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Epidemiology of okra powdery mildew caused by *Erysiphe cichoracearum* DC

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Abstract

Okra (*Abelmoschus esculentus* (L.) Moench) a commercial vegetable crop, commonly known as Ladies finger and is one of the most widely known species of family Malvaceae. India occupies an area of 530.79 thousand hectares with the production of 6350.26 thousand tones and productivity of 12.00 mt/ha. In Maharashtra, *Bhendi* is grown throughout the year providing continuous and a good source of income to the farmers. During summer season, it fetches lucrative price due to shortage of other vegetables in the market. Amongst the fungal diseases, powdery mildew caused by *Erysiphe cichoracearum* DC. Is one of the important and of common occurrence disease, wherever okra crop is grown? Disease initiates as white minute patches, first on the upper surface of lower leaves or older leaves and then gradually spreads to younger ones while, grayish powdery coating is visible on severely affected leaves and such leaves finally show necrosis; resulting in withering, drying and defoliation, leading to yield losses of about 17 to 86.6 per cent. Crop is vulnerable to disease at late growth stage i.e. from 51 days after sowing. Average disease severity and yield in Parbhani Ok were 48.47% and 5t/ha, respectively whereas, in variety Parbhani Kranti severity, it was 46.62% and yield was 6t/ha. Results on weather parameters had negative correlation with disease except temperature (Max. and Min.), which showed positive and significant correlation with the disease.

Keywords: Okra, *Abelmoschus esculentus*, powdery mildew, *Erysiphe cichoracearum*, weather parameters, disease severity

Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) a commercial vegetable crop, commonly known as ladies finger and is one of the most widely known species of family Malvaceae (Bayer and Kubitzki, 2003)^[5]. It is originated in tropical Africa (Akanbi *et al.*, 2010)^[1] and is cultivated in different parts of the World including India and Pakistan (Anonymous, 2003)^[2]. Its seed contain protein, edible oil (Oyelade *et al.*, 2003)^[18], vitamin A, B, C, minerals and linoleic acid (Savello *et al.*, 1980)^[14].

India occupies an area of 530.79 thousand hectares with the production of 6350.26 thousand tones and productivity of 12.00 MT/ha. (Anonymous, 2013)^[3]. In Maharashtra, *Bhendi* is grown throughout the year providing continuous and a good source of income to the farmers. During summer season, it fetches lucrative price due to shortage of other vegetables in the market. It is extensively grown in the districts *viz.*, Ahmednagar, Amravati, Aurangabad, Dhule, Jalgaon, Nagpur, Nasik, Osman Abad, Parbhani and Pune. In Maharashtra, it was cultivated on an area of 22.00 thousand hectares with the annual production of 328.00 thousand tones and productivity of 11.80 MT/ha (Anonymous, 2013)^[3].

Kumar *et al.* (2013)^[10] reported major fungal diseases of okra as: damping off (*Macrophomina phaseolina*, *Pythium aphanidermatum* and *Rhizoctonia solani*), vascular wilt (*Fusarium oxysporum*), Cercospora blight (*Cercospora abelmoschus*, *Cercospora malayensis*) and powdery mildew (*Erysiphe cichoracearum*, *Oidium abelmoschi*). Amongst the fungal diseases, powdery mildew caused by *Erysiphe cichoracearum* DC. Is one of the important and of common occurrence disease, wherever okra crop is grown?

The occurrence of the disease has been reported from Mexico (Diaz Franco, 1999)^[6]. In India, the disease has been reported to occur from Delhi region (Prabhu *et al.*, 1971)^[12], Karnataka (Sohi and Sokhi, 1974)^[15], Himachal Pradesh (Raj *et al.*, 1992)^[13] and Maharashtra (Jambhale and Nerker, 1983)^[8]. Disease initiates as white minute patches, first on the upper surface of lower leaves or older leaves and then gradually spreads to younger ones while, grayish powdery coating is visible on severely affected leaves and such leaves finally show necrosis; resulting in withering, drying and defoliation, leading to yield losses of about 17 to 86.6

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percent (Sridhar and Sinha, 1989)^[17]. Considering the economic importance of the disease, present studies was undertaken.

Materials and Methods

The present experiment on epidemiology of powdery mildew (*Erysiphe cichoracerum*) of okra (*Abelmoschus esculentus* (L.) Moench) was conducted under field condition at Department of Plant Pathology, College of Agriculture, and Latur during *summer*, 2016.

Experimental details:

Non-replicated plots of two varieties using Parbhani Kranti and Parbhani Ok of size 4×3 m² were sown on 25/1/2016 at spacing 30× 20 cm. All recommended package of practices for crop were followed.

