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Impact of weather parameters on Alternaria blight of marigold incited by *Alternaria tagetica* Shome and Mustafee at different planting time

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ABSTRACT

Alternaria leaf spot and flower blight of marigold caused by *Alternaria tagetica* Shome and Mustafee is appearing in mild to severe form in Haryana. Field experiments were conducted to see the effect of weather parameters on development of Alternaria blight of marigold transplanted on different date. Alternaria leaf spot intensity decreased from 77.6 to 71.7 and 86.0 to78.1 during 2013 and 2014, respectively with delay in transplanting. Similarly, flower blight intensity also reduced from 85.4 to 80.4 and 88.7to 82.3% during both the years with delay in transplanting. Disease progression revealed that Alternaria leaf spot and flower blight intensity had significant negative correlation with weekly maximum and minimum temperatures and sunshine hrs whereas; morning and evening relative humidity had significant positive correlation.Maximum and minimum temperature 27.5±1.0°C and 7.5±1.0°C respectively, were found to be conducive for the development of Alternaria blight of marigold. Regression analysis indicated that the 83 per cent variation in Alternaria leaf spot and 87 per cent in flower blight intensity could be explained by weather parameter which was statistically highly significant.

Key words:Alternaria tagetica, Tagetica erecta, marigold,planting time, Alternaria leaf spot and flower blight, weather parameters

Marigold (*Tagetica erecta* L.)has attained a special status in floriculture industry due to its beauty, longer vase life, widely use in religious and social functions. The leaves and flower possess great value in cosmetic, medicine and pharmaceutical industry (Khalil *et.al.*2007). In Haryana, its commercial production has emerged due to lack of essential knowledge of demand, marketing and production technology, availability of diseased free seed materials and pathological information.Among the various integration practices associated with growing plant conditions, biotic and abiotic stresses are responsible for affecting quantity and quality of flower; however, the diseases have been identified as major limiting factor. Alternaria leaf spot and flower blight of marigold has gain manifold in the marigold growing areas of Haryana. Keeping in view the seriousness of the disease in the state, the present investigations were planned to find role of weather parameters on appearance and progress of Alternaria blight of marigold leaf and flower blight of marigold at different planting time.

MATERIALS AND METHODS

A field experiment was conducted at the research farm of Department of Plant Pathology,CCS Haryana Agricultural University (CCSHAU), Hisar during 2013-14 and 2014-15 to study the effect of planting time on marigold seedlings at three different dates (Table 1) in a plot size of 2×2.5 m^2 having row to plant distance of 40 x30cm. African Giant Yellow marigold variety nursery was raised one month in advance before transplanting as per requirement in plots. Disease progression was measured after the appearance of the disease at weekly interval on both flowers and leaves separately. The data was recorded on ten marigold plants in each plot for per cent leaf spot and flower blight intensity. The average disease intensitywas recorded using 0-5 scale as per method of Hotchkiss and Baxter (1983) and disease intensity was calculated using the formula of McKinney (1923).

The percent disease intensity (PDI) was calculated using following formulae:

$$PD1 = \frac{\text{Sum of all numerical rating}}{\text{No of leaves/flowers assessed x Maximum disease rating}} \times 100$$

The progression of the disease was correlated with prevailing weather parameters such as maximum temperature ($T_{max.}$), minimum temperature ($T_{min.}$) relative humidity morning (RH_m), relative humidity evening (RH_e), bright sunshine hours (SSH) and rainfall obtained from the Observatory,

Table 1: Effect of transplanting date on Alternaria blight intensity (camulative) in African marigold during 2013-14 and 2014-15.

Week after transplanting (WAT)	Leaf spot Intensity (%)			Flower blight Intensity (%)		
	D_1***	D_2	D_3	D_1	D_2	D_3
Crop and Season 2013-14						
8	4.2*	2.7	0.9	6.3*	4.6	2.1
9	10.2	7.5	5.9	8.6	6.6	4.4
10	20.0	14.3	19.4	16.1	13.6	18.6
11	31.2	28.5	32.0	26.4	24.6	29.5
12	46.5	43.6	41.6	42.6	41.7	42.3
13	58.4	55.4	52.6	57.7	56.9	53.0
14	66.5	63.8	60.9	73.4	71.6	65.0
15	72.3	69.8	67.9	84.2	78.9	76.7
16	77.6	74.7	71.7	85.4	83.4	80.4
C.D.	3.19	4.71	4.69	4.17	3.81	3.9
Crop season 2014-15						
7	7.2*	5.7	4.5	4.0	2.5	1.2
8	16.7	14.1	12.1	7.1	6.8	4.3
9	28.7	28.6	22.2	21.0	19.7	17.5
10	42.2	42.9	37.2	36.1	34.1	32.7
11	54.2	58.3	50.1	48.8	49.5	44.8
12	68.4	66.8	58.8	64.7	62.1	52.6
13	77.1	73.3	64.6	76.1	73.1	61.4
14	82.3	78.6	72.3	83.8	81.6	74.1
15	86.0	82.2	78.1	88.7	85.3	82.3
C.D.	3.27	4.07	4.91	3.91	3.74	5.09

D_1=First date of transplanting, D_2= Second date of transplanting, D_3=Third date of transplanting; CD=Critical Difference at 5%.

