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Influence of Sowing Dates on the Incidence of Powdery Mildew of Chilli

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ABSTRACT

A field experiment was conducted during kharif, 2005 at Agricultural Research station, Devihosur, Haveri, Karnataka to assess the progress of powdery mildew at different time interval of sowing dates. Totally 20 different dates of sowings were imposed in the experiment at an interval of 10 days. The crop sown on last week of May to mid of June recorded minimum disease severity compared to rest of the date of sowings. This clearly indicated that crop sown during this period suffers less, which may be due to low inoculum potential, whereas late sown crop suffers more because of the readily available inoculum in the early sown crops. Low disease severity in last week of May to mid of June sowing may be attributed to the non-congenial weather factors for the development of the disease.

Keywords: Powdery mildew, sowing dates, inoculum, weather, correlation

INTRODUCTION

Chilli suffers from many diseases caused by fungi, bacteria, viruses, nematodes and also abiotic stresses. Among the fungal diseases, powdery mildew, leaf spot and anthracnose or fruit rot are the most prevalent ones (Singh and Pandey, 2014). The powdery mildew caused by Leveillula taurica (Lev.) Arn. is a major constraint in chilli production in India causing heavy yield loss ranging from 14 to 20 per cent, due to severe defoliation and reduction in photosynthesis, size and number of fruits per plant (Sivaprakasam *et al.,* 1976 and Gohokar and Peshney, 1981). Under greenhouse conditions, 10 to 15 per cent yield loss has been reported from Canada (Cerkauskas *et al.,* 1999). The loss caused by chilli powdery mildew is proportional to the disease severity and varies remarkably depending on the stage of infection, genotypes and environmental conditions. The fungus causing powdery mildew is an obligate parasite. The disease is characterized by yellowing on the upper surface of the foliage with a whitish powdery mass on the corresponding lower surface. In severe cases, whitish mass develops on both the surfaces and results in premature defoliation (Jharia *et al.,* 1978). The disease has attained the economic status in the state. However, not much systematic research work being carried out on loss assessment, epidemiology and management of the hitherto neglected but important disease of chilli. A number of management approaches, viz., development of tolerant varieties, application of fungicides, cultural practices and combination of approaches leading to integrated management of the disease have been evaluated and recommended. In spite of all these measures, powdery mildew continues to be one of the major constraints in chilli production. Globally, India is a leading country in the context of the area covered in chilli production, making it's the most dominant player in the world chilli market (Singh and Pandey, 2014 and Singh and *et al.,* 2012). In Karnataka, research work on important aspects of the powdery mildew disease of chilli has not been done properly. Therefore, it was thought necessary to initiate systematic studies on influence of sowing dates on powdery mildew of chilli.

MATERIALS AND METHODS

A field experiment was conducted during kharif at Agricultural Research station, Devihosur to assess the progress of powdery mildew at different time interval of sowing dates. A replicated field trial was carried out to explore the possibility of disease escape. The experiment was conducted with randomized block design with three replications. The first sowing date treatment was imposed by sowing seeds of highly susceptible variety 'Byadgi dabbi' on 4th April and subsequent sowings were done at an interval of 10 days till the last sowing date on 14th October, so totally 20 different dates of sowings were imposed in the experiment. The severity of powdery mildew was recorded at weekly interval after appearance of the disease on five randomly selected plants / plot using a disease rating scale 0-9. The observations on per cent disease index (PDI) were recorded as explained in crop loss assessment trial. The meteorological data for the experimental period was collected and correlated with powdery mildew incidence.

RESULTS AND DISCUSSION

Alteration of the date of sowing of crop always plays an important role in disease escape due to unfavourable weather conditions for infection (Singh *et al.,* 2013). Field experiment was undertaken to determine the effect of sowing time and corresponding weather factors on powdery mildew severity. The information on the incidence of powdery mildew in chilli sown at different dates and also the influence of meteorological conditions in powdery mildew development

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will be very much useful to adjust the sowing times for growing good crop under very low disease pressure. The results are presented in Table 1.

