

Original Research Article

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Development of Eggplant Diseases with Reference to Meteorological Parameter in Kymore Zone of Madhya Pradesh, India

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ABSTRACT

Eggplant (*Solanum melongena* L.) is an important Solanaceous crop widely grown in different parts of the country. Incidence of Phomopsis fruit rot was observed at 39th standard week (October 2016) till 3rd standard week (January 2017) and incidence ranged from 2.0-22.0%. Almost 10 time increase in fruit rot was recorded within 30 days during October 2016 when the average temperature 23.65°C with 55.5% relative humidity having 9.3 sunshine hours. The incidence ranged from 4.0-13.0% during 56th standard week (maximum temperature 30.7°C and minimum 13.6°C with relative humidity (morning 82% and evening 92%) provided the congenial condition and incidence up to 13.0% was recorded. Bacterial wilt was not recorded at early stage however, the plant were infected during pre-fruited incidence of bacterial wilt which ranged from 4.0-13.0% under natural field condition. The leaf spot (*Cercospora melongenae*) increased up to five times (3.0-15.0%) from 43rd-46th week when the average temperature was 18.2°C with morning humidity 88%. and remained constant till 49th week. Pin prick method was better and typical symptoms on eggplant fruits were developed within 3-6 days in Pusa Round and 6-9 days in Pusa Purple long inoculated by *Phomopsis vexans*. In case of test virulence of *Cercospora melongenae* it took 4-6 days of development and 7-8 days in pusa round and Pusa Purple Long, respectively

Keywords

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Introduction

Brinjal or eggplant (*Solanum melongena* L.) is an important Solanaceous crop of sub tropics and tropics. The bringal, eggplant or Aubergine (French name) has originated in Indian sub-continent and China (Thompson and Kelly, 1957). India is considered to be the Centre of Origin of cultivated eggplant, from where it spread to the other parts of the world (Choudhury and Malda, 1968). Eggplant contains 92.7 g moisture, 1.4 g of proteins and 4.0 g of carbohydrates, 0.3 g minerals, 124

I.U. vitamins and 12.0 mg vitamin C per 100 g of edible portion (Kalra *et al.*, 1988). It is low in calories and fat, contain mostly water, little protein, fibre and carbohydrate, water soluble sugars, and vitamins (Bajaj *et al.*, 1979).

Unripe fruits are used primarily as vegetable throughout the country. It is also used as raw material in pickle making (Singh *et al.*, 1963). It is used as an excellent remedy for those suffering from liver complaints. Eggplant fruit is used in ayurvedic medicine for curing the diabetes.

The eggplant crop is affected by several plant pathogens at different growth stages. Important diseases are damping off (*Pythium* spp), Phomopsis blight (*Phomopsis vexans*), leaf spot (*Cercospora melongenae*), leaf spot (*Alternaria melongenae*), little leaf (*Phytoplasma*) and collar rot (*Sclerotium rolfsii*) (Bhupendra *et al.*, 2014). Symptoms of leaf blight, fruit rot, leaf spot, stem canker and damping off of eggplant caused by *Phomopsis vexans* has been studied (Edgerton and Moreland, 1921 and Vishunavat, 1992). At different growth stages the crop suffers from various diseases during all the growing season (Ahmed and Hossain, 1985).

Materials and Methods

The experiments were conducted at Seed Technology Research Experimental Area, Department of Plant Breeding & Genetics, JNKVV, Jabalpur. The investigations were conducted on the crop grown during 2016-17 at Jabalpur. The location site lies between 22°49' and 22°80' North latitude and 78°2' and 80°58' East longitude at an altitude of 411.78 meter above the mean sea level.

Development of diseases under field condition

The progressive development of *Phomopsis* blight, bacterial wilt, *Alternaria* leaf spot, *Cercospora* leaf spot was determined on crop grown under natural field. The development of disease was correlated with weather parameters such as temperature, relative humidity, rainfall during growth period with standard weeks. The plants were pre-tagged and observations on the progressive development were determined.

Meteorological data

During 2016-2017, the data on rainfall, relative humidity, minimum-maximum

temperature were obtained from the Meteorological Observatory, College of Agricultural Engineering, JNKVV, Jabalpur (MP) (Table 1).

