

## Reaction of Popular Commercial varieties Against *Alternaria alternata* (Fr.) Keissler causing Blight in chrysanthemum

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**ABSTRACT:** *Alternaria* blight caused by *Alternaria alternata* (Fr.) Keissler is one of the major fungal diseases limiting the cultivation and production of high-quality flowers in chrysanthemum. Finding out a source of resistance against the disease is one of the major concerns for a state like Karnataka who have higher potential in production of chrysanthemum for cut and loose purpose. So, on these lines, ten commercial varieties of chrysanthemum were taken in field condition to check their resistance against the incidence of *Alternaria* blight disease in natural epiphytotic condition. Of the grown varieties, Meghna Orange was the most highly susceptible variety was highest disease incidence 73.12 PDI and mean AUDPC value of 703.11 at which was followed by Marigold Yellow and Thanu Purple. Regarding flower yield, Thanu Purple showed the least yield at 3.20 t/ha Whereas, Aishwarya White was the only variety considered susceptible with least disease incidence of 34.69 PDI and mean AUDPC value of 275.41 and maximum flower yield of 8.53 t/ha. None of the tested varieties exhibited resistance reaction against *Alternaria* blight disease.

**Keywords:** *Alternaria*, resistance, chrysanthemum, susceptible, disease, incidence.

### INTRODUCTION

Chrysanthemum (*Chrysanthemum indicum* L.), is one of the most attractive flowering plant belonging to the Asteraceae family and is the second most important crop in the world for floriculture after roses (Kumar *et al.*, 2011), plays a significant role in the cut flower industry. It is an important commercial flower crop used mainly as loose flower in domestic market and as well as a popular cut flower in the world market (Ravikumar *et al.*, 2016). It is sometimes referred to as the "Queen of the East" or the autumn queen of golden flowers (Adolf and Ali 2023). The production of high-quality bloom yield is endangered by numerous abiotic and biotic factors. Some of the most important biotic factors include brown rust (*Puccinia chrysanthemi*), crown galls caused by *Agrobacterium tumefaciense*, leaf spot caused by *Septoria* sp., vascular wilts caused by *Fusarium* and *Verticillium* spp. (Ahasan *et al.*, 2021). One of the most destructive diseases in chrysanthemum is *Alternaria* blight, which is caused by *Alternaria alternata* (Fr.) Keissler (Deepthi and Reddy 2013). The disease appears on the leaf as small,

scattered brown to black spots which further increase in size and coalesced to cover more leaf area, with a dark brown margin and a yellow halo, causing leaf blight, and eventually, defoliation (Kumar, 2008).

It is typically present in most of the chrysanthemum growing pockets which is resulting in quantifiable yield losses (> 80%) as well as reduced flower quality (Divyajyothi *et al.*, 2018). A survey conducted by Shamala and Janardhana (2015) explored the prevalence and incidence of leaf blight disease in Southern Karnataka districts, revealing its distribution in all chrysanthemum cultivation areas. For effective management of this disease, there is a need to find the source of resistance against the disease. So, on these lines an experiment was taken to check the resistance of some popular commercial varieties of chrysanthemum cultivated by farmers in Karnataka against the *Alternaria* blight disease in field conditions. Further, the area under disease progress was also evaluated according to Poonam *et al.* (2022) to study epidemic nature of disease by studying the progress of disease over the period of time.

## MATERIALS AND METHODS

The experiment was conducted in June 2023 at College farm, College of Horticulture, Bagalkot (University of Horticulture Science, Bagalkot). Initially, preparation of land was done by removing weeds and stubbles. Ploughing was done carefully with a disc harrow and beds were prepared fifteen days before transplanting with the help of tractor operated leveler. Laterals were laid to provide irrigation through drip system and further, these beds were covered with 40-micron, 1.2-meter width mulching sheet to avoid weeds and to conserve moisture. In the month of June 2023, fifteen-days-old, uniformly proportioned, and healthy chrysanthemum plantlets of varieties as mentioned in Table 1 were transplanted in two replications, where each replication of the varieties were maintained in blocks of 4 × 3 m<sup>2</sup> in augmented design with chosen spacing of 45 × 30 cm (Row × Plant). An infector row (Susceptible variety – Poornima white) were planted at the start of the experimental block to create disease epiphytotic condition. The crop was raised as per package of practices of UHS Bagalkot and irrigation was provided based on availability of soil moisture for proper establishment of the plantlets.

To determine the origins of resistance, disease progress was evaluated by taking an experiment under field condition with natural disease epiphytotic circumstances. The field was laid such that, infector rows of susceptible variety were grown and maintained to increase the progress of the disease after the initial occurrence of disease. The disease severity was determined using a 0–5 disease severity scale as given in Table 2 (Kumar *et al.*, 2011). After scoring the plants on severity scale, the grades are converted into percent disease index by using the formula given below (Wheeler, 1969).