Observations

The observations on disease incidence were recorded at first appearance of the disease and subsequent three observations were taken after each spraying and per cent incidence was calculated, applying following formula.

$$\text{Percent disease incidence} = \frac{\text{No. of plants affected}}{\text{Total number of plants observed}} \times 100$$

Observations on powdery mildew disease severity were recorded on five randomly selected plants. The first observation was taken at first appearance of the disease and subsequent three observations were taken after each spraying. The powdery mildew disease was graded on the basis of disease severity observed on leaves by applying 0-5 disease rating scale developed by McKinney (1923)^[11].

Standard disease rating (0-5 grade) scale for powdery mildew of okra

Score	Description	Disease rating
0	No symptoms	Immune
1	1-10 per cent leaf area affected	Resistant
2	11-25 per cent leaf area affected	Moderately resistant
3	26-50 per cent leaf area affected	Moderately susceptible
4	51-75 per cent leaf area affected	Susceptible
5	Above 76 per cent leaf area affected	Highly susceptible

Based on numerical ratings observed, the percent disease severity was calculated by applying the formula as given below:

$$\text{PDS} = \frac{\text{Summation of numerical ratings}}{\text{Number of leaves observed} \times \text{maximum rating}} \times 100$$

Fruit harvesting and yield

About 3-4 pickings of okra fruits during experimentation were done. Finally fruit yield / treatment / replication was computed and final fruit yield data was presented on hectare basis (tons / ha).

Correlation with weather parameter

The data on powdery mildew incidence was correlated with weekly meteorological weather parameters. The weekly meteorological data on average temperature (Min. and Max.), relative humidity (A.M. and P.M.), total rainfall and rainy

days etc. was collected from the observatory of Oilseeds Research Station, Latur.

Results and Discussion

Powdery mildew disease incidence, severity and yield of okra in varieties Parbhani Ok and Parbhani Kranti

The results (Table 1) indicated that, the disease incidence and severity in the growing period of okra. First incidence of disease was observed at 51th day after sowing and it continued throughout the season. Results also indicated that, the growth period from 51-63 days was highly vulnerable to okra powdery mildew disease infection.

Disease incidence was more in the last week of March than rest of the weeks and was 90.04 and 87.44%, in variety Parbhani Ok and Parbhani Kranti, respectively. The disease severity in variety Parbhani Ok and Parbhani Kranti was more i.e. 85.1% and 82.20%, respectively in the last week of March.

Table 1: Disease incidence and severity of okra powdery mildew disease in var. Parbhani Ok and Parbhani Kranti in different meteorological weeks

Meteorological week	Disease incidence %		Disease severity %	
	Parbhani Ok	Parbhani Kranti	Parbhani Ok	Parbhani Kranti
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	10.10	8.07	6.20	5.10
9	20.07	18.00	15.07	13.30
10	36.00	34.04	31.70	29.50
11	42.10	41.30	39.00	38.20
12	46.05	44.10	42.02	40.10
13	49.00	48.00	47.04	45.50
14	68.02	64.00	62.30	60.40
15	78.10	75.60	72.80	70.90
16	88.40	85.50	83.50	81.00
17	90.04	87.44	85.10	82.20
Average	52.78	50.60	48.47	46.62

The results presented in Table 2 indicated that, average disease incidence in variety Parbhani Ok was 52.78% and in Parbhani Kranti 50.60%, respectively. Average disease severity and yield in Parbhani Ok were 48.47% and 5t/ha, respectively whereas, in variety Parbhani Kranti severity, it was 46.62% and yield was 6t/ha, respectively.

Table 2: Powdery mildew mean incidence, severity and yield in okra variety Parbhani Ok and Parbhani Kranti

Variety	Disease incidence (%)	Disease severity (%)	Yield (t/ha)
Parbhani Ok	52.78	48.47	5
Parbhani Kranti	50.60	46.62	6

Correlation between powdery mildew incidence and weather parameters

The correlation between disease incidence and climatic factor was worked out and presented in Table 3 and graphically depicted in Fig.1.