The observations revealed that the disease progression in 1st date of sowing (i.e. 4th May) indicated, the incidence of disease appeared after 90 days after transplanting (DAT) and further there was progress of the disease week by week and reached highest peak of 100 per cent at 146 DAT. So also, in 2nd DOS, as given in the Table 1, the disease appearance was observed at 83 DAT and reached maximum PDI at 139 DAT. In following 3rd DOS, initiation of disease was observed on 76 DAT and reached maximum little earlier than previous DOS i.e. at 132 DAT.

First incidence of disease during 4th DOS (4th May) was noticed at 76 DAT and the disease progression curve attained maximum PDI at 125 DAT., as these periods and stage of the crops were favourable for the development of the disease. But in case of 5th DOS (14th May), disease was maximum at 146 DAT onwards. However, in 6th DOS (24th May) the disease initiation was delayed to 118 DAT and its maximum PDI was 68.66 PDI even at 153 DAT which was less PDI when compared to rest of the DOS.

Table 2: Mean weather parameters of different sowing dates and per cent disease index (PDI) of powdery mildew of chilli caused by Leveillula taurica

PDI (at 118 DAT)	Temperature (⁰C)		Relative humidity (%)		Rainfall (mm)
14.91	Max.	Min	Morn.	Eve.	
26.67	30.28	21.76	89.6	71.7	2.98
76.97	28.18	22.40	90.4	87.6	2.66
90.73	27.04	21.04	89.0	84.8	1.82
38.77	29.70	20.56	86.9	73.9	2.28
3.63	31.74	21.04	84.7	61.4	2.38
9.30	29.70	21.18	89.6	73.5	3.72
20.77	28.78	20.52	83.0	68.8	1.44
32.57	30.22	17.45	77.6	57.2	0
75.53	30.36	22.64	65.5	43.2	0
84.07	29.38	17.32	72.8	52.3	0
97.63	30.54	16.10	70.0	50.8	0
97.13	30.36	14.68	71.2	43.2	0
94.73	29.52	13.5	79.1	40.0	0
100	30.21	16.14	73.9	43.7	0
100	32.86	16.32	58.7	27.1	0
100	31.48	14.18	53.3	31.1	0
100	32.14	13.82	52.0	21.3	0
100	33.5	15.10	53.1	20.0	0
100	35.75	17.14	60.0	16.1	0
	34.48	19.68	72.4	32.1	0

In similar way, during 7th DOS (3rd June), the observation depicted the similar observation as disease progressed slowly and reached maximum of 83.46 PDI at 153 DAT, whereas the PDI was maximum of 96.83 and 100 per cent at 153 DAT for 8th DOS (13th June) and 9th DOS (23rd June) respectively. Similar types of observations were observed for rest of the other dates of sowings (Table 1).

The Table 1 indicated the higher PDI of 89.67 and 92.16 per cent for 19th DOS (4th October) and 20th DOS (14th October) respectively. It was noticed earlier than other dates of sowings, at just 54 DAT stage of the crop and progress of disease reached maximum of 100 per cent at very early stages of the crop in both DOS. The observations revealed that, there was significant difference with respect to the 6th DOS for PDI when compared to other DOS from 111 DAT and onwards. The least PDI and slower disease progression were recorded in 6th DOS (24th May) than rest of the dates of sowing at all stages of the crop growth and showed significantly lesser PDI compared to all other dates of sowing after 111 DAT stage of the crop at different intervals of observations. This is followed by crop sown on 7th DOS (3rd June) and 8th DOS (13th June), wherein the lesser PDI and slower rate of disease progression observed in contrast to higher PDI in crop sown during August and subsequent months. The delayed dates of sowing, particularly August onwards, where disease initiation started earlier and reached maximum very early. The results are similar to Sharma and Sharma (1999) who reported that early sown fenugreek crop suffered least due to low inoculum potential and unfavourable weather conditions for pathogen whereas, late sown crop suffered more because of ready availability of inoculum buildup in early sown crop. Similar observations were made by Naik and Rangaswamy (1994) in case of powdery mildew of horse gram caused by L. taurica. In the present study, severity of powdery mildew of chilli was found to be influenced by environmental factors, which prevailed during crop growth period. The disease severity was maximum at the end of July month onwards (Table 2).

