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INCIDENCE AND INFECTION OF *ALTERNARIA TENUIS NEES* IN *ERUCA* SEEDS OF RAJASTHAN

NEELAM SHARMA, TRIBHUWAN SINGH AND DALBIR SINGH
Department of Botany, University of Rajasthan, Jaipur - 302 004.

Alternaria tenuis Nees, was recorded in 135 out of 211 seed samples of taramira (*Eruca sativa* Linn.). The incidence was mostly below 20%. Seed - coat and endosperm were readily infected but infection in embryo was seen only in heavily infected seeds. Rarely, the embryo was reduced and formless with lysogenic cavities showing sporulation of the pathogen.

Key Words : *Eruca sativa, Seeds, Alternaria tenuis,* Histopathology.

Taramira (*Eruca sativa* Linn.) an oilseed crop, suffers from many phytopathogenic fungi (Vasudeva, 1960). *Alternaria tenuis* Nees has been reported on many crops causing black point, seedling - malformation and rot, leaf-spot and fruit rot (Richardson, 1979). It is a seed-borne pathogen (Richardson, 1979) and has been shown to have well established infection in seeds of sunflower (Singh *et al* 1977) and radish (Thakur *et al* 1981). But, the host-parasite relationship of *A. tenuis* in naturally infected taramira seed is unknown. It is also a dominant and common seed-borne pathogen in taramira.

MATERIALS AND METHODS

Two hundred and eleven seed samples of taramira collected from 19 districts of Rajasthan during the harvest years, 1988-91 were screened for seed-borne mycoflora by using the standard techniques of ISTA (Anon., 1976). Four naturally infected seed samples ac. nos. 6608, 6610, 6685 and 6900 were selected to study the presence of *A. tenuis* in seeds. Symptomless and categorised symptomatic seeds (weakly, moderately and heavily discoloured) were used for component plating, cleared wholemount preparations and microtome sectioning (Singh *et al.*, 1977). Five seeds per category per sample were used for microtomy.

RESULTS AND DISCUSSION

124 seed samples belonging to 17 districts had seeds with dark-brown discolouration (Table - 1 Fig. 1A). The discoloured seeds invariably yielded infection of *A. tenuis*. In incubation test *A. tenuis* was recorded in 135 samples (Table-I). Majority of the samples were in the range of 0.5-5% followed by 5.5 -20%, only 15 samples showed high incidence 0.5-98.0%. The occurrence of infection was high in samples from Alwar, Bharatpur, Dholpur, Jaipur and Tonk districts.

Table 1 : Occurrence and incidence of seed discolouration in dry seed examination and Alternaria tenuis in standard blotter method (400 seeds/sample) in the seed samples of Rajasthan.

Districts	No. of samples	Dark-Brown discolouration		*A. tenuis*	
Ajmer	14	8	(0.5 - 10.0%)	7	(.1.0 - 12.0%)
Alwar	10	9	(0.5 - 29.5%)	10	(3.0 - 27.5%)
Banswara	1	-	-	1	(0.5%)
Bharatpur	14	11	(0.5 -56.5%)	11	(4.0 - 92.5%)
Bhilwara	1	-	-	1	(0.5%)
Bikaner	4	2	(2.5, 6.0%)	2	(5.0, 5.0%)
Bundi	9	7	(0.5 - 2.0%)	7	(0.5 - 5.0)
Dholpur	7	6	(2.5 - 90.0%)	7	(2.5 - 98.0%)
Jaipur	74	38	(3.0 - 90.5%)	46	(5.0 - 95.5%)
Jalaur	1	1	(4.0%)	1	(5.0%)
Jhalawar	3	1	(1.0%)	1	(1.0%)
Jodhpur	3	3	(0.5 -10.0%)	3	(1.0 - 7.5%)
Kota	12	5	(0.5 - 7.5%)	5	(0.5 - 17.0%)
Nagaur	5	1	(0.5 %)	1	(0.5 %)
Pali	4	4	(6.0 - 8.0%)	4	(4.0 - 6.0%)
Sawai Madhopur	8	4	(1.0 - 10.5%)	4	(6.0 - 9.5%)
Sikar	12	5	(1.0 - 17.5%)	5	(1.5 - 20.5%)
Sriganganagar	14	5	((0.5 - 4.0%)	5	(1.5 - 8.5%)
Tonk	15	14	(0.5 - 20.5%)	14	(0.5 - 41.5%)

In component plating the symptomless seeds revealed *A. tenuis* only in seed coat (10-26%), whereas in discoloured seeds it varied from 30-100% (Fig.18). The cotyledons of weak and moderate categories either had low infection (Ac. nos. 6608, 6900) or no infection (ac. nos. 6610, 6685), whereas the embryal axis was always free from infection. The seeds with heavy infection showed 52 - 82% and 42-70% incidence in cotyledons and embryal axis (Fig. 1C) respectively. The cotyledons were readily covered with dense sporulating growth of *A. tenuis*.

