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Occurrence and Distribution of Sesame Alternaria Leaf Blight Disease in Nine Agro Climatic Zones of Maharashtra State, India

D.V. Pawar*, A.P. Suryawanshi and V.A. Kadam

Department of Plant Pathology, Vasantrao Naik Marathwada Krushi Vidhyapeeth,
Parbhani-431 402, Maharashtra, India

*Corresponding author

ABSTRACT

A roving survey to record sesame Alternaria blight disease intensity was conducted during two *Kharif* seasons (2014-15 and 2015-16), covering 234 and 240 sesame crop fields of nine agro climatic zones, of the Maharashtra state in India, respectively. The results of the survey indicated that overall disease intensity was comparatively higher in the sesame crop grown during *Kharif*, 2015-16 season compared to that of *Kharif*, 2014-15 grown crop. During *Kharif*, 2014-15 maximum average blight disease intensity of 39.58 per cent was recorded in Central Maharashtra Plateau Zone, followed by the zones viz., Western Maharashtra Plain Zone (37.28 %), Central Vidarbha Zone (35.19 %) and Western Maharashtra Scarcity Zone (32.67 %). In rest of the zones surveyed, the disease intensity was ranged from 21.83 (Western Ghat Zone) to 27.94 (Sub Mountane Zone) per cent. This variability may be due to rainfall pattern, relative humidity, temperature, wind velocity etc. prevailed and a wide range of sesame cultivars grown by the farmers. The pooled mean (*Kharif*, 2014-15 and 2015-16) results revealed maximum mean blight disease intensity in Central Maharashtra Plateau Zone (37.99 %), followed by the zones viz., Western Maharashtra Plain Zone (36.21 %), Central Vidarbha Zone (34.27 %) and Western Maharashtra Scarcity Zone (31.06 %); whereas, it was minimum in the zones of Western Ghat Zone (20.24 %) and North Konkan Coastal Zone (21.82 %). Of various sesame cultivars / varieties grown in the nine agro climatic zones, maximum mean blight disease intensity was recorded on AKT-64 (43.76 %), followed by Local cultivar (40.08 %); whereas, rest of the cultivars exhibited minimum mean blight disease intensity in the range of 19.63 to 32.33 per cent.

Keywords

Sesame, Alternaria
leaf blight disease,
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Introduction

Sesame, (*Sesamum indicum* L.), is one of the world's ancient important oilseed crop cultivated in more than 55 countries of the world belonging to the family Pedaliaceae and native of India (Joshi, 1961; Weiss, 1983). It is

an herbaceous, annual, self pollinated (considerable insect cross pollination) crop with $2n=26$ chromosomes and which is mentioned in *Atharva Veda*, *Ashtadavaiji*, *Manusmriti* and *Puranas* as *tila* indicating the presence of sesame in India since the pre-Christian era. The word *taila*, a Sanskrit word

for oil supposed to have been derived from *tila*, Sanskrit name of sesame (Yertmanos, 1980). The Vedic scriptures (300-600 BC) contain instructions for using sesame seeds in a ceremonial food, symbolic of immortality. India is among the largest vegetable oil economies in the world and it ranks first in area and production among the sesame growing countries (Ashri, 1998).

Among the major factors responsible for lower yields, diseases play an important role. Sesame is also affected by many biotic and abiotic stresses. Among the biotic agents, fungi cause major diseases, followed by bacteria, viruses and nematodes. Major Sesame diseases caused by fungi are: Leaf spot / blight (*Alternaria sesami*), *Cercospora* leaf spot (*Cercospora sesami*), Wilt (*Fusarium oxysporum* f. sp. *sesami*), Root rot (*Rhizoctonia bataticola*), Powdery mildew (*Sphaerotheca fuliginia*), stem blight (*Phytophthora parasitica*) and Anthracnose (*Colletotrichum capsici*); bacterial Leaf blight / spot (*Pseudomonas sesami*); Mycoplasmal such as phyllody (*Mycoplasma*); viral diseases such as Leaf curl (*Nicotina virus* 10), Mosaic (Cucumber mosaic virus), Necrosis (Tobacco streak virus) and root knot (*Meloidogyne hapla*) nematode (Bhale *et al.*, 1998). Among these diseases, at present leaf blight caused by *Alternaria sesame* (Kawamura) is widespread and have continued to be the major constraints in the production and productivity of sesame all over the country in general as well as in the state of Maharashtra particularly. The disease was first reported by Dey (1948) from Uttar Pradesh, which later spread in sesame growing region of the country (Dolle, 1981; Kolte, 1985; Narute and Utikar, 1994; Tripathiet.al, 2005). The disease (*A. sesami*) has been reported to cause 20 to 40 per cent yield losses all over India (Kumar and Mishra, 1992; Prasad and Reddy, 1997). During *Kharif* 2014-15, occurrence of *Alternaria* leaf blight disease was noticed in severe form in farmers fields in different Agro climatic zones of