Department of Agro-meteorology, CCS HAU, Hisar. The data were subjected for correlation and regression coefficients. The prediction equations $Y = a + b_1X_1 + b_2X_2 + \ldots b_6X_6$, where Y = predicted disease progression, a= intercept, b_1 to b_7 = regression coefficient, X_1 to X_6= independent variables, $X_1 = T_{max}.(^0C)$, $X_2 = T_{min}.(^0C)$, $X_3 = RH_m(\%)$, $X_4 = RH_e$ (%), X_5= SSH, X_6= rainfall (mm) were developed using standard package of statistical method.

RESULTS AND DISCUSSION

Cumulative Alternaria blight intensity of marigold on leaves and flowers on staggering dates of transplanting was recorded during 2013 and 2014. The results obtained during 2013-14 revealed that the maximum Alternaria leaf spot intensity was 77.6 per cent during first transplanting, but it declined to 74.7 per cent in D_2 (71.7%) transplanted plants (Table1). The results also depict that maximum flower blight intensity was 85.4, 83.4 and 80.4 per cent under D_1, D_2 and D_3 transplanted plants respectively.

Similarly, during 2014-15, maximum leaf spot intensity was 86.0, 82.2 and 78.1 per cent was under three dates (D_1, D_2, D_3) transplanted plants respectively. The perusal of data showed that mxaximum flower blight intensity (88.7 per cent) was also recorded during first transplanting which decreased to 85.3 per cent during second transplanting and further reduced to 82.3 per cent in third transplanting (Table 1).

Table 2: Correlation matrix of cumulative Alternaria leaf spot and flower blight intensity with weather parameter

Weather variables	Leaf spot intensity (%)	Flower blight intensity (%)
Maximum temperature (X_1)	-0.84**	-0.85**
Minimum temperature (X_2)	-0.71**	-0.70**
Relative humidity morning (X_3)	0.85**	0.85**
Relative humidity evening (X_4)	0.81**	0.82**
Sunshine (X_5)	-0.71**	-0.72**
Rainfall (X_6)	0.10*	0.11**

*Significant at 5% (P= 0.05), **Significant at 1%,

Table 3: Regression equations for the cumulative progression of Alternaria blight in relation to weather parameter on planting time

	Regression equation	R^2
Leaf spot intensity	$Y= -52.580-6.47X_1+3.22X_2+1.85X_3+0.01X_4+9.04X_5-4.84X_6$	0.83
Flower blight intensity	$Y= -43.230-6.69X_1-3.26X_2-1.63X_3+0.17X_4+9.65X_5-4.32X_6$	0.87

X_1= Temperature (Maximum), X_2 = Temperature (Minimum), X_3 = Relative Humidity (Morning), X_4= Relative Humidity (Evening), X_5= Sunshine hrs, X_6= Rainfall

From two years observations on Alternaria leaf spot and flower blight intensity, it can be explained that the Alternaria blight decreased with protracted date of transplanting. In early transplanting, the Alternaria leaf spot and flower blight intensity was highest than other dates of transplanting. Thus, it can be deducedfrom present study that delay in transplanting resulted in retardation of Alternaria blight intensity that may be due to prolong incubation period of *Alternaria tagetica,* which get cognizant from Mahapatra and Das (2014), and Khatun *et.al*. (2011) observations that delay sowing of mustard showed less disease intensity and gave higher seed yield against Alternaria blight. No such information has been generated against Alternaria leaf spot and flower blight of marigold and literature is silent on Alternaria bilght of marigold, which also confirm present observations made on same necrotroph.

The correlation matrix for the progression of Alternaria leaf spot and flower blight in relation to weather parameter was also drawn from pooled data. The data presented in Table 2 indicated that Alternaria leaf spot and flower blight had highly significant negative correlation with minimum temperature, maximum temperature and sunshine hr in three dates of transplanting, but relative humidity (morning and evening)had highly significant positive correlation. Disease progression revealed that Alternaria leaf spot and flower blight intensity had significant negative correlation with weekly maximum temperature (r =0.84**and 0.85**) and minimum temperature (r =0.71**and 0.70**)and sunshine hrs (r=0.71** and 0.72**) whereas; morning (r=0.85** and 0.85**) and evening relative humidity (r=0.81**and 0.82**) had significant positive correlation. Regression coefficient of determinant (R^2) also indicated (Table 3) that variation in Alternaria leaf spotintensity(83%) and flower blight intensity (87%) during both years was governed by weather parameter in all three date of transplanting. The contribution of these factors i.e. maximum temperature(X_1) and minimum temperature(X_2) relative humidity morning(X_3) and bright sunshine hrs (X_5) in prediction was statistically highly significant.Literature is silent on correlation of Alternaria blight of marigold incited by *Alternaria tagetica* with weather parameters.However,some observations were made by Mazumder (2000) on the incidence of Alternaria blight of marigold caused by *Alternaria dianthi* which had significant and negatively correlation with maximum and minimum temperature whereas, significant positive correlation with relative humidity and total rainfall showing that with the increase in rainfall, accelerate the disease intensity, thus support the finding of present study, and which is in agreement with Meena *et.al*. (2011).The above results are also in conformity with Yu and Park (1988) who reported that *A. zinniae* developed best at 15- 25^{0}C with over 90 per cent relative humidity. Awasthi and Kolte (1994) also studied the effect of combined temperature and relative humidity on infection in cabbage by *A. brassicicola* and further reported that disease intensity increased with increasing relative humidity levels at optimum temperature of 25^{0}C.

From the pooled data during 2013-14 and 2014-15, it

may also be concluded that the maximum (27.5^{0}C) and minimum temperature (9.5^{0}C)have a significant role on the progression of Alternaria leaf spot and flower blight of marigold. Therefore, it can also be inferred that planting time play role on disease developmentand have correlation with weather parameter for disease progression.

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