moderately susceptible
Arka Nirantara	18.09 (25.15)	19.33 (26.07)	18.71	Moderately resistance
GKCT-4	15.00 (22.62)	17.22 (25.25)	16.11	Moderately resistance
Phule Rajani	22.76 (28.48)	23.30 (28.86)	23.03	Moderately susceptible
Prajwal	27.67 (34.70)	25.56 (30.98)	26.61	Moderately susceptible
Local Single	35.61 (36.61)	36.17 (36.98)	35.89	Moderately susceptible
Local Double	20.26 (26.74)	20.72 (27.07)	20.49	Moderately susceptible
Vaibhav	32.70 (34.87)	27.78 (31.77)	30.24	Moderately susceptible
Suhashini	31.14 (33.91)	26.11 (30.72)	29.62	Moderately susceptible
Shringer	32.65 (34.84)	34.05 (35.69)	33.35	Moderately susceptible
SEd (±)	2.12	1.72	-	-
CD (P=0.05)	4.63	3.75	-	-

CONCLUSION

None of the cultivars tested showed resistant reaction (category 0 and I) while three cultivars viz., GK-TC-4, Bidhan Rajani-1 and Arka Nirantara showed moderate resistant reaction with recorded per cent disease incidence of 16.11%, 18.17% and 18.71%, respectively (category II). Rest cultivars viz., Bidhan Ranjani-2, Prajwal, Phule Rajani, Local Single, Local Double, Vaibhav, Suhashini and Shringer were placed under moderately susceptible category (category III). Systemic fungicides viz., azoxystrobin, difenconazole and a combo fungicide consisting of iprodione (25%) + carbendazim (25%) at 0.1% resulted lowest per cent disease incidence of 7.91%, 9.83% and 11.85%, respectively compared to control (33.62 PDI). Economic analyses revealed effectiveness of difenconazole followed by iprodione + carbendazim and azoxystrobin with highest B:C ratio of 7.28, 7.03 and 6.79, respectively.

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