Wholemount cleared preparation also revealed

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Table 2: Percentage infection of A. tenuis in different parts of asymptomatic and symptomatic (weakly, moderately and heavily infected) seeds of taramira in component plating in SBM and cleared wholemount preparations (Sc - Seed coat, Cot - cotyledon, Ea - Embryal axis).

SAMPLE	ASYMPTOMATIC			SYMPTOMATIC								
				Weak			Moderate			Heavy		
	Sc	Cot	Ea	Sc	Cot	Ea	Sc	Cot	Ea	Sc	Cot	Ea
COMPONENT PLANTING												
6900	26	0	0	58	0	0	72	14	0	100	82	70
6608	10	0	0	48	0	0	60	0	0	100	68	64
6685	18	0	0	50	0	0	66	0	0	100	56	42
6610	12	0	0	30	0	0	52	10	0	100	52	44
CLEARED WHOLEMOUNT PREPARATIONS												
6900	30	0	0	50	0	0	70	12	0	100	79	64
6608	10	0	0	36	0	0	62	2	0	100	70	58
6685	12	0	0	52	0	0	58	0	0	100	45	32
6610	10	0	0	28	0	0	50	7	0	100	48	27

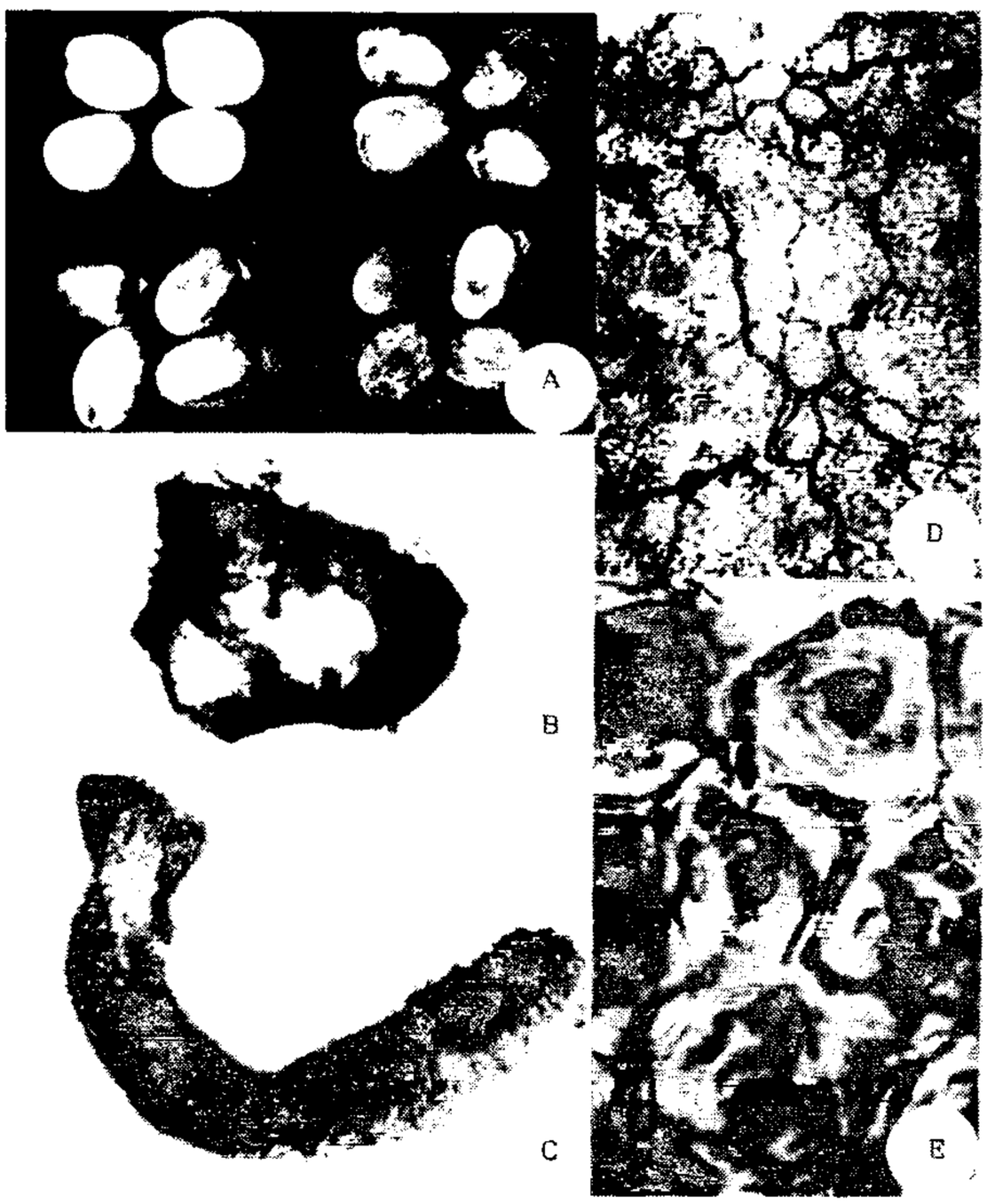

Figure 1. Dry seed examination (A), component plating (B,C) and cleared wholemount preparations (D,E) of *Eruca* seeds infected with *Alternaria tenuis*.
A. *Eruca* seeds symptomless (upper left), weakly (upper right), moderately (lower left), and heavily infected (lower right). X13.
B.C. Growth of fungus on seed coat (B) and embryal axis (c). X50, X75.
D.E.. Mycelium in seed coat (D) and endosperm (E). X250, X500.

Figure 2. Histology of taramira seeds infected with *Alternaria tenuis*.
A. T.S. part of moderately infected seed showing mycelial bits in endosperm and in space between endosperm and cotyledons X500.
B-E. T.s. part of heavily infected seed. Note intra-cellular mycelial bits in palisade cells (B), mycelial aggregation in seed coat, endosperm and cotyledon (C), intra-cellular mycelium in epidermis, subepidermis. Palisade of seed coat and endosperm with lytic cavities (D), infected cotyledon with lytic cavities and mycelium in vascular region. X500, X500, X250, X250.

infection in different parts of seed (Table 2, Figs. 1D,E).

In mocrotome sections the amount of internal inoculum varied with the degree of symptoms on seeds. In symptomless seeds infection was confind only to outermost radially elongated mucilagenous layer showing mycelial bits in 4 out of 5 seeds.