The coincidence of the favourable period with stage of the crop led to considerable boost in disease incidence. Correlation coefficients between disease severity and weather parameters showed that minimum temperature, morning and evening relative humidity and rainfall have significantly negative correlation with the disease. However, correlation coefficient with maximum temperature was positive but non-significant (Table 3).

Table 3: Correlation coefficient between weather parameters and per cent disease index (PDI) of powdery mildew of chilli caused by Leveillula taurica

Weather parameters	Correlation coefficient
Maximum temperature (0C)	0.392
Minimum temperature (0C)	- 0.645*
Relative humidity (%) morning	- 0.562*
Relative humidity (%) evening	-0.576*
Rainfall (mm)	-0.597*

* Significant at 5% probability levels.

CONCLUSION

In the present study, the crop sown on last week of May to mid of June recorded minimum disease severity compared to rest of the date of sowings. This clearly indicated that crop sown during this period suffers less, which may be due to low inoculum potential, whereas late sown crop suffers more because of the readily available inoculum in the early sown

crops. Low disease severity in last week of May to mid of June sowing may be attributed to the non-congenial weather factors for the development of the disease. Very early sowing of crop i.e., in the month of April, wherein prevalence of non congenial environmental factors and improper period do not support chilli crop growth and establishment, resulting in the unfavourable conditions for the pathogen in the initial period.

Table 1: Influence of date of sowing (DOS) on the incidence of powdery mildew of chilli caused by Leveillula taurica

