Original Research Article

Influence of weather parameters on incidence of black spot of papaya caused by *Asperisporium caricae*

Abstract

The severity of the black leaf spot disease of papaya increased with increase in rainfall and during dry spells the disease declined considerably. The maximum disease severity was found during the late winter and spring seasons of the year. In the present study, the disease severity of black spot of papaya was recorded in the TNAU, Orchard at monthly interval for a period of one year from January 2018 to December 2018. The results revealed that the disease severity increased progressively from August 2018 to November 2018 and the disease was found to be less in summer months. The disease severity was found to reach maximum of 31.21% during the November 2018. The lowest disease severity of 9.45% was found during the month of May 2018.

Key words: Epidemiology, weather parameters, Black spot, Disease incidence, Papaya

Introduction:

Papaya (Caricae papaya. L) commonly called as "Paw`paw" or "Common man's fruit" or "Tree melon" is cultivated both in commercial and kitchen gardens throughout India. The papaya belongs to the family "*Caricaceae*" genus Caricae and species papaya. Papaya (*Caricae papaya* L.) is one of the most important fruit crop cultivated in many parts of tropical and subtropical regions and rich in vitamins, minerals and digestive fibres required for human health [1]. Papaya is native of tropical America. Papaya was introduced to India during 16th century by portuguese and spanish sailors. Papaya mainly cultivated in India, Brazil, China, Congo, Indonesia, Mexico, Nigeria, Peru, Philippines, Taiwan and Thailand. India ranks first in papaya production which is cultivated over an area of 1.39 million hectares with production of 5831 Metric Tonnes (MT). Among the states, Andhra Pradesh occupied highest area under production (1288.58MT) followed by Gujarat (1241.25MT) and Karnataka (527.86MT) (Hort stat, 2017). In Tamil Nadu the crop is being cultivated with an area of 1.76 thousand hectares with the production of

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403.19MT during 2018. Popular varieties widely cultivated are Red lady, Sinta and CO 8. Papaya crop is being affected by many fungal, bacterial and viral diseases. Among the various fungal diseases, Black spot disease of papaya is a minor disease which becomes major one and the recently emerging disease. This disease was first observed in the variety "Honey dew" at Chettali, Karnataka later it was observed in variety CO 1 in Palani hills, Tamil Nadu during cooler months was reported by Ullasa *et al.* [5]. The symptoms appear on the upper surface of leaves as small water-soaked spots, later these spots become greyish white in colour and the corresponding lower surface of the leaves develop black velvety conidial mass around the lesions. Severely affected leaves shrivel, develop larger necrotic lesions which become brittle and finally die. This leads to severe defoliation of the older leaves. In the fruits, the symptoms are small dot like spots appear initially, later they enlarge up to 2-6mm in diameter. The spots are confined to the outer rind of the fruit which reduces the market value of exported fruit [3].The favorable environmental conditions play an important role in the incidence of the disease and prolonged humid conditions leads to the disease epidemics. In disease triangle, susceptible host, virulent pathogen and favorable environment coincides there is a chance of high epidemics, so it always important to study the influence of weather parameters on the disease incidence. In the present study, the influence of weather parameters on incidence of black spot disease of papaya was studied under the natural field infection which helps to under the period of highest disease severity period and thereby precautionary suitable management practices can be planned.

Materials and methods:

To study the role of meteorological factors on disease development data on disease severity was recorded at monthly interval from January 2018 to last week of December 2019 in TNAU orchard, Coimbatore. The meteorological data on temperature (maximum and minimum), relative humidity (morning and evening) and rainfall were collected from Agro Climate Research Centre, TNAU, Coimbatore. Correlation and regression were worked out separately in SPSS 18 software in that weather parameters were taken as independent variables and disease diversity as dependent variable to establish the relative contribution of these factors in the spread of the disease

Results and decision:

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Influence of weather parameters on disease incidence:

The black spot disease of papaya was recorded in TNAU orchard at monthly interval from January 2018 to December 2018 for a period of one year. The results revealed that the disease increased progressively from August 2018 to December 2018 and the disease was found to be lesser during other months. The disease severity of was very low in the month of May 2018 (9.45 per cent) which reached maximum (31.21 per cent) during the month of November 2018. During January 2018 to December 2018, the maximum temperature and minimum temperature recorded was 35.46ºC and 18.71ºC respectively. The maximum relative humidity of 90.80 per cent was noted during the month of November 2018. The maximum rainfall recorded was 8.35cm during the month of November (Table 1, Graph 1). Similarly, Ogata and Heu (2001) reported that the black spot of papaya *A. caricae* was more prevalent during wet weather period that may increase the disease development on papaya foliage and fruits. Further, Vawdrey *et al.* (2008) also observed during cold weather condition from June until the end of September favored the disease development and warm hot conditions reduced the viability of spores that they failed to germinate. The results are strongly supported by Thiribhuvanamala *et al*., 2016 stated that *A. caricae* pathogen development remain active during the humid, warm wet weather conditions of the year. Conidial spread disseminated through wind and water splash. The infected secondary lateral branches and twigs of conifers contain conidia that severed as the inoculum for upcoming season. The incidence is more in nursery and greenhouse if overhead irrigation is followed.

Correlation and Regression Analysis:

Correlation analysis:

The correlation studies revealed that maximum temperature had a negative effect on the disease development, while the morning and evening relative humidity was found to be highly significant with positive effect on disease development with “r value” (Correlation coefficient) of 0.695 and 0.310 respectively (Table 2).

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Regression analysis:

Regression analysis was done by taking disease severity as dependent variable and weather parameters as independent variables. The "R2 value" was found to be 0.811 which indicated that 81.10 per cent of black spot of papaya disease was influenced by the weather parameters (Table 3). The multiple regression equation was Y= -7.64 + 0.96 X1- 6.66 X2 + 4.49 X3 + 2.29 X4 + 1.31* X5 Where, X1 = Rainfall, X2 = Temperature maximum, X3 = Temperature minimum, X4 = Morning relative humidity, X5 = Evening relative humidity. The maximum temperature (X2) was found to have negative effect on disease severity which indicated that for every increase in 1ºC of maximum temperature reduced the disease development by 6.66%. The equation showed that increase of 1% morning and evening relative humidity (X4 and X5) increased the disease severity by 2.29 and 1.31 per cent respectively, while the 1ºC increase in maximum and minimum temperature (X2 and X3) decreased the disease by 6.66 and 4.49 per cent respectively. The 1 cm increase of rainfall (X1) reduced the disease by 0.96 per cent. Hence, the black spot of papaya was found to be negatively influenced by maximum temperature and positively influenced by minimum temperature with maximum relative humidity.

Table 1. Effect of weather parameters on disease incidence of black spot of papaya

Sl.no	Month	Temperature (^{o}C)		Relative Humidity (%)		Rainfall (cm)	Disease Severity (%)
		Max	Min	Max	Min		
1	January	30.35	18.71	83.74	45.84	0.07	12.2
2	February	32.36	19.48	84.57	41.11	0	13.8
3	March	34.31	22.33	83.71	40.74	0.59	11.23
4	April	35.46	24.77	84.37	46.03	1.51	10.9
5	May	32.78	23.51	88.48	61.26	1.4	9.45
6	June	30.29	23.72	83.70	67.13	1.80	12.34
7	July	30.29	23.27	84.00	63.81	2.21	14.56
8	August	30.19	22.96	84.87	63.94	1.95	22.78
9	September	32.91	22.72	86.97	52.97	4.00	26.67

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10	October	30.48	21.93	88.97	60.57	5.22	27.89
11	November	29.00	21.90	90.80	62.40	8.35	31.21
12	December	30.08	20.79	88.67	52.53	0.27	29.3

Graph 1: Effect of weather parameters on disease incidence of black spot of papaya