In seeds with weak to moderate infection mycelium was mostly observed in the epidermis, subepidermis and occasionally in palisade cells and endosperm in the latter (Fig. 2A). The cells were normal looking.

The heavily infected seeds showed inter-as well as intra-cellular mycelium in all the layers of seed-coat (epidermis, subepidermis and palisade). The cells were loose at places. The palisade cells showed signs of stress with weak thickenings of radial walls (Fig 2B). The different layers of seed-coat were indistinguishable and revealed cell necrosis (Fig. 2C). The endosperm, embryo including cotyledons and embryal axis had dense mycelium, particularly in spaces between endosperm and cotyledons and between the two cotyledons (Fig. 2D). Mycelium was also seen in the vascular region of the cotyledon (Fig. 2E). Necrosis of host cells which took red stain with safranine and light green combination, disintegration of cell contents and lytic cavities were commonly observed in seed-coat, endosperm and embryo. The pathogen had sporulated in such cavities. In some seeds the embryo appeared as formless mass of tissues.

The present study has clearly shown that the *A. tenuis* is a prominant pathogen of *Eruca* seed in Rajasthan and the infected seeds may be symptomless or discoloured. In symptomless seeds the pathogen may also occur either as conidial contamination on seed surface or as dormant mycelial infection. Depending on infection severity it is both extra-as well as intra-embryal. In case of heavily infected seeds it appears that the pathogen after entering in seed, spreads rapidly. This may be attributed to high moisture content, high level of gaseous exchange in immature seeds and weak cuticula of different components. Heavily infected seeds never germinate on incubation and no fungicidal treatment may cause recovery of such seeds. *Alternaria* spp. causing seed discolouration also result in poor quality and deterioration of oil in *Eruca* (Singh and Sinha, 1978, 1979) and in other cruciferous crops (Singh and Negi, 1984).

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