Maharashtra. Surveys were carried for disease intensity of *Alternaria* leaf blight in farmers' fields. The disease intensity of the disease in commonly grown cultivars was recorded along with variation in Symptoms.

Materials and Methods

Survey

A roving survey of randomly selected sesame crop fields covering nine Agro-climatic zones viz., South Konkan Coastal Zone, North Konkan Coastal Zone, Western Ghat Zone, Sub Mountain Zone, Western Maharashtra Plain Zone, Western Maharashtra Scarcity Zone, Central Maharashtra Plateau Zone, Central Vidarbha Zone and Eastern Vidarbha Zone (Fig. 1) of the Maharashtra state was undertaken during *Kharif* seasons of 2014-15 and 2015-16, to assess *Alternaria* blight disease intensity and simultaneously to collect the disease samples. In both the years, the survey was conducted during the month of August, when the sesame crop was mostly at 50% flowering stage. Sesame growing pockets were identified from the records available at the office of Sub-Divisional Agriculture Officers of the respective districts. Details of sesame crop fields surveyed are given in the Table 2.

In the selected sesame crop fields, 10 plants were randomly selected and recorded the observations on blight disease intensity by applying 0-9 grade disease rating scale (Mayee and Datar, 1986), as detailed in Table 1.

Per cent *Alternaria* blight disease intensity (PDI) was worked out by applying following formula (McKinney, 1923).

$$\text{PDI} = \frac{\text{Summation of numerical ratings observed}}{\text{No. of leaves / plants observed} \times \text{maximum grade}} \times 100$$

Results and Discussion

A roving survey to record sesame *Alternaria* blight disease intensity was conducted during the *Kharif* seasons of 2014-15 and 2015-16, covering 234 and 240 sesame crop fields, which are distributed under nine Agro-climatic zones of the state of Maharashtra (Table 2). The observations recorded on the overall disease intensity (Table 3), zone-wise intensity (Table 4 and Fig. 1 and 2) and sesame variety-wise intensity (Table 5 and Fig. 3) are presented (PLATE I and II).

Overall and tahsil-wise *Alternaria* blight intensity in various agro-climatic zones of Maharashtra state

The results obtained on overall per cent *Alternaria* blight intensity on sesame crop grown in nine agro-climatic zones of Maharashtra covering 63 tahsils each 234 and 240 sesame crop fields, respectively, during *Kharif*, 2014-15 and 2015-16 seasons is presented in Table 3 and zone-wise range of blight disease intensity in Table 4.

Zone-wise *Alternaria* blight intensity

The results (Table 4) revealed that the zone-wise sesame blight disease intensity was comparatively higher during *Kharif*, 2015-16 in the range of 21.83 (Western Ghat Zone) to 39.58 per cent (Central Maharashtra Plateau Zone) with overall average of 29.90 per cent (Fig. 1) than during *Kharif*, 2014-15 in the range of 18.64 (Western Ghat Zone) to 36.39 (Central Maharashtra Plateau Zone) per cent with overall average of 27.35 per cent. During *Kharif*, 2014-15 average disease intensity was highest in Central Maharashtra Plateau Zone (36.39 %), followed by the zones viz., Western Maharashtra Plain Zone (35.13 %), Central Vidarbha Zone (33.34 %), and Western Maharashtra Scarcity Zone (29.44 %); whereas, in rest of the zones surveyed, the

disease intensity was ranged from 18.64 (Western Ghat Zone) to 27.23 (Sub Mountane Zone) per cent.

