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Correlation of weather parameters with powdery mildew disease severity on okra (*Abelmoschus esculentus* L.)

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Abstract
Powdery mildew disease of okra occurs on epidemic scale in areas of cool night temperatures and low relative humidity causing considerable yield loss. Weather factors such as temperature and moisture play a vital role in occurrence, prevalence and spread of powdery mildew disease. Experiment was conducted to correlate weather parameters with powdery mildew disease severity on okra at College of Agriculture, Shivamogga. Data on disease severity of powdery mildew was recorded at weekly intervals on susceptible okra cultivar 'Arka Anamika'. Highly significant and negative correlation of disease severity with maximum and minimum relative humidity was observed at 1 per cent level of significance. While, significantly negative correlation of disease severity with wind speed was observed at 5 per cent level of significance. Negative correlation of disease severity with maximum and minimum temperature was observed. Average temperature range between 16.33 to 30.93 ^{0}C, humidity ranged between 53.43 to 84.56 per cent, rainfall of 6.5 mm with wind speed of 4.56 km/hr was found to be an ideal condition for powdery mildew disease development on okra.

Keywords: okra, powdery mildew, weather parameters, correlation and multiple regression

Introduction

Okra [*Abelmoschus esculentus* (L.) Moench] popularly known as lady's finger or bhendi in India belonging to the family Malvaceae, grows well in relatively warmer temperatures. Okra is used in developing countries to mitigate malnutrition and alleviate food security because of its nutritious value. Every 100 g of okra contains 7.46 g of carbohydrates, 0.19 g of fat, 1.9 g of protein, 82 mg of calcium, 57 mg of magnesium, 61 mg of phosphorous, 299 mg of potassium and 23 mg of vitamin C. A ripe bhendi fruit is also rich in minerals like iodine, magnesium, potassium, vitamin A and vitamin B (Aykroud, 1963) [1]. Okra seeds contain 18 to 20 per cent of crude protein (Berry *et al*., 1988) [2]. Okra increases fibre intake that promotes better diabetic control and improves insulin sensitivity (Fujji *et al*., 2013) [3]. The mucilage produced by the okra plant can be used for the removal of turbidity from waste water by the virtue of its flocculant properties (Konstantino *et al*., 2008; Monika *et al*., 2001) [4, 5]. Research is under process to use okra mucilage in biodegradable food packaging, whose composition is similar to a thick polysaccharide film (Araujo *et al.*, 2018) [6].

Despite of its importance, the production and productivity of okra is hampered as it suffers from many diseases caused by fungi, bacteria, viruses, nematodes and abiotic stresses. Some of the diseases results in heavy losses if adequate and timely control measures are not taken. The major diseases occurring in okra are powdery mildew, yellow vein mosaic virus, cercospora leaf spot and fusarium wilt. Among them, powdery mildew is a devastating disease in okra growing areas in general. It is caused by *Erysiphe cichoracearum* DC. leading to heavy yield loss ranging from 17 to 86.6 per cent (Sridhar *et al*., 1989) [7] due to severe defoliation and reduction in photosynthesis.

It occurs on epidemic scale in areas of lower night temperature coupled with lower relative humidity. In the initial stages grayish-white powdery growth appears on upper surface of old leaves, later grayish-white spots spread to younger leaves covering all parts of plants. In severe cases, petiole and stem are also infected and develop necrosis resulting in withering and drying of leaves (Singh, 1984) [8]. Natural occurrence of powdery mildew on okra at College of Agriculture, Shivamogga had been inconsistent. Since environmental condition especially temperature and moisture play a important role in occurrence, prevalence and spread of disease.

It was considered to correlate the weather parameters with powdery mildew disease severity observed, to formulate strategies for management practices of okra powdery mildew.

Material and Methods

A trial was conducted during *rabi* 2020 at College of Agriculture, Shivamogga to correlate weather parameters *viz*., temperature (° C), relative humidity (%), rainfall (mm) and windspeed (km/hr) with disease severity of powdery mildew disease on okra. Powdery mildew susceptible okra cultivar 'Arka Anamika' was grown in a plot of 8 × 5 m area following all cultural practices except the management of powdery mildew disease. The observations on powdery mildew severity was recorded on 10 randomly selected plants following 0-5 scale given by Gawande and Patil (2003) [9] as in Table 1. at an interval of seven days starting from the day of sowing till the end of the crop. Per cent disease index was calculated as described by Wheeler (1969) [10].

$$PDI = \frac{\text{Sum of the individual disease ratings}}{\text{No. of leaves observed} \times \text{Maximum disease grade}} \times 100$$

Table 1: Disease scale (Gawande and Patil, 2003) [9]

Disease scale	Description	Reactions
0	No infection	Immune
1	1-10 per cent of leaf area infection	Resistant
2	11-25 per cent leaf area infection	Moderately resistant
3	26-50 per cent of leaf area infection	Moderately susceptible
4	51-75 per cent of leaf area infection	Susceptible
5	76-100 per cent of leaf area infection and defoliation	Highly susceptible

Meteorological data was collected from the meteorological station, College of Agriculture, Shivamogga. Severity of powdery mildew disease in the season was correlated with meteorological factors. Multiple regression co-efficient was calculated for the meteorological factors as independent variables with the prediction equation $Y= b+ b_1X_1+ b_2X_2 \ldots\ldots\ldots b_6X_6$, where Y = Per cent disease index, b is the constant, b_1, $b_2 \ldots\ldots\ldots b_6$ are regression co-efficient and X_1, $X_2 \ldots X_6$ are independent weather variables.

