INTERNATIONAL JOURNAL OF SCIENCE AND NATURE
©2004-2010 Society for Science and Nature (SFSN). All rights reserved
Www.scienceandnature.org

INFLUENCE OF WEATHER FACTORS ON THE INCIDENCE OF STEM ROT IN VANILLA

[1]Gangadhara Naik B., Saifulla M[1]., Basavaraja M. K[1]., Ganesh Naik.,[1] Nagaraja R[2] ., Devappa V[1]
[1] Department of Plant Pathology, College of Agriculture, Shimoga, University of Agricultural Sciences, Bangalore , Karanataka, India.
[2]Department of Microbiology, college of Agriculture, shimoga, University of Agricultural Sciences, Bangalore , Karanataka, India.

ABSTRACT
The impact of different weather factors on vanilla stem rot incidence was studied in a vanilla garden located in malnad region. The observation on stem rot incidence was recorded to assess the disease incidence. The environmental factors play an important role on the incidence of pathogen causing disease. The role of weather parameters such as rainfall, number of rainy days, mean maximum and minimum temperature, relative humidity on the development of stem rot incidence of vanilla has been documented. From the data it is evident that, disease incidence was significantly correlated with maximum and minimum temperature whereas mean rainfall, rainy days, maximum and minimum relative humidity negatively and significantly related.

KEY WORDS: relative humidity, temperature, rainfall, stem rot incidence,

INRODUCTION

Vanilla (*Vanilla planifolia*) Andrews (Salisb) (Ames) is one of the most valuable spices and is emerging as a low volume-high value spice crop. Diseases of fungal and viral nature pose serious threat to vanilla cultivation. Among these diseases, rots or wilts caused by *F. oxysporum* f.sp. *vanillae* have been reported from almost all the vanilla growing countries causing considerable loss in yield. The literature pertaining to different aspects of studies on etiology, epidemiology, variability and management of *F. oxysporum* f.sp. *vanillae* causing stem rot of vanilla are reviewed here under.

Vanilla is believed to have been first introduced to Reunion in 1973, and from Reunion the crop was taken to Mauritius in 1827 and to Madagascar in 1840. The history of introduction of vanilla into India appears to be obscure since no authentic information on this subject is readily available. According to Correl (1953) attempts to introduce vanilla cultivation in India dates back to 1835, however, documentary evidences available reveal that this crop was experimentally introduced to West Bengal, Bihar, Tamil Nadu, Pondicherry, Karnataka, Kerala, and Assam 100 years ago (Anon, 1982). In Karnataka, nearly three decades back an enterprising planter established a vanilla plantation in an area of about one hectare in Sasthan in South Canara district. Cultivation of this crop was gradually taken up by growers of South and North Canara districts and subsequently spread to other parts of Karnataka. Now the global cultivation of vanilla is estimated to be about 40846 hectares from which production is about 5583 metric tones and in India it is grown in an area of 2545 hectares covering Karnataka, Kerla and Tamil Nadu, with the Production of about 100 metric tonnes (Kuruvilla, *et al*., 2004). Vanilla is one of the expensive spice crop traded in the global market. The substance chiefly responsible for the fragrance, flavor and pleasant aroma of vanilla is the vanillin ($C_8 H_8 O_3$).

MATERIALS & METHODS

The impact of different weather factors on vanilla stem rot incidence was studied in a vanilla garden at malnad area in a farmer field at Shimoga during 2004 and 2005. The observation on stem rot incidence was recorded at 10 days interval from 100 randomly selected plants from 1st January to 16th of September 2004 and 1st January to 17th of September 2005 to asses the disease incidence. The data on per cent disease incidence was calculated by observing number of plants showing stem rot symptoms from 100 randomly selected plants at 10 days interval. The simple correlation co-efficient between weather parameters and per cent disease incidence was worked out by adopting the standard statistical procedures (Gomez and Gomez, 1984). The independent variables chosen for correlation studies were temperature, relative humidity, rainfall and the number of rainy days. The disease incidence was calculated using the following formula.

$$\text{Disease incidence (\%)} = \frac{\text{No.of plants with stem rot incidence}}{\text{No. of plants examined}} \times 100$$

RESULTS

Influence of weather factors on the development of stem rot in vanilla during the year 2004 and 2005.