During *Kharif*, 2015-16 average disease intensity was ranged from 21.83 (Western Ghat Zone) to 39.58 (Central Maharashtra Plateau Zone) per cent with overall average of 29.90 per cent. However it was maximum in Central Maharashtra Plateau Zone (39.58 %), followed by the zones viz., Western Maharashtra Plain Zone (37.28 %), Central Vidarbha Zone (35.19 %) and Western Maharashtra Scarcity Zone (32.67 %). In rest of the zones surveyed, the disease intensity was ranged from 21.83 (Western Ghat Zone) to 27.94 (Sub Mountane Zone) per cent.

The pooled mean (*Kharif*, 2014-15 and 2015-16) results (Fig. 2) revealed maximum mean blight disease intensity in Central Maharashtra Plateau Zone (37.99 %), followed by, Western Maharashtra Plain Zone (36.21 %), Central Vidarbha Zone (34.27 %) and Western Maharashtra Scarcity Zone (31.06 %); whereas, it was minimum in the zones of Western Ghat Zone (20.24 %) and North Konkan Coastal Zone (21.82 %).

Sesame variety-wise *Alternaria* blight intensity

The results (Table 5 and Fig. 3) revealed that in nine agro-climatic zones of the Maharashtra state surveyed, a wide range of sesame varieties / cultivars were grown by the farmers. Due to lack of proven resistance / tolerance against *A. sesami* in the sesame cultivars commonly grown all over the Maharashtra state, all those cultivars are more or less prone to *Alternaria* leaf spot / blight disease. During *Kharif*, 2015-16 average disease intensity on sesame varieties was comparatively maximum (30.85%) than that of during *Kharif*, 2014-15 (27.87 %).

During *Kharif*, 2014-15 and 2015-16 about 10 varieties of sesame, were grown by the farmers on which average blight disease intensity was comparatively higher (20.64 to 46.39 %) during *Kharif*, 2015-16 than that of during *Kharif*, 2014-15 (18.62 to 41.12 %). Among the sesame varieties grown, AKT-64 was found to suffer more with the blight intensity of 41.12 and 46.39 per cent, respectively during 2014 and

2015, followed by Local cultivar (39.05 and 41.11 %). Rest of the sesame varieties grown exhibited comparatively minimum to moderate blight intensity the range of 18.62 to 31.00 per cent and 20.64 to 33.65 per cent, respectively during *Kharif*, 2014-15 and 2015-16. However, the sesame varieties which exhibited minimum average blight intensity were JLT-7 (18.62 % and 20.64 %), followed by N-

Table.1 *Alternaria* blight disease rating scale

Rating scale	Description
0	No symptoms on the leaf.
1	Small, irregular brown spots covering 1 per cent or less of the leaf area.
3	Small, round to irregular brown spots with concentric rings covering 1-10 per cent of the leaf area.
5	Round to irregular brown lesions enlarging, with concentric rings covering 11-25 per cent of the leaf area.
7	Lesions enlarging and coalescing to form irregular brown patches with concentric rings and covering 26-50 per cent of the leaf area. Lesions also appeared on stem petioles and pods.
9	Lesions enlarged coalesced to forming irregular, dark brown patches with concentric rings covering 51 per cent or more of the leaf area. Lesions on stem petioles and pods.

Table.2 Agroclimatic zone-wise tahsils and sesame crop fields surveyed in Maharashtra state, during *Kharif*, 2014-15 and *Kharif* 2015-16

Sr.No.	Zone	Zones Name	<i>Kharif</i> 2014-15		<i>Kharif</i> 2015-16	
			Tahsils	Fields	Tahsils	Fields
1	I (SKCZ)	South Kokan Coastal Zone	04	13	04	16
2	II (NKCZ)	North Kokan Coastal Zone	03	10	03	09
3	III (WGZ)	Western Ghat Zone	03	11	03	10
4	IV (SMZ)	Sub Mountain Zone	04	15	04	16
5	V (WMPZ)	Western Maharashtra Plain Zone	05	20	05	18
6	VI (WMSZ)	Western Maharashtra Scarcity Zone	14	52	14	59
7	VII (CMPZ)	Central Maharashtra Plateau Zone	18	70	18	72
8	VIII (CVZ)	Central Vidarbha Zone	09	34	09	32
9	IX (EVZ)	Eastern Vidarbha Zone	03	09	03	08
Total			63	234	63	240

