

INFECTION OF *CURVULARIA UNATA* IN ALL SORGHUM SEEDS

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Sorghum seeds infected with *Curvularia lunata* showed black discolouration and mycelial net on seed surface. It was recorded in 151 out of 161 seed samples collected from 19 districts of Rajasthan. Incidence varied from 1-74%. Histopathology of symptomatic naturally infected seed revealed infection of *C. lunata* confined to pericarp and aleurone layer near hilar end in seed with moderate infection (extra embryal) and to all parts including endosperm and embryo (intraembryal) in heavily infected seeds. In intraembryal infection it caused lysis of cell wall of various seeds tissues and premature xylogenesis and deformation in embryo.

Key words - Sorghum, Seed, *Curvularia lunata*, Histopathology

Curvularia lunata (Wakker) Boedijn is a seed-borne pathogen causes seed-rot, seedling blight, leaf spot diseases and is also associated with grain mold of sorghum (Bhale & Khare, 1980; Gopinath *et al.*, 1985). Bhatnagar (1971) reported it to be internally seed-borne in seeds raised from artificially inoculated plants. We present incidence of *C. lunata* and host-parasite relationship in naturally field infected sorghum seeds grown in Rajasthan.

MATERIALS AND METHODS

One hundred sixty one samples collected 19 districts of Rajasthan were tested by dry seed inspection and standard blotter test using both untreated and 1% chlorine pretreated seeds (Anon, 1976). Four seed samples ac. nos. 662, 663, 1387 and 1889 carrying 74, 66, 59 and 36% infection of *Curvularia lunata* respectively were selected. Asymptomatic and symptomatic seed were used for histopathological studies following component plating, cleared wholemount preparation and microtome sectioning (Singh *et al.*, 1980). For microtome sectioning 5 seeds per category per sample was used.

RESULTS AND DISCUSSION

Samples were either white or cream seeded. 130 samples revealed black discolouration and mycelial net on seed surface (Fig. 1). Their incidence varied from 0.5-85%. Total 58 fungi were isolated from sorghum seeds of which *Curvularia lunata* was the most dominant and recorded in 151 samples. The infection ranged from 1-94% in untreated seeds (Table 1). 61, 57, 26 and 7 samples were in the range of 0.5-10, 11-25, 26-50 and 51-100% infection respectively. No significant difference was observed in chlorine

pretreated seeds. Black, rigid, horny, simple or branched stromata were frequently observed on incubated seed alongwith *C. lunata* colony (Fig. 2). Anatomically the stromata were comprised of pseudoparenchymatous mycelial structure (Fig. 3, 4). Samples from Ajmer, Banswara, Bundi, Chittorgarh, Jaipur, Jhalawar, Kota, Tonk and Udaipur revealed high infection percentage. These are relatively wet districts during the crop season. Gopinath *et al.*, 1985 reported high incidence of head mold in wet Kharif season. Sample from Jaisalmer was free from infection (Table 1).

Table 1: Number of samples with per cent range of black discolouration in dry seed inspection and *Curvularia lunata* in standard blotter test (400 untreated seeds per sample)

District	No. of samples	Seeds with black discolouration	<i>C. lunata</i>
Ajmer	3	2(4-9)	3(3-47)
Alwar	5	-	4(7-33)
Banswara	5	3(2-37)	5(11-41)
Barmer	1	1(4)	1(2)
Bharatpur	7	6(2-15)	7(3.5-27)
Bundi	8	8(13-43)	7(4-47)
Chittorgarh	14	14(2-85)	14(1.5-94)
Jaipur	15	15(1-57)	14(5-66)
Jaisalmer	1	-	-
Jhalawar	6	6(4-45)	6(2-44)
Jhunjhunu	4	3(1.5-10)	3(6-11)
Jodhpur	16	13(1-27)	16(1-30)
Kota	35	22(1-47)	34(1-55)
Nagaur	5	5(1-10)	4(10.5-19.5)
Pali	9	6(12-32)	7(1-19)
Sikar	1	1(18)	1(14)
Sawai-Madhopur	7	7(1-33)	7(4-32.5)
Tonk	7	7(2-37)	7(3-4.5)
Udaipur	12	11(0.5-40)	11(7-59)

The per cent infection of *C. lunata* ranged from 60-96% in pericarp, 54-83% in aleurone layer +

endosperm and 16-44% in embryo in four samples. The fungus growth was better on aleurone layer + endosperm and embryo than on pericarp. It was not recorded in any part of asymptomatic seed.

invaded the stilar tissue. In some seed sections hyphae was observed in stilarvoid region and rarely invaded the aleurone layer. No infection was seen in endosperm and embryo.