The influence of weather factor *viz.*, maximum and minimum temperature and relative humidity, rainy days, rainfall on stem rot incidence was recorded in the vanilla garden at Shimoga from 1-1-2004 to 16-9-2004 and 1-1-2005 to 17-9-2005 and the data obtained are presented hereunder.

During the year 2004, weather factors *viz.*, average rainfall, number of rainy days, mean minimum and maximum temperature and relative humidity were recorded from 1st of January to 16th of September and these weather parameters were ranged between 0–142.40 mm, 0–10, 23.93-39.10 ^{0}C, 16.02–25.12^{0}C and 54.60–91.20 and 38.10–83.90 per cent respectively. The disease was found tobe at its peak of 23.00 per cent with the prevalence of rainfall (0.0mm), rainy days (0 days), mean maximum and minimum temperature of 35.92 and 18.78 ^{0}C and mean maximum and minimum relative humidity of 62.70 – 57.10 per cent and a minimum of 3.00 per cent with the prevalence of rainfall, rainy days, mean maximum and minimum temperature and mean maximum and minimum relative humidity of 14.60mm, 7days , 23.93 – 17.53 ^{0}C and 88.20 – 74.20 per cent respectively (Table1).

Table 1: Role of weather parameters on stem rot incidence of Vanilla during the year 2004.

Sl. no	Period	Rainfall (mm)	Rainy days	Temperature(^{0}C)		RH (%)		PDI
				Max	Min	Max	Min	
1	1st-10 Jan	0.0	0	34.96	16.02	57.80	50.50	5.00
2	11-20	0.0	0	34.08	16.06	57.10	51.50	12.00
3	21-30	0.0	0	35.30	16.50	62.70	51.00	16.00
4	31-9 Feb	0.0	0	35.60	17.17	54.60	50.08	21.00
5	10-19	0.0	0	35.92	18.78	62.70	57.10	23.00
6	20-29	0.0	0	36.10	20.18	66.40	38.10	20.00
7	1-10 Mar	0.0	0	36.66	20.12	76.00	42.10	19.00
8	11-20	0.0	0	36.98	21.14	76.20	36.90	20.00
9	21-30	0.0	0	37.50	22.68	73.40	38.30	18.00
10	31-9 April	14.40	3	37.78	21.17	65.60	53.20	17.00
11	10-19	1.40	1	38.66	20.41	74.30	53.70	15.00
12	20-29	0.0	0	39.10	24.02	76.80	51.30	14.00
13	30-9 May	69.60	6	35.00	19.72	81.22	56.10	12.00
14	10-19	1.60	1	34.36	21.04	74.30	59.00	15.00
15	20-29	59.70	1	31.75	25.12	76.80	51.30	11.00
16	30-8 June	139.0	5	31.20	15.32	81.10	55.80	8.00
17	9-18	1.60	1	34.36	17.16	78.40	60.40	10.00
18	19-28	59.70	4	29.80	18.21	85.00	65.40	9.00
19	29-8 July	29.60	5	27.32	19.78	87.90	78.40	6.00
20	9-18	42.40	7	27.21	21.06	91.20	78.40	5.00
21	19-28	41.60	7	26.62	22.64	88.80	77.60	5.00
22	29-7 Aug	142.40	10	26.38	21.82	89.40	83.90	4.00
23	8-17	38.60	5	27.14	21.92	85.90	78.60	4.00
24	18-27	14.60	7	23.93	17.53	88.20	74.20	3.00
25	28-6 Sep	5.40	2	28.70	18.42	86.00	78.80	6.00
26	7-16 Sep	13.80	4	28.31	19.12	87.50	81.10	6.00

PDI – Percent disease Incidence **RH** : Relative Humidity

From the data, it was observed that, disease incidence was significantly correlated with maximum (r= 0.836) and minimum (r= 0.064) temperature whereas negatively correlated with rainfall (r= -0.473), number of rainy days (r= -0.729) and maximum (r= - 0.674) and minimum (r= - 0.808) relative humidity. The regression equation showed that, the expected change in Y(disease incidence) due to maximum and minimum temperature was greater than mean rainfall, rainy days, maximum and minimum relative humidity when the counter factors were kept constant (Table 1).