Disease indeed (%) =

$$\frac{\text{Sum of all individual ratings}}{\text{Number of plants assessed} \times \text{Maximum rating in the scale}} \times 100$$

Further, the categorization of chrysanthemum varieties into resistance or susceptible were done based scale given in Table 3. The AUDPC (area under disease progress curve) was calculated for plants from disease severity score using the formula given by Popoola *et al.* (2015).

$$\text{AUDPC} = \sum_i [(D_i + D_{i-1}) * (t_i - t_{i-1})] / 2$$

Where, i is days at which disease incidence calculated; D is disease score using 0-5 scale; t is days after disease incidence.

Finally, yield of chrysanthemum was calculated by picking the flowers at four intervals during harvest. The weight of the flowers was taken at each time after harvest. The total yield of the block was calculated by pooling the yield at each harvest to get net yield from the block. This data was considered for calculating the gross yield which was converted into total yield per hectare extrapolated to tones per hectare.

## RESULTS AND DISCUSSION

For effective management of *Alternaria* blight in chrysanthemum, resistance reaction of the variety

against the disease plays a major role. Innate resistance of a plant helps to check the disease progress and further avoid the disease epidemic in field condition. In this experiment, percent disease index (PDI) was calculated by using a 0–5 disease severity scale for every 15 days after the initial appearance of disease. The results from the terminal PDI data collected revealed that “Aishwarya White” was the only variety which was susceptible to disease with 34.69 PDI value whereas, all the other varieties were highly susceptible to disease. Meghna Orange was the highly susceptible variety with highest PDI value of 73.12 followed by Marigold Yellow (71.23 PDI), Thanu Purple (69.88 PDI), Poornima White (52.29 PDI) Scent Yellow (51.91 PDI), Thanu White (51.11 PDI), Mansi Bronz (49.91 PDI), Scent White (48.51 PDI) and Poornima Yellow (41.55 PDI) (Table 4). This result may be due to the geographical location of the experiment conducted, which is confirmed in experiment conducted by Vaishnavi *et al.* (2023) who undertook similar investigation on varietal screening in Ratnagiri district (Maharashtra).

The results from the pattern of AUDPC values among different varieties over the different observation intervals revealed that, the “Aishwarya White” variety recorded least AUDPC value of 47.53 at August 1<sup>st</sup> fortnight, which gradually increased to 471.00 at October 1<sup>st</sup> fortnight with the progress of disease. The mean AUDPC value of 275.41 was correlated with the less disease index of 34.69 PDI and was hence classified as susceptible variety. Whereas, in all other varieties the AUDPC values ranged from 136.92 - 374.50 on August 1<sup>st</sup> fortnight. Further it ranged from 643.20 – 1015.88 from August 2<sup>nd</sup> fortnight to October 1<sup>st</sup> fortnight with the progress of disease with mean AUDPC values of 396.60 - 703.11. This was in line with higher disease index of 41.55 PDI to 73.12 PDI and were classified as highly susceptible to disease (Table 5) which is similar to the study conducted by Poonam *et al.* (2022) while studying disease progression of *Alternaria* leaf spot on asalio.

Regarding the flower yield, the highest yield was recorded in the variety “Aishwarya White” at 8.53 t/ha followed by Mansi Bronz (7.75 t/ha), Thanu White (7.70 t/ha), Poornima Yellow (7.66 t/ha), Scent Yellow (7.13 t/ha), Scent White (7.09 t/ha) and Poornima White (7.08 t/ha). The minimum yield was recorded in Thanu Purple at 3.20 t/ha followed by Meghna Orange (5.83 t/ha) and Marigold Yellow (6.04 t/ha) (Table 6).

**Table 1: List of chrysanthemum varieties for screening against *Alternaria* blight.**

Sr. No.	Varieties
1.	Aishwarya White
2.	Scent White
3.	Mansi Bronz
4.	Thanu White
5.	Scent Yellow
6.	Poornima White
7.	Thanu Purple
8.	Marigold Yellow
9.	Meghna Orange
10.	Poornima Yellow

**Table 2: Scale used for scoring of *Alternaria* blight diseases of chrysanthemum.**

Scale	Description
0	No disease symptoms
1	A few spots towards tip covering 10 per cent leaf area
2	Several dark brown patches covering up to 20 per cent leaf area
3	Several patches with paler outer zone covering up to 40 per cent leaf area
4	Lesion covering up to 60 per cent leaf area
5	Complete drying and breaking of the leaves from the center

**Table 3: Scale representing reaction of chrysanthemum varieties against *Alternaria* blight disease.**

Scale	Percent disease index	Reaction
1	0-10 % PDI	Resistant (R)
2	10-20 % PDI	Moderate resistant (MR)
3	20-30 % PDI	Moderate susceptible (MS)
4	30-40 % PDI	Susceptible (S)
5	> 40% PDI	Highly susceptible (HS).