Test of virulence

The virulence of *Phomopsis vexans* and *Cercospora melongenae* was tested by pin prick and tooth pick prick method under natural field condition small bits of *Phomopsis vexans* culture was inserted in the fruit wall small bit of infected portion was inoculated in the leaves.

Symptomatology

The symptoms caused by different pathogens were critically observed and documented. Symptoms incited at nursery stage, pre-fruiting stage and fruiting stage were recorded. The association of pathogen was identified on the basis of cultural characteristics and symptoms caused.

Identification of diseases

Collection of infected eggplant parts

During present study, infected leaves, fruits and stem were collected in paper envelopes and brought to the laboratory. The samples so collected were numbered and stored in paper envelopes at 4°C to avoid any further deterioration.

Isolation, purification and identification of fungi

Fruits, twigs, leaves and seeds from infected plants/fruits were collected from different locations. Isolations were made to determine the associated mycoflora. The diseased plant parts were cut into small pieces. Surface sterilized with 0.1% NaOCI for 30 seconds and there after placed in Petri dishes

containing 17-20ml of solidified PSA mixed with small quantity of streptopenicillin to avoid bacterial contamination. The Petri dishes were incubated at $25 \pm 2^\circ\text{C}$. After 4 to 7 days incubation, the developing fungi were sub cultured on PSA medium and purified.

Results and Discussion

Development of eggplant diseases was recorded at seven days interval on pre-tagged randomly selected plants. Periodically observations were recorded on the particular plant during this investigation.

Development of phomopsis fruit blight

Development of diseases was recorded at research experimental field variety Pusa round. The incidence of phomopsis fruit blight/fruit rot was observed on 39th standard week (I week of October, 2016) till 3rd standard week (January, 2017) during 39th standard week of phomopsis fruit blight incidence was 2.0% and during this period average temperature was 26.7°C (Maximum 29.9°C and Minimum 23.5°C) with 94.0% relative humidity in the morning and 83.0% relative humidity in the evening. Prior to 39th week 91.8mm rains were received in six days. The incidence of fruit blight increased from 2.0% (39th week) to 19.0% (42nd week) and 22.0% (43rd standard week) almost 10 times increase in the incidence of fruit blight was recorded within 30 days during October, 2016. During 43rd week the incidence was 22.0% that was coincided with average temperature 23.65°C (maximum 31.7°C and minimum 16.6°C) with 55.5% relative humidity (morning 82.0% and evening 29.0%) having 9.3 sunshine hours per day during November, 2016 between 44th-47th standard week only 3.0% increase in disease incidence was noticed and it reached 35.0% in 58th standard week. The development of fruit blight remained stagnant during II fortnight of

December to II fortnight of January (35%) during this period maximum temperature was 24.42°C and minimum 6.82°C , the humidity during this period ranged from 84-91% in the morning and 28-48% in the evening with range of sunshine hours 6.5-8.6 hours the incidence of phomopsis fruit blight was in the range of 2.0-35.0% during October to December, 2016 (Table 2).

Development of bacterial wilt

The prevalence of bacterial wilt under natural field condition, bacterial wilt was not recorded at early stage however, the plant were infected during pre-fruiting incidence of bacterial wilt which ranged from 4.0-13.0% under natural field condition. Initiation of bacterial wilt was noticed when the average temperature was 26.7°C and average relative humidity was 46.0% with 52.4mm rainfall during 39th standard week (I week of October, 2016) with the incidence of 4.0% a graduate development till 43th week was noticed (4.0-7.0% incidence). It reached up to 13.0% during 46th week during 43rd week maximum temperature 30.7°C and minimum 15.6°C . having morning relative humidity 82% and evening 92% the sunshine hours are maximum (9.3 hours) that might have provided the continued condition from 46th standard week onward the incidence remained constant up to 49th standard week (Table 3).