Régression

Y = 2.849 – 0.016X1 + 0.099X2 + 0.578X3 + 0.281X4 – 0.095X5 – 0.137X6

During the year 2005, average rainfall, number of rainy days, mean maximum and minimum temperature, maximum and minimum relative humidity were recorded from 1st of January to 17th of September and these weather parameters were ranged between 0 – 269.20 mm, 0 – 10, 36.96 - 26.12 ^{0}C, 24.00 -13.96 ^{0}C, 89.30 – 60.40 and 76.80 – 43.50 per cent respectively. The disease was found to be at its peak of 18.00 per cent with the prevalence of rainfall, rainy days, mean maximum and minimum temperature and mean maximum and minimum relative humidity of 0.0mm, 0 days, 35.96–20.82 ^{0}C and 81.00–47.40 per cent respectively and a minimum of 2.00 per cent disease incidence was recorded with the prevalence of rainfall, rainy days, mean maximum and minimum temperature and mean maximum and minimum relative humidity of269.20mm, 10 days , 28.74 – 14.12 ^{0}C and 85.00 – 74.90 per cent respectively (Table2).

Table 2 : Correlation co-efficient for percent disease incidence during 2004

	PDI	Rainfall	Rainy days	Max temp(^{o}c)	Min temp(^{o}c)	Max RH(%)	Min RH(%)
PDI	1						
Rainfall	- 0.473	1					
Rainy days	- 0.729	0.725	1				
Max temperature (^{o}c)	0.836	- 0.480	- 0.799	1			
Min temperature (^{o}c)	0.064	0.057	0.114	0.0352	1		
Max RH (%)	- 0.674	0.492	0.759	- 0.719	0.345	1	
Min RH (%)	- 0.808	0.393	0.783	- 0.872	0.019	0.712	1

Table 3 : Role of weather parameters on stem rot incidence at Shimoga during the year 2005

Sl. no	Period	Rainfall (mm)	Rainy days	Temperature(^{0}C)		RH (%)		PDI
				Max	Min	Max	Min	
1	1st-10 Jan	0.0	0	27.64	16.52	67.90	58.8	4.00
2	11-20	0.0	0	26.12	13.96	60.40	53.8	5.00
3	21-30	0.0	0	26.14	16.94	61.30	54.6	6.00
4	31-9 Feb	0.0	0	28.72	17.24	62.30	57.10	8.00
5	10-19	0.0	0	33.74	17.06	72.10	53.30	12.00
6	20-1 Mar	0.0	0	34.48	19.08	70.20	58.20	14.00
7	2-11	0.0	0	33.92	18.00	83.00	50.20	11.00
8	12-21	0.0	0	35.98	18.12	76.40	44.70	15.00
9	22-31	0.0	0	36.96	19.23	75.20	43.50	16.00
10	1-10 April	57.00	1	36.21	21.36	83.40	44.60	15.00
11	11-20	76.80	3	36.15	16.80	83.00	49.20	11.00
12	21-30	117.80	5	35.28	20.86	83.70	48.00	10.00
13	1-10 May	0.0	0	35.60	20.14	82.30	50.10	16.00
14	11-20	0.0	0	35.96	20.82	81.00	47.40	18.00
15	21-30	34.60	3	35.68	24.00	75.50	49.70	15.00
16	31-9 June	118.40	3	32.90	21.12	87.20	51.70	13.00
17	10-19	206.20	7	31.54	15.23	89.30	59.40	8.00
18	20-29	86.60	7	27.65	16.14	84.90	76.80	6.00
19	30-9 July	71.80	8	27.68	16.89	84.20	70.30	7.00
20	10-19	95.20	8	28.74	16.32	85.30	68.80	5.00
21	20-29	244.20	9	28.10	15.86	86.40	72.60	4.00
22	30-8 Aug	269.20	10	28.74	14.12	85.00	74.90	2.00
23	9-18	50.00	10	29.30	16.13	83.10	75.50	4.00
24	19-28	16.00	6	30.84	16.31	76.70	63.20	7.00
25	29-7 Sep	8.90	4	30.36	16.72	86.30	62.00	9.00
26	8-17 Sep	27.70	7	28.34	16.00	85.00	73.20	6.00