Result and Discussion

During *Rabi* 2020 crop season, average maximum temperature recorded was 30.93 ^{0}C, while the average minimum temperature recorded was 16.33 ^{0}C. The average maximum relative humidity was 84.56%, while the minimum relative humidity was 53.43%. Total rainfall recorded was 104.2 mm in 5 rainy days, while average wind speed during crop season was 4.56 km/hr
(Table 2).

From the study, it was noticed that powdery mildew infection was first observed during 50th meteorological week i.e. from December 14th to December 20th and recorded a PDI of 10.33. Then the disease progressed and reached a maximum PDI of 65 per cent during 5th meteorological week i.e. from February 1st to 7th and during the period temperature ranged between 31.6 to 15.1 ^{0}C, with humidity between 77 and 37 per cent, which was congenial condition for the spread of the pathogen at maturity. While, according to Kohire *et al*. (2008) [11] dry and cool environment conditions i.e. mean temperature range between 12.2 to 22.8 ^{0}C and minimum relative humidity of 30.2 to 48.8% was ideal for conidial germination in mustard.

The correlation of environmental factors with per cent disease index in susceptible okra cultivar 'Arka Anamika' was studied (Table 3). During the crop season, all the weather parameters showed negative correlation with the disease severity, but there was highly significant negative correlation of disease severity with maximum relative humidity (- 0.693) and minimum relative humidity (- 0.713) at 1 per cent level of significance. Significant negative correlation of disease severity with wind speed (- 0.615) at 5 per cent level of significance was observed. Kareppa *et al*. (2004) [12] reported that increase in maximum and minimum temperature had significant negative effect on powdery mildew disease severity. Relative humidity and rainfall showed non-significant negative correlation with disease severity on grape. Sharma (2016) [13] reported that minimum temperature, maximum and minimum relative humidity showed significant negative correlation with powdery mildew disease severity. With wind speed and rainfall showing non-significant negative correlation with powdery mildew severity among different okra varieties. The data was further subjected to multiple linear regression analysis, six regression co-efficients -11.37, 1.51, -1.65, -0.98, -0.06 and -6.96 for independent weather variables *viz*., maximum and minimum temperature, maximum and minimum relative humidity, rainfall and wind speed, respectively with an R^2 value of 0.829. R^2 value indicating 83% variation in disease severity due to weather parameters. Maximum relative humidity was significant in predicting disease severity (P<0.05). Based on multiple regression analysis, linear regression equation was designed to predict the severity of the disease depending upon weekly weather parameters prevailing during crop season.

$$Y= 575+ (- 11.37) X_1+ (1.51) X_2+ (- 1.65) X_3*+ (- 0.98) X_4+ (- 0.06) X_5+ (- 6.96) X_6$$

*- Significant (P<0.05)

Where,
Y – Disease severity
b – Constant
X_1 –Max. Temperature
X_2 –Min. Temperature
X_3 –Max. RH
X_4 –Min. RH
X_5 –Rainfall
X_6 –Wind speed

Tulasi (2016) [14] obtained the best fit equation with maximum and minimum temperature, wind speed and relative humidity. With all the independent variables showing 86.6 per cent role on powdery mildew severity. Singh *et al*. (2019) [15] obtained a coefficient of determination (R^2) of 78 and 68 per cent during 2015 and 2017, respectively in ber powdery mildew.

Table 2: Effect of weather parameters on the severity of bhendi powdery mildew caused by *E. cichoracearum* during 2020-2021.

Months	Meteorological Standard week	PDI	Temperature(◦C)		Relative humidity (%)		Rainfall (mm)	Wind speed Km/hr.
			Max.	Min.	Max.	Min.		
November 16-22(2020)	46	0.00	30.3	18.7	84	72	0.00	6.4
November 23-29	47	0.00	31.3	15.2	91	65	0.00	4.3
November 30-6	48	0.00	29.4	16.8	94	74	0.00	5.3
December 7-13	49	0.00	28.7	17.5	93	80	16.20	7.0
December 14-20	50	10.33	30.9	15.9	93	65	0.00	3.2
December 21-27	51	13.33	29.9	14.5	85	60	0.00	4.9
December 28-3	52	20.00	31.2	15.2	82	50	0.00	4.1
January 4-10 (2021)	1	27.22	29.7	18.3	86	64	59.00	5.0
January 11-17	2	38.88	30.1	17.7	80	64	0.80	5.3
January 18-24	3	47.77	31.8	16.1	74	46	0.00	3.4
January 25-31	4	52.20	31.8	14.1	82	34	0.00	2.7
February 1-7	5	65.00	31.6	15.1	77	37	0.00	4.0
February 8-14	6	44.40	31.5	13.5	87	29	0.00	3.7
February 15-21	7	34.40	30.9	14.7	84	34	0.60	4.0
February 22-28	8	21.66	31.8	18.4	78	46	27.60	4.4
March 1-7	9	10.55	34.1	19.7	83	35	0.00	5.4
Average/ Total			30.93	16.33	84.56	53.43	104.2	4.56