Development of Cercospora leaf spot

Development of Cercospora leaf spot was recorded on pre tagged plant variety Pusa round by adopting fixed plot monitoring system. Data presented in Table 4 indicate that Cercospora leaf spot was initiated during 42nd week when the maximum temperature was 31.5°C and minimum 15.4°C (average 23.45°C) with morning humidity 91% (Average humidity 61.5%). It was observed that incidence of Cercospora leaf spot

increased up to five times (3.0-15.0%) from 43rd-46th week, at this stage average temperature was 18.2°C with morning humidity 88%. *Cercospora* leaf spot incidence ranged from 3.0-15.0% and remained constant till 49th week.

Test of virulence

Test of virulence of *Phomopsis vexans* and *Cercospora melongenae* was verified by two methods.

Phomopsis vexans

Virulence of *Phomopsis vexans* was evaluated by pin prick and tooth pick prick method. On fruit from naturally infected fruits small portion of affected part was picked up with the help of biological niddle and inserted into

healthy fruit and small infected part was picked with the help of tooth pick and inserted in the fruits separately. Data presented in Table 5 indicate that in pin prick method infection and typical symptoms developed within 3-6 days in Pusa round, 6-9 days in Pusa purple long and 3-5 days in local variety of eggplant. Tooth pick prick method took 6-12 days for development of the disease after inoculation on an eggplant fruit under natural condition.

Cercospora melongenae

Disease development by pin prick and tooth pick prick methods were adopted. Small bit was transferred from diseased leaves to healthy leaves for evaluation of disease development.

Table.1 Weekly meteorological data (2016-2017)

Months	Standard Weeks	Temperature (°C)		Relative humidity (%)		Rainfall (mm)	Wind velocity	Rainy days	Sunshine Hr/day
		Max.	Min.	Mor.	Eve.				
September 2016	36	30.6	23.0	87	63	06.9	04.5	017.6	02
	37	31.7	23.6	89	65	04.5	01.9	018.0	01
	38	33.0	23.9	92	64	03.5	06.7	03.80	00
	39	29.9	23.5	94	83	04.0	04.6	052.4	03
October	40	31.9	23.9	93	64	03.0	07.3	024.2	02
	41	31.5	21.3	88	51	04.2	08.0	0000	00
	42	31.5	15.4	91	32	02.5	09.3	0000	00
	43	31.7	15.6	82	29	02.9	08.8	0000	00
November	44	29.7	12.3	87	34	02.4	08.7	0000	00
	45	29.7	10.6	91	24	02.2	08.1	0000	00
	46	28.3	08.1	88	24	02.0	08.1	0000	00
	47	28.8	08.4	87	23	01.4	08.3	0000	00
December	48	28.8	08.7	89	27	01.7	08.7	0000	00
	49	25.1	07.9	93	43	02.1	06.2	0000	00
	50	26.1	07.3	91	28	02.0	07.8	0000	00
	51	24.7	05.5	91	30	01.8	07.4	0000	00
January 2017	52	25.7	05.6	88	29	01.9	08.6	0000	00
	1	23.9	09.1	20	48	02.8	06.5	0000	00
	2	21.7	06.6	86	42	02.9	07.2	000.2	00
	3	24.1	09.2	89	47	03.1	06.4	0000	00
February	4	25.7	10.1	97	45	02.9	06.5	003.2	01
	5	25.4	07.5	92	38	02.3	09.6	0000	00
	6	27.2	09.8	84	42	03.2	09.0	0000	00
	7	26.4	10.6	95	42	02.9	08.4	13.20	01
March	8	29.7	10.0	83	26	03.3	10.3	0000	00
	9	31.2	11.1	80	26	02.6	10.2	0000	00
	10	30.3	12.5	72	24	04.5	09.6	0000	00
	11	29.3	09.8	74	16	02.7	10.1	0000	00
April	12	33.9	14.4	75	19	03.4	10.0	002.8	01
	13	38.6	15.9	69	15	03.5	10.3	0000	00
	14	39.3	20.6	41	15	06.1	10.0	0000	00
	15	38.1	14.4	54	09	03.7	10.2	0000	00

Table.2 Progressive development of Phomopsis fruit blight during 2016-17 (Variety Pusa round)