PDI – Percent disease incidence **RH** : Relative Humidity

From the data, it was observed that, disease incidence was significantly correlated with maximum (r=0.893) and minimum (r=0.808) temperature whereas stem rot incidence was negatively correlated with rainfall (r= -0.470), number of rainy days (r= -0.714) and maximum (r= -0.043) and minimum (r= -0.817) relative humidity. The regression equation showed that, the expected change in Y(disease incidence) due to maximum and minimum temperature was greater than mean rainfall, rainy days, maximum and minimum relative humidity when the counter factors were kept constant (Table 3,4).

Table 4 : Correlation co-efficient for percent disease incidence- 2005

	PDI	Rainfall	Rainy days	Max temp(^{o}c)	Min temp(^{o}c)	Max RH(%)	Min RH(%)
PDI	1						
Rainfall	- 0.470	1					
Rainy days	- 0.714	0.716	1				
Max temperature (^{o}c)	0.893	- 0.248	- 0.503	1			
Min temperature (^{o}c)	0.808	- 0.294	- 0.451	0.732	1		
Max RH (%)	- 0.043	0.563	0.614	0.157	0.042	1	
Min RH (%)	- 0.817	0.461	0.838	- 0.765	- 0.646	0.311	1

Regression

Y = - 31.772 – 0.003X1 - 0.548X2 + 0.754X3 + 0.488X4 + 0.083X5 + 0.073X6

DISCUSSION

The environmental factors play an important role on the incidance of pathogen causing disease. The role of weather parameters such as rainfall, number of rainy days, mean maximum and minimum temperature, relative humidity on the development of stem rot incidence of vanilla has been documented. Results from epidemiological studies on stem rot incidence revealed that, maximum disease incidence of 23.00 per cent was recorded after 50 days of observation in the month of February, 2004 when the rainfall is zero, maximum and minimum temperature are 35.92 and 18.78^{0}C and maximum and minimum relative humidity of 62.70 and 57.10 per cent respectively. From the data it is evident that, the disease incidence was significantly correlated with maximum and minimum temperature whereas mean rainfall, rainy days, maximum and minimum relative humidity are negatively and significantly related.

Results from 2005 epidemiological studies on stem rot incidence revealed that, maximum disease incidence of 18.00 per cent was recorded after 140 days of observation in the month of May when the rainfall is zero, maximum and minimum temperature of 35.96 and 20.82^{0}C and maximum and minimum relative humidity of 81.00 and 47.40 per cent respectively. From the data it is evident that, disease incidence was significantly correlated with maximum and minimum temperature whereas mean rainfall, rainy days, maximum and minimum relative humidity negatively and significantly related.

During the two seasons studied, the regression equation showed that, the average or expected change in Y (disease incidence) due to maximum and minimum temperature was greater when other counter factors were kept constant.

ACKNOWLEDGEMENTS

The authors are grateful to Department of Plant pathology, College of Agriculture, Shimoga for providing all the facilities for conducting the experiment. This research is a part of Ph.D. work.

REFERENCES

Anonymus (1982) *The Wealth of India, Raw Materials*, Vol, 10, 1982 edition (Council of Scientific and Industrial Research, New Delhi.112pp

Correll, D.S. (1953) Vanilla, its botany, history, cultivation and economic importance. *Econ. Bot*. **7**: 291-358.

Gomez, K.A. and Gomez, A.A. (1984) Statistical procedures for Agricultural research II Ed. John Willey and Sons publications, Newyork. 680 pp.

Kuruvalla, K. M., Vadivel, V. Radhakrishnan, V.V. and Madhusoodanan, K.J. (2004) Crop improvement programmes on vanilla. pp 39-44, March, Spice India.