Table 3: Effect of weather factors on severity of okra powdery mildew during 2020-21

Characters	PDI
PDI	1
Temperature (Max.)	-0.324
Temperature (Max.)	-0.437
Relative humidity (Max.)	-0.693**
Relative humidity (Min.)	-0.713**
Rainfall	-0.051
Wind speed	-0.615*

** - Significance at 1 per cent level
* - Significance at 5 per cent level

Conclusion

During the crop season, all the weather parameters showed negative correlation with the disease severity, but there was highly significant negative correlation of disease severity with maximum relative humidity and minimum relative humidity at 1 per cent level of significance. Significantly negative correlation of disease severity with wind speed at 5 per cent level of significance was observed. Multiple regression analysis with an R^2 value of 0.829 showed that

83% of the variation in the disease severity was due to the change in the weather parameters. Average temperature range between 16.33 to 30.93 ^{0}C, humidity ranged between 53.43 to 84.56 per cent, rainfall of 6.5 mm with wind speed of 4.56 km/hr was found to be an ideal condition for powdery mildew disease development on okra.

References

1. Aykroud GF. Indian Council of Medical Research, Special Report Series, 1963, 42.
2. Berry SK, Kalra CL, Seghal RC, Kulkarni SG, Sukhvirkaur, Arora SK, Sharma BR *et al*. Quality characteristics of seeds of five okra [*Abelmoschus esculentus* (L.) Moench] cultivar. Journal of Food Science and Technology. 1988;25:303-305.
3. Fujji H, Iwase M, Ohkuma T, Ogata-Kaizu S, Ide H, Kikuchi Y, *et al*. Impact of dietary fiber intake on glycemic control, cardiovascular risk factors and chronic kidney disease in Japanese patients with type 2 diabetes mellitus: the Fukuoka Diabetes Registry. Nutrition Journal. 2013;12(1):1-8.
4. Konstantino A, Dimitrios K, Evan D. Flocculation behavior of mallow and okra mucilage in treating wastewater. Desalination. 2009;249(2):786-791.
5. Monika A, Rajani S, Anuradha M. Study on flocculation efficiency of okra gum in sewage waste water. Macromolecular Material Engineering. 2001;286(9):560-563.
6. Araujo A, Galvao A, Filho CS, Mendes F, Oliveira M, Barbosa F, *et al*. Okra mucilage and corn starch bio-based film to be applied in food. Polymer Testing. 2018;71:352-361.
7. Sridhar TS, Poonam-Sinha, Sinha P. Assessment of loss caused by powdery mildew (*Erysiphe cichoracearum*) of okra (*Hibiscus esculentus*) and its control. Indian Journal of Agricultural Sciences. 1989;59(9):606-607.
8. Singh RS. Introduction to Principles of Plant Pathology. Edn 3, Oxford and IBH Publications, 1984, 608.
9. Gawande VL, Patil JV. Genetics of powdery mildew (*Erysiphe polygoni* DC.) resistance in Mungbean (*Vigna radiata* (L.) Wilczek). Crop Protection. 2003;22(3):567-571.
10. Wheeler BEJ. An Introduction to Plant Disease. John Wiley Sons Ltd, London, 1969, 331.
11. Kohire OD, Patil VO, Ahmed R, Chavan SS, Khilare VC. Epidemiology of powdery mildew of mustard in Marathwada. Journal of Plant Disease Sciences. 2008;3(2):235-236
12. Kareppa SM, Ghure TK, Yadav DB. Epidemiological aspects of powdery mildew on grape. Journal of Maharashtra Agricultural University. 2004;29(1):103-104.
13. Sharma JK. Occurrence, epidemiology and management of powdery mildew of okra (*Abelmoschus esculentus* (L.) Moench) under South Gujarat conditions. Ph.D. Thesis submitted to Navsari Agricultural University, Navsari, 2016.
14. Tulasi K. Studies on powdery mildew (*Erysiphe polygoni* DC) of urdbean [*Vigna mungo* (L.) Hepper] in relation to weather, host plant resistance and management. Ph.D. Thesis submitted to Acharya NG Ranga Agricultural University, Tirupati, 2016.
15. Singh R, Kumar M, Mamta D, Baloda S. Development of growth model for ber powdery mildew in relation to weather parameters. Indian Phytopatholgy. 2019;72(2):235-241.