Table.3 Tahsil -wise Alternaria blight disease intensity in the agro-climatic zones of Maharashtra state, during *Kharif*, 2014-15 and *Kharif*, 2015-16

Sr. No.	Zone	Tahsils	No. of Fields		Av. Intensity2 (%)	
			2014-15	2015-16	2014-15	2015-16
1	I (SKCZ)	Vaibhavwadi	04	05	22.22	27.11
		Kankavli	02	03	20.00	24.44
		Dapoli	04	05	18.89	18.67
		Rajapur	03	03	23.70	28.87
Overall average			13	16	21.20	24.77
2	II (NKCZ)	Poladpur	03	03	17.04	22.96
		Mahad	03	02	19.26	18.89
		Murbad	04	04	23.89	28.89
Overall average			10	09	20.06	23.58
3	III (WGZ)	Chandgad	04	02	22.22	17.78
		Patan	03	05	14.82	26.22
		Mahabaleshwar	04	03	18.89	21.48
Overall average			11	10	18.64	21.83
4	IV (SMZ)	Gargoti (Bhudargad)	02	03	33.34	31.85
		Karad	04	04	28.89	22.78
		Wai	05	05	24.44	27.11
		Mulshi	04	04	22.22	30.00
Overall average			15	16	27.23	27.94
5	V (WMPZ)	Shirol	04	02	32.22	31.11
		Koregaon	05	05	34.22	38.67
		Khandala	05	05	39.56	39.56
		Purandar	03	03	36.30	36.30
		Sangamner	03	03	33.33	40.74
Overall average			20	18	35.13	37.28
6	VI (WMSZ)	Sangli	03	03	25.92	48.15
		Khanapur-Vita	03	03	23.70	31.85
		Atpadi	02	04	26.67	35.56
		Dahiwadi (Man)	04	05	30.00	28.87
		Phaltan	05	05	31.55	36.89
		Baramati	04	04	34.44	41.11
		Sangole	05	05	29.78	38.67
		Pandharpur	04	05	30.00	34.22
		Shirur	03	02	31.85	23.34
		Shrigonda	02	04	26.67	32.22
		Rahuri	04	05	31.11	34.22
		Vaijapur	05	05	32.44	31.55

				Contd...				
		Yeola	05	05	30.66	37.78		
		Dhule	03	04	27.41	30.00		
Overall average			52	59	29.44	32.67		
7	VII (CMPZ)	Tuljapur	02	03	33.34	31.85		
		Nilanga	04	04	40.00	38.89		
		Udgir	05	05	41.33	35.11		
		Latur	05	05	39.56	40.44		
		Ahmadpur	03	04	40.74	44.45		
		Deglur	05	04	36.00	42.23		
		Ambajogai	05	05	34.22	37.78		
		Parli	05	05	35.11	45.78		
		Gangakhed	05	05	29.78	32.44		
		Parbhani	05	05	38.67	43.11		
		Jintur	03	02	30.37	40.00		
		Partur	02	03	37.78	36.30		
		Badnapur	04	04	25.00	37.78		
		Kannad	03	02	27.41	53.34		
		Jalgaon	02	03	33.34	27.40		
		Sindkhed Raja	05	05	45.78	42.22		
		Deulgaon Raja	05	05	51.11	44.00		
		Amravati	02	03	35.56	39.26		
		Overall average			70	72	36.39	39.58
		8	VIII (CVZ)	Basmath	05	05	37.78	29.78
AundhaNagnath	05			05	35.11	35.11		
Kinwat	03			02	31.85	40.00		
Malegaon	02			03	28.89	37.78		
Washim	04			04	35.56	33.33		
Contd...								
Karanja	04			04	36.67	35.55		
Yavatmal	02			02	31.11	40.00		
Arvi	05			03	29.78	27.41		
Nagpur	04			04	33.34	37.78		
Overall average			34	32	33.34	35.19		
9	IX (EVZ)	Chimur	04	02	19.44	21.11		
		Sakoli	03	03	23.70	31.85		
		Gondia	02	03	31.11	25.92		
Overall average			09	08	24.75	26.29		