Month	Standard week	Percent Phomopsis fruit blight	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Rainy Days	Sunshine Hour /day
			Maximum	Minimum	I	II			
September 16	36	0.0	30.6	23.0	87	63	17.6	02	04.5
	37	0.0	31.7	23.6	89	65	18.0	01	01.9
	38	0.0	33.0	23.9	92	64	03.8	00	06.7
October 16	39	2.0	29.9	23.5	94	83	52.4	03	04.6
	40	2.0	31.9	23.9	93	64	24.2	02	07.3
	41	5.0	31.5	21.3	88	51	00	00	08.0
	42	19.0	31.5	15.4	91	32	00	00	09.3
	43	22.0	31.7	15.6	82	29	00	00	09.3
November 16	44	27.0	29.7	12.3	87	34	00	00	08.8
	45	27.0	29.7	10.6	91	24	00	00	08.1
	46	30.0	28.3	08.1	88	24	00	00	08.1
	47	30.0	28.8	08.4	87	23	00	00	08.3
December 16	48	32.0	28.8	08.7	89	27	00	00	08.7
	49	32.0	25.1	07.9	93	43	00	00	06.2
	50	35.0	26.1	07.3	91	28	00	00	07.8
	51	35.0	24.7	05.5	91	28	00	00	07.4
	52	35.0	25.7	05.6	88	29	00	00	08.6
January 17	01	35.0	23.9	09.1	84	48	00	00	06.5
	02	35.0	21.7	06.6	86	42	0.2	00	07.2
	03	30.0	24.1	09.2	89	47	00	00	06.4
	04	-	25.7	10.1	97	45	3.2	01	06.5

(-) Not recorded due to consistent prevalence

Table.3 Progressive development of bacterial wilt during 2016-17 (Variety Pusa round)

Month	Standard week	Bacterial wilt	Temperature (C)		Relative Humidity (%)		Rainfall (mm)	Rainy Days	Sunshine Hour /day
			Maximum	Minimum	I	II			
September 16	36	0.0	30.6	23.0	87	63	17.6	02	04.5
	37	0.0	31.7	23.6	89	65	18.0	01	01.9
	38	0.0	33.0	23.9	92	64	03.8	00	06.7
October 16	39	4.0	29.9	23.5	94	83	52.4	03	04.6
	40	7.0	31.9	23.9	93	64	24.2	02	07.3
	41	7.0	31.5	21.3	88	51	00	00	08.0
	42	7.0	31.5	15.4	91	32	00	00	09.3
	43	7.0	31.7	15.6	82	29	00	00	09.3
November 16	44	11.0	29.7	12.3	87	34	00	00	08.8
	45	11.0	29.7	10.6	91	24	00	00	08.1
	46	13.0	28.3	08.1	88	24	00	00	08.1
	47	13.0	28.8	08.4	87	23	00	00	08.3
December 16	48	13.0	28.8	08.7	89	27	00	00	08.7
	49	13.0	25.1	07.9	93	43	00	00	06.2

Table.4 Progressive development of Cercospora leaf spot during 2016-17 (Variety Pusa Round)

Month	Standard week	Cercospora leaf spot	Temperature (C)		Relative Humidity (%)		Rainfall (mm)	Rainy Days	Sunshine Hour /day
			Maximum	Minimum	I	II			
September 16	36	0.0	30.6	23.0	87	63	17.6	02	04.5
	37	0.0	31.7	23.6	89	65	18.0	01	01.9
	38	0.0	33.0	23.9	92	64	03.8	00	06.7
October 16	39	0.0	29.9	23.5	94	83	52.4	03	04.6
	40	0.0	31.9	23.9	93	64	24.2	02	07.3
	41	0.0	31.5	21.3	88	51	00	00	08.0
	42	3.0	31.5	15.4	91	32	00	00	09.3
	43	3.0	31.7	15.6	82	29	00	00	09.3
November 16	44	11.0	29.7	12.3	87	34	00	00	08.8
	45	12.0	29.7	10.6	91	24	00	00	08.1
	46	15.0	28.3	08.1	88	24	00	00	08.1
	47	15.0	28.8	08.4	87	23	00	00	08.3
December 16	48	15.0	28.8	08.7	89	27	00	00	08.7
	49	15.0	25.1	07.9	93	43	00	00	06.2

Table.5 Development of disease after inoculation on leaves and fruits of eggplant