**Table 4: Screening of chrysanthemum varieties against *Alternaria* blight in field conditions.**

Sr. No.	Varieties	Disease incidence (%) at different days interval					
		Day 1*	Day 15	Day 30	Day 45	Day 60	Day 75
1.	Aishwarya White	00.00	06.78	16.58	23.21	28.11	34.69
2.	Scent White	05.33	15.38	22.12	30.33	38.14	48.51
3.	Mansi Bronz	16.51	28.13	33.23	39.33	41.25	49.91
4.	Thanu White	08.12	15.57	24.41	33.69	41.33	51.11
5.	Poornima Yellow	06.99	12.57	21.23	36.67	44.21	41.55
6.	Poornima White	11.13	22.31	36.17	42.19	47.18	52.29
7.	Thanu Purple	17.33	29.11	42.32	47.01	59.17	69.88
8.	Scent Yellow	13.57	27.78	38.19	42.23	47.08	51.91
9.	Meghna Orange	19.11	32.05	44.39	51.19	62.33	73.12
10.	Marigold Yellow	23.31	30.19	44.22	49.97	60.01	71.23

\* Onset of disease (30 days after transplanting)

**Table 5: Pattern of area under disease progress curve (AUDPC) of chrysanthemum varieties screened against *Alternaria* blight in field conditions.**

Sr. No.	Varieties	Area under disease progress curve (AUDPC)					Mean
		August 1 <sup>st</sup> fortnight	August 2 <sup>nd</sup> fortnight	September 1 <sup>st</sup> fortnight	September 2 <sup>nd</sup> fortnight	October 1 <sup>st</sup> fortnight	
1.	Aishwarya White	47.53	175.20	298.43	384.90	471.00	275.41
2.	Scent White	144.97	281.25	393.38	513.53	649.88	396.60
3.	Mansi Bronz	312.48	460.20	544.20	604.35	683.70	520.99
4.	Thanu White	165.83	299.85	435.75	562.65	693.30	431.48
5.	Poornima Yellow	136.92	253.50	434.25	606.60	643.20	414.89
6.	Poornima White	234.08	438.60	587.70	670.28	746.03	535.34
7.	Thanu Purple	325.08	535.73	669.98	796.35	967.88	659.00
8.	Scent Yellow	289.45	494.78	603.15	669.83	742.43	559.93
9.	Meghna Orange	358.12	573.30	716.85	851.40	1015.88	703.11
10.	Marigold Yellow	374.50	558.08	706.43	824.85	984.30	689.63

**Table 6: Reactions of chrysanthemum varieties against *Alternaria* blight in field conditions.**

Sr. No.	Varieties	Severity grade*	Reaction	Flower yield (t/ha)
1.	Aishwarya White	4	S	8.53
2.	Scent White	5	HS	7.09
3.	Mansi Bronz	5	HS	7.75
4.	Thanu White	5	HS	7.70
5.	Poornima Yellow	5	HS	7.66
6.	Poornima White	5	HS	7.08
7.	Thanu Purple	5	HS	3.20
8.	Scent Yellow	5	HS	7.13
9.	Meghna Orange	5	HS	5.83
10.	Marigold Yellow	5	HS	6.04

## CONCLUSIONS

By studying the resistant reaction of popular commercial varieties of chrysanthemum against the incidence of *Alternaria* blight disease in field condition, it was observed that, of all the grown varieties “Meghna Orange” was considered as highly susceptible variety with highest percent disease incidence of 73.12 and with highest mean AUDPC value of 703.11 which was followed by “Marigold Yellow” and “Thanu Purple”. Regarding flower yield, variety “Thanu Purple” exhibited least yield at 3.20 t/ha. Whereas, “Aishwarya White” was the only variety considered as susceptible with least percent disease incidence of 34.69 and mean AUDPC value of 275.41. It was also the variety with maximum flower yield of 8.53 t/ha. Finally, it was also observed that, all the commercial varieties tested against *Alternaria* blight in chrysanthemum at Bagalkot are susceptible to disease and there are no varieties among the tested showing resistance reaction against the disease incidence.

## FUTURE SCOPE

Most of the popular commercial varieties of chrysanthemum grown by farmers in Karnataka are susceptible to *Alternaria* blight disease and lack of innate resistance against the disease incidence among these varieties is one of the major drawbacks of present chrysanthemum cultivation in this region. So, further discovering the market acceptable, resistance source in varieties of chrysanthemum against the disease by identifying the resistant cultivars or by discovering resistance gene source against the disease is one of the most essential and a required step. Further avoiding the usage of plant protection chemicals for management of disease so as to manage the disease in an environmentally friendly way.

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**Conflict of Interest.** None.

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