Table.4 Zone-wise overall average *Alternaria* blight intensity on sesame crop in Maharashtra state during *Kharif*, 2014-15 and 2015-16

Sr. No.	Zones	2014-15		2015-16		Mean Intensity (%)
		No. of Fields	Intensity (%)	No. of Fields	Intensity (%)	
1	I (SKCZ)	13	21.20	16	24.77	22.99
2	II (NKCZ)	10	20.06	09	23.58	21.82
3	III (WGZ)	11	18.64	10	21.83	20.24
4	IV (SMZ)	15	27.23	16	27.94	27.59
5	V (WMPZ)	20	35.13	18	37.28	36.21
6	VI (WMSZ)	52	29.44	59	32.67	31.06
7	VII (CMPZ)	70	36.39	72	39.58	37.99
8	VIII (CVZ)	34	33.34	32	35.19	34.27
9	IX (EVZ)	09	24.75	08	26.29	25.52
Overall average		234	27.35	240	29.90	- -

Table.5 Sesame variety-wise average *Alternaria* blight intensity in various agro-climatic zones of Maharashtra state during *Kharif*, 2014-15 and 2015-16

Varieties	2014-15		2015-16		Pooled Mean Intensity (%)
	No. of Fields	Av. Intensity (%)	No. of Fields	Av. Intensity (%)	
Local	63	39.05	88	41.11	40.08
AKT-64	18	41.12	16	46.39	43.76
Gujrat-til-3	24	26.67	13	30.94	28.81
N-8	11	19.80	12	22.78	21.29
AKT-101	15	23.70	11	25.25	24.48
JLT-26(Padma)	10	24.22	16	26.66	25.44
PKV-NT-11	18	25.92	12	29.63	27.78
JLT-7 (Tapi)	15	18.62	21	20.64	19.63
Phule-til-1	29	28.20	23	31.40	29.80
JLT-408	31	31.00	28	33.65	32.33
Average	234	27.87	240	30.85	-

Av : Average, No : Number

Table.6 Sesame leaf blight symptomatic variability observed during survey

Sr. No.	Zone No	Leaf blight/spot characters			
		Shape	Size	Colour	Concentric rings
1	I (SKCZ)	Circular	Small to large	Light gray	Present
2	II (NKCZ)	Circular to irregular	Large	Light brown to dark brown	Absent
3	III (WGZ)	Circular to irregular	Small	Light brown	Absent
4	IV (SMZ)	Circular to irregular	Medium	Light brown to dark brown	Absent
5	V (WMPZ)	Irregular	Large	Light brown to dark brown	Absent
6	VI (WMSZ)	Circular to irregular	Medium	Light brown	Present
7	VII (CMPZ)	Irregular	Large	Light gray	Absent
8	VIII (CVZ)	Circular	Medium	Dark brown to black	Present
9	IX (EVZ)	Irregular	Small to large	Light brown to dark brown	Present

Plate I

**Sesame crop fields surveyed for recording *Alternaria* blight diseases intensity
During *Kharif*, 2014 – 2015**

Plate II

**Sesame crop fields surveyed for recording *Alternaria* blight diseases intensity
During *Kharif*, 2015 – 2016**

Plate III

**Alternaria blight diseased sesame leaf samples collected during field survey
Kharif, 2014 - 2015**

Plate IV

A) Capsule

B) Leaf and Stem

B) Leaf

Typical symptoms of Alternaria blight on sesame crop

Plate V

(A)

(B)

(C)

A. sesami pure culture (A) and microphotograph of its mycelium (B) and conidia (C)

Fig.1 Zone-wise average Alternaria blight intensity on sesame of Maharashtra state during *Kharif*, 2014-15 and 2015-16

Fig.2 Zone-wise pooled intensity of Alternaria blight on sesame in Maharashtra state (*Kharif*, 2014-15 and 2015-16)

Fig.3 Sesame variety-wise average intensity of Alternaria blight in Maharashtra state during *Kharif*, 2014-15 and 2015-16

Fig.4 Sesame variety-wise pooled mean intensity of Alternaria blight in Maharashtra state during *Kharif*, 2014-15 and 2015-16

On the basis of pooled mean (*Kharif*, 2014-15 and 2015-16) results (Fig. 4), maximum mean blight disease intensity was recorded on

AKT-64 (43.76 %), followed by Local cultivar (40.08 %); whereas, rest of the cultivars exhibited minimum mean blight

disease intensity in the range of 19.63 to 32.33 per cent.