Days after transplanting (DAT)														
54	**62**	**69**	**76**	**83**	**90**	**97**	**104**	**111**	**118**	**125**	**132**	**139**	**146**	**153**
0.0	0.0	0.0	0.0	0.0	5.47	7.88	11.83	12.87	14.91	16.75	33.47	68.83	100	100
(1.28)*	(1.28)	(1.28)	(1.28)	(1.28)	(13.32)	(16.21)	(20.67)*	(20.94)	(22.6)	(24.1)	(34.97)	(56.09)	(88.72)	(88.72)
0.0	0.0	0.0	0.0	4.16	11.18	11.93	12.97	15.84	26.67	34.23	73.03	100	100	100
(1.28)	(1.28)	(1.28)	(1.28)	(11.65)	(19.46)	(20.15)	(21.04)	(23.46)	(30.01)	(35.78)	(59.11)	(88.72)	(88.75)	(88.72)
0.0	0.0	0.0	5.7	10.42	12.23	16.68	25.62	42.8	76.93	89.37	100	100	100	100
(1.28)	(1.28)	(1.28)	(13.60)	(18.80)	(20.44)	(23.93)	(30.18)	(40.83)	(61.51)	(79.97)	(88.72)	(88.72)	(88.72)	(88.72)
0.0	0.0	0.0	6.98	11.23	17.51	21.36	32.83	73.73	90.73	100	100	100	100	100
(1.28)	(1.28)	(1.28)	(15.29)	(19.42)	(24.49)	(27.35)	(34.95)	(59.55)	(72.36)	(88.72)	(88.75)	(88.72)	(88.72)	(88.72)
0.0	0.0	0.0	9.4	12.06	12.5	14.1	16.13	18.03	38.77	62.23	69.93	71.6	100	100
(1.28)	(1.28)	(1.28)	(17.85)	(20.51)	(17.68)	(22.03)	(23.63)	(25.09)	(38.5)	(52.2)	(56.75)	(57.82)	(88.72)	(88.72)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	3.63	10.1	17.8	30.8	31.46	100
(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(10.97)	(18.51)	(24.85)	(33.59)	(34.0)	(88.72)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	3.13	9.3	18.37	30.26	30.8	73.6	68.66
(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(10.12)	(17.74)	(25.3)	(33.35)	(33.68)	(60.63)	(68.13)
0.0	0.0	0.0	0.0	0.0	0.0	2.6	5.6	7.6	20.77	27.43	34.63	68.66	84.63	83.46
(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(9.25)	(13.67)	(15.98)	(27.03)	(31.48)	(35.68)	(56.73)	(67.66)	(66.60)
0.0	0.0	0.0	0.0	0.0	3.03	8.53	21.83	30.93	32.57	76.67	85.93	95.9	97.53	96.83
(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(10.0)	(16.93)	(27.84)	(33.73)	(34.78)	(61.39)	(68.36)	(78.62)	(81.06)	(79.79)
0.0	0.0	0.0	0.0	3.4	7.1	14.07	28.369	32.6	75.53	82.33	97.26	97.3	97.9	100
(1.28)	(1.28)	(1.28)	(1.28)	(10.46)	(14.38)	(22.03)	(34.24)	(34.77)	(60.92)	(65.35)	(80.89)	(80.34)	(82.01)	(88.72)
0.0	0.0	0.0	0.0	3.76	8.17	19.4	40.73	67.47	84.07	97.1	97.56	97.66	96.66	100
(1.28)	(1.28)	(1.28)	(1.28)	(11.08)	(17.60)	(27.69)	(39.64)	(55.3)	(66.62)	(80.22)	(81.05)	(81.25)	(79.93)	(88.72)
0.0	0.0	0.0	0.0	12.86	23.7	73.33	84.36	96.13	97.63	98.53	97.76	100	100	100
(1.28)	(1.28)	(1.28)	(1.28)	(20.90)	(31.17)	(58.92)	(66.92)	(78.91)	(82.92)	(83.43)	(81.74)	(88.72)	(88.72)	(88.72)
0.0	0.0	0.0	0.0	14.46	65.0	80.0	93.93	96.9	97.13	97.4	100	100	100	100
(1.28)	(1.28)	(1.28)	(1.28)	(22.14)	(52.06)	(63.62)	(75.78)	(79.86)	(80.25)	(82.08)	(88.72)	(88.72)	(88.72)	(88.72)
0.0	0.0	0.0	0.0	0.0	24.73	35.27	91.66	94	94.97	100	100	100	100	100
(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(33.02)	(35.92)	(73.77)	(76.22)	(76.99)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)
0.0	0.0	0.0	0.0	0.0	26.37	89.37	96.3	97.13	100	100	100	100	100	100
(1.28)	(1.28)	(1.28)	(1.28)	(1.28)	(34.01)	(54.14)	(80.4)	(81.47)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)
0.0	0.0	0.0	0.0	27.7	86.07	94.33	94.33	100	100	100	100	100	100	100
(1.28)	(1.28)	(1.28)	(1.28)	(31.62)	(66.20)	(76.47)	(76.98)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)
0.0	0.0	24.77	89.16	91.66	92.97	100	100	100	100	100	100	100	100	100
(1.28)	(1.28)	(29.56)	(70.98)	(73.28)	(73.36)	(88.72)	(88.75)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)
0.0	0.0	90.40	91.76	92.9	100	100	100	100	100	100	100	100	100	100
(1.28)	(1.28)	(72.08)	(73.37)	(74.60)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)
89.67	90.66	93.83	100	100	100	100	100	100	100	100	100	100	100	100
(71.69)	(72.55)	(75.92)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)
92.16	98.56	100	100	100	100	100	100	100	100	100	100	100	100	100
(74.35)	(83.59)	(88.75)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)	(88.72)
0.85	0.46	1.13	0.65	1.22	2.19	4.09	1.75	1.75	1.92	1.46	2.21	1.95	2.42	2.48
2.45	1.32	3.24	1.86	3.49	6.28	11.71	5.02	5.01	5.49	4.18	6.33	5.59	6.94	7.09

* Figures in parentheses are angular transformed values.

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