Pathogen	Method	Plant Part	Symptoms appeared days / variety		
			Pusa Purple Long	Pusa Round	Local
<i>Phomopsis vexans</i>	Pin prick	Fruit	7-9	3-6	3-5
	Tooth pick prick	Fruit	9-12	6-8	6-8
<i>Cercospora melongenae</i>	Pin prick	Leaf	7-10	4-6	6-9
	Tooth pick prick	Leaf	8-11	7-11	6-9

Test conducted during II week of November, 2016

In Pusa round it took 4-6 days for development of infection in tooth prick method. It took about 6-11 days for development of disease in Pusa purple long by tooth prick method and about 11 days required for infection and in Pusa round it required 7-11 days whereas in local variety within 9 days development was noticed.

Phomopsis fruit rot was first noticed at 39th standard week (I week of October 2016) till 3rd standard week (January 2017) and incidence ranged from 2.0-22.0%. Almost 10 time increase in fruit rot was recorded within 30 days during October 2016 when the average temperature 23.65°C with 55.5% relative humidity having 9.3 sunshine hours. During 58th standard week the incidence reached up to 35.0% (October, 2016) Influences of temperature and relative humidity on the development of fruit rot symptoms caused by *Phomopsis vexans* has been studied by Chowdhary and Hasija (1979) and Ahmed (1987). Fruit rot development under laboratory condition has been studied by Islam and Sitansu (1990), and Singh and Chouhan (1984).

Under natural field condition bacterial wilt was not recorded at early plant stage however, the plant infection was noticed at pre-fruited stage. The incidence ranged from 4.0-13.0% during 56th standard week (maximum temperature 30.7°C and minimum 13.6°C with relative humidity (morning 82% and evening 92%) provided the congenial condition and incidence up to 13.0% was recorded. Goto (1990) and Kelman (1953) studied the development of bacterial wilt in eggplant.

The leaf spot (*Cercospora melongenae*) increased up to five times (3.0-15.0%) from 43rd-46th week when the average temperature was 18.2°C with morning humidity 88%. *Cercospora* leaf spot incidence ranged from 3.0% to 15.0% and remained constant till 49th week. Ullasa and Sohi (1987) reported that development of leaf spot due to *Cercospora melongenae* was favored by high humidity, warm days and cool night. These factors have been identified for the ideal infection role of weather on the development of leaf spot disease. The virulence of *Phomopsis vexans* and *Cercospora melongenae* was verified by pin prick and tooth pick prick method under natural field condition. A small bit of *Phomopsis vexans* infected tissue was inserted in the fruit wall while small bit of infected portion was inoculated in the leaves, respectively. Pin prick method was comparatively better and typical symptoms on eggplant fruits developed within 3-6 days in Pusa Round and 6-9 days in Pusa Purple Long inoculated by *Phomopsis vexans*. In case of test virulence of *Cercospora melongenae* it took 4-6 days for development and 7-8 days in pusa round and pusa purple long respectively.

Incidence of Phomopsis fruit rot was observed at 39th standard week (I week of October 2016) till 3rd standard week (January 2017) and incidence ranged from 2.0-22.0%. Almost 10 time increase in fruit rot was recorded within 30 days during October 2016 when the average temperature 23.65°C with 55.5% relative humidity having 9.3 sunshine hours. The incidence ranged from 4.0-13.0% during 56th standard week (maximum temperature 30.7°C

and minimum 13.6°C with relative humidity (morning 82% and evening 92%) provided the congenial condition and incidence up to 13.0% was recorded. Bacterial wilt was not recorded at early stage. The leaf spot (*Cercospora melongenae*) increased up to five times (3.0-15.0%) from 43rd-46th week when the average temperature was 18.2°C with morning humidity 88%. *Cercospora* leaf spot incidence ranged from 3.0-15.0% and remained constant till 49th week.

Pin prick method was better and typical symptoms on eggplant fruits were developed within 3-6 days in Pusa Round and 6-9 days in Pusa Purple long inoculated by *Phomopsis vexans*. In case of test virulence of *Cercospora melongenae* it took 4-6 days development and 7-8 days in pusa round and pusa purple long, respectively.

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