Variability in *Alternaria* blight symptoms

During survey, natural leaf spot / blight symptoms expressed a wide range of variability in respect of their shape, size, colour and presence or absence of concentric zonation etc. (PLATE III and Table 6).

Shapes of the leaf spots observed were mostly circular to irregular on the sesame crop grown in the four zones viz., North Kokan Coastal Zone, Western Ghat Zone, Sub Mountain Zone and Western Maharashtra Scarcity Zone; circular from the two zones viz., South Kokan Coastal Zone and Central Vidarbha Zone and irregular from the three zones viz., Western Maharashtra Plain Zone, Central Maharashtra Plateau Zone and Eastern Vidarbha Zone.

Size of the leaf spots was also varied and were small from the one zone Western Ghat Zone; medium from the three zones viz., Sub Mountain Zone, Western Maharashtra Scarcity Zone and Central Vidarbha Zone; large from the three zones viz., North Kokan Coastal Zone, Western Maharashtra Plain Zone and Central Maharashtra Plateau Zone and small to large from the two zones viz., South Kokan Coastal Zone and Eastern Vidharbha Zone.

Colour of the leaf spots on sesame crop was mostly light brown to dark brown from the four zones viz., North Kokan Coastal Zone, Sub Mountane Zone, Western Maharashtra Plain Zone and Eastern Vidarbha Zone; dark brown to black from the one zone Central Vidarbha Zone; light brown from the two zones viz., Western GhatZone and Western Maharashtra Scarcity Zone and light gray from the two zones viz., South Kokan Coastal Zone and Central Maharashtra Plateau Zone. Concentric zonations around the leaf spots

were found on the sesame crop grown in the four zones viz., South Kokan Coastal Zone, Western Maharashtra Scarcity Zone, Central Vidarbha Zone and Eastern Vidarbha Zone; whereas, there absence of concentric zonation around the leaf spots on sesame crop grown in the five zones viz., North Kokan Coastal Zone, Western Ghat Zone, Sub Mountain Zone, Western Maharashtra Plain Zone and Central Maharashtra Plateau Zone. Thus, during survey, distinguishing features of the leaf spot / blight on sesame crop observed were circular or irregular, medium to large sized, light brown to dark brown coloured leaf spots with or without concentric zonation.

From the ongoing results it has been inferred that the sesame *Alternaria* blight disease intensity varied at different locations surveyed of nine agro-climatic zones of Maharashtra state falling under various climatic conditions, inoculum potential and varieties cultivated with different genetic makeup. Overall average disease intensity was of higher tune in the range of 21.83 to 39.58 per cent during *Kharif*, 2015-16 than that of *Kharif*, 2014-15 (18.64 to 36.39 %). This may be due to overall maximum rainfall received during rainy season of 2015-16.

These results of the present studies on occurrence and distribution of *Alternaria* blight disease in sesame crop are similar to those reported earlier by several workers (Mohanty and Behera, 1958; Leepik and Sowell, 1964; Chohan, 1978; Kolte, 1985; Naiket *al.*, 2004; Akbari and Parkhia, 2011; Anonymous, 2014).

Ojiambo *et al.*, (1998) reported the long period of high humidity and spore dispersal by frequent rain showers during *Kharif* were more suitable for infection of leaf spot / blight of sesame. Leepik and Sowell (1964) reported that species *Alternaria sesami* probably occurs wherever sesame is grown. Akbari and Parkhia (2011) reported occurrence of

Alternaria leaf spot / blight of sesame from Saurashtra region of Gujrat state, which caused 80 per cent losses in grain yield under wet climate. Anonymous (2014) reported similar result that Alternaria leaf blight of sesame incidence were higher in Tamil Nadu (Cuddalore district) 1-2 grade, Keonjhor and Dhenkanal districts (2-3 grade) and less in Madhya Pradesh (Jabalpur and Chhatrapur districts) 1-2 grade, Jodhpur district (0-2 grade) due to unfavourable environmental conditions prevailed.

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