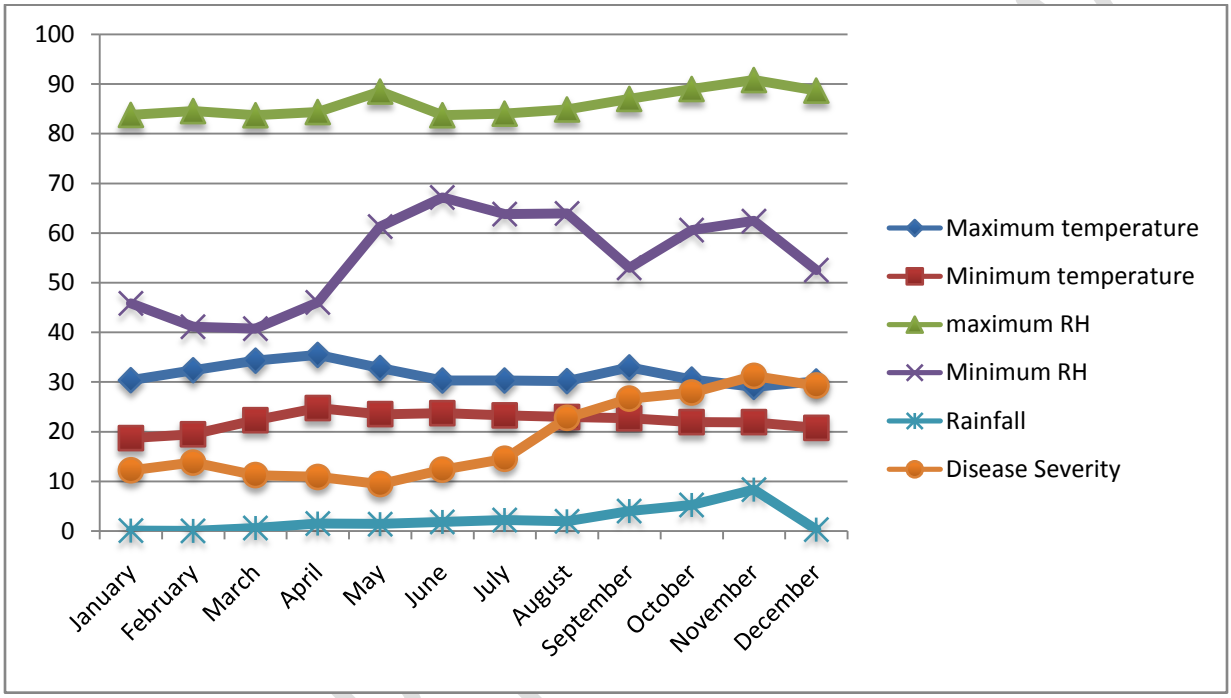

Table 2. Correlation between black spot disease and weather parameters

S.No.	Weather parameters	r value (correlation coefficient)
1	Maximum temperature	0.047
2	Minimum temperature	0.332
3	Maximum relative humidity	0.468
4	Minimum relative humidity	0.210
5	Rainfall	0.0719

Table 3: Regression analysis of black spot of papaya disease severity with weather parameters

S.No.	Weather parameters	b value (Regression coefficient)	Standard error of Regression coefficient	Constant (a)	R square (R^2)
1	Maximum temperature	0.832	0.832	83.68758	0.811517
2	Minimum temperature	2.90	2.90		
3	Maximum relative humidity	2.89	2.89		
4	Minimum relative humidity	0.90	0.90		
5	Rainfall	0.63	0.63		

Conclusion:

In the present study, the disease severity of black spot of papaya was recorded in the TNAU, Orchard at monthly interval for a period of one year from January 2018 to December 2018. The results revealed that the disease severity increased progressively from August 2018 to November 2018 and the disease was found to be less in summer months. The fungus normally survives in fallen leaf debris and cause severe outbreak with the onset of rainfall. The disease severity was found to reach maximum of 31.21% during the November 2018.The lowest disease severity of 9.45% was found during the month of May 2018. The influence of weather parameters on incidence of black spot disease of papaya under the natural field infection helps to under the period of highest disease severity period and thereby paves way for precautionary sustainable disease management practices.

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