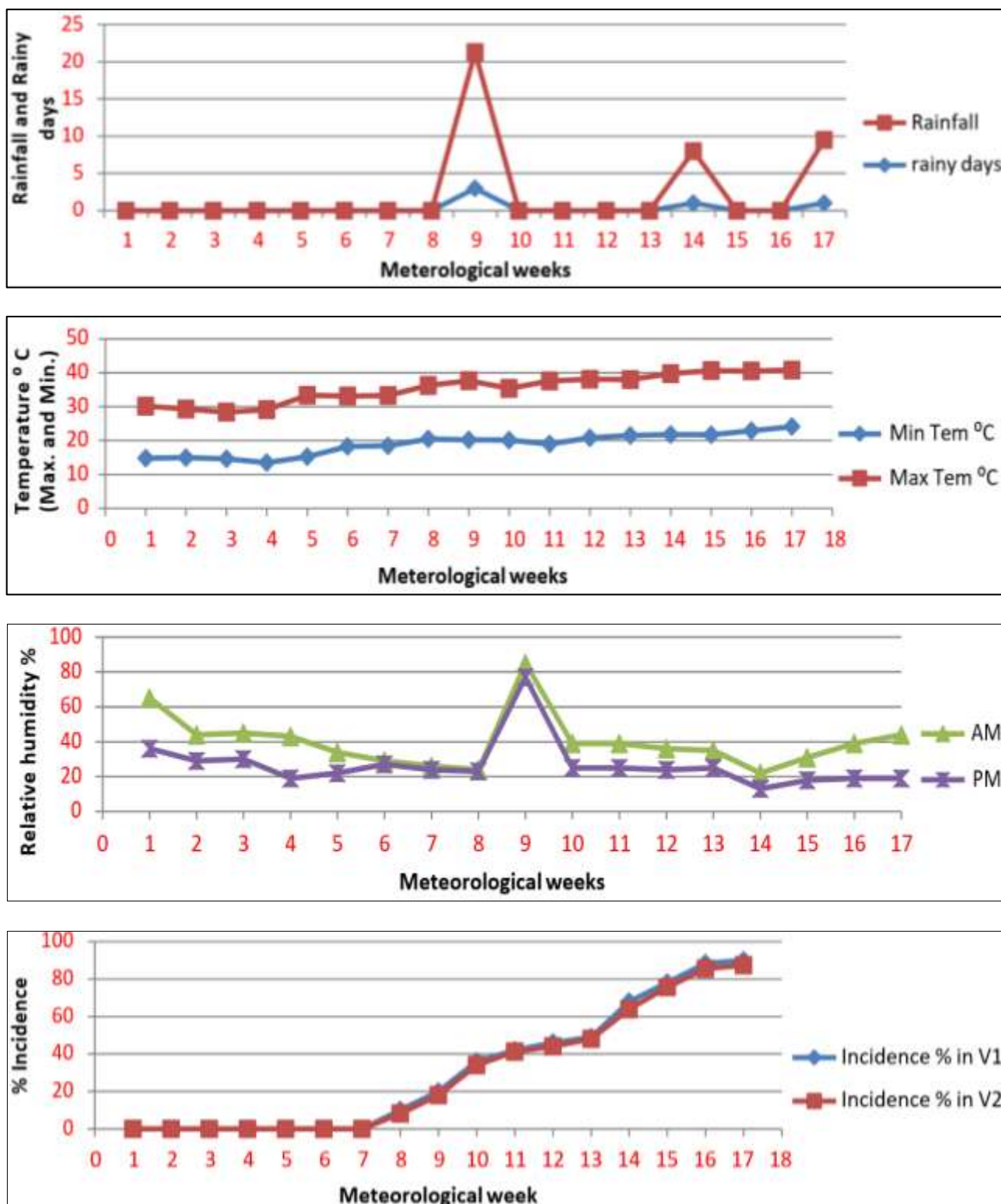


Fig 1: Relation between disease incidence and weather parameters in varieties Parbhani Ok (v1) and Parbhani Kranti (v2)

Results (Table 3) on correlation between different weather parameters viz., Maximum and minimum temperatures (°C), relative humidity (%) a.m. and p.m., Rainfall (mm), number of rainy days and disease incidence, revealed that, all the weather parameters had negative correlation with disease incidence except temperature (Max. and Min.), which had positive correlation with disease incidence in both the varieties Parbhani Ok and Parbhani Kranti. Amongst all correlations, temperature maximum and minimum had significantly positively correlated with disease incidence. It

means that, with increase in maximum and minimum temperature, there is increase in disease incidence. Similar results on epidemiology of powdery mildew of okra were earlier reported by Spencer (1978) [16], Deka (1995) [7], Kumar and Gupta (2006) [9] and Band *et al.* (2007) [4]. They reported that, prevalence of high temperature and dry spell favored the disease development.

Conclusion

Study on epidemiology indicated that, crop is vulnerable to

disease at late growth stage i.e. from 51 days after sowing. Results also indicated that, weather parameters had negative correlation with disease except temperature (Max. and Min.), which showed positive and significant correlation with the disease.

variety on protein, fat contents and some physical characteristics of okra seeds. Journal of Food Engineering. 2003 Apr 1;57(2):111-114.

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