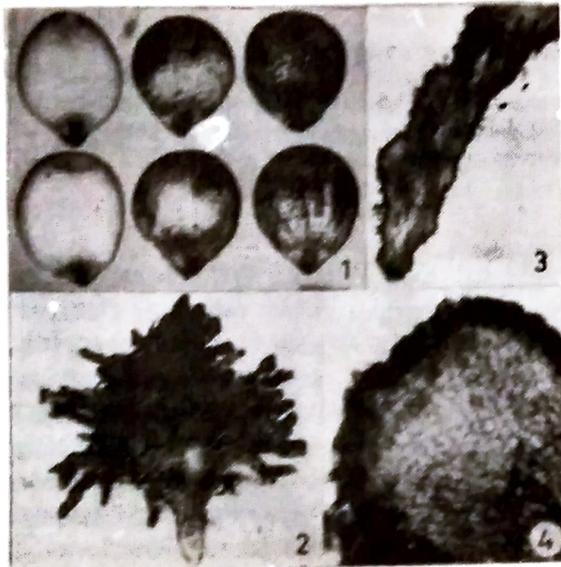


Fig. 1. Sorghum seed-healthy and black discoloured X 3.8. Fig. 2 Stromata of *Curvularia lunata* on seed surface X 4.5. Fig. 3-4 L.S. of stomata showing pseudoparenchymatous cells. X 30, X 100.

Thick, dark brown, septate, knotty mycelium was observed only in glume and pericarp of moderately infected seeds whereas in heavily infected seed it was observed in all parts including endosperm and embryo. In glumes hyphae was exo- and endophytic.

Both asymptomatic and symptomatic seeds were used for microtome sectioning. The sorghum seed consists of pericarp, seed coat or testa present or absent, aleurone layer, endosperm and embryo. The pericarp has epicarp, mesocarp and endocarp. Cultivars have seeds either with or without testa. Testa, if present forms a complete cover over endosperm and usually intensely coloured. Aleurone layer is composed of rectangular cells followed by endosperm. The graminaceous embryo is laterally situated (Glueck & Rooney, 1980).

Seeds with moderate infection - Curvularia lunata mostly colonized the pericarp and its cells in different layers were deformed. Hyphae was inter- as well as intracellular forming hyphal clumps at places. It also

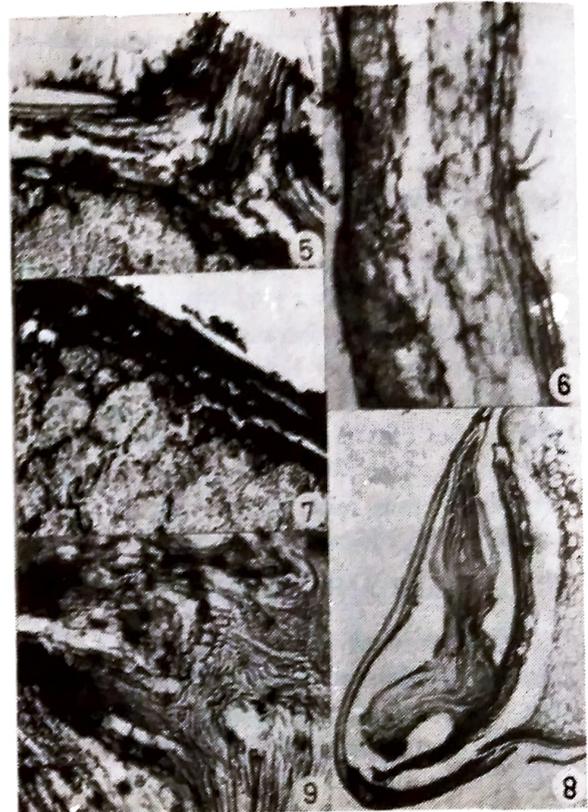


Fig. 5-8. L.S. of symptomatic seeds 5-stylar region with hyphae and hyphal clumps X 100, 6-pericarp with hyphae and disintegrated cells X 200, 7-hyphae in pericarp and endosperm X 100, 8- infected embryo X 100, 9- Xylogenesis in vascular supply of embryo X 100.

Seeds with heavy infection - Hyphae was observed in all parts i.e. pericarp, aleurone layer, endosperm and embryo (Figs. 5-9). The pericarp cells were distorted and its different layers were indistinguishable. The cells were completely colonized by hyphal clumps (Fig. 6). Hyphal aggregation developed in parenchymatous tissue of stilar region (Fig.5). Histopathological manifestation in aleurone layer varied with degree of infection. The cells showed compression, detachment of cell walls and depleted cell contents. Infection also caused lysis of cell wall and cell contents.

The infection in endosperm proceeded centripetally. The comeous endosperm received infection first followed by floury endosperm. Infected cells were fragile with poor contents and abundant mycelium. In four seeds cell wall of floury endosperm was completely replaced by mycelium which became intracellular and caused complete disintegration of cell contents (Fig. 7).

Embryal infection reached almost all of its parts such as scutellum, coleoptile, cotyledonary node, primary root and coleorhiza. In two seeds embryo showed lack of cell contents and premature xylogenesis in vascular supply which normally comprised procambial strands (Fig. 9). Scutellum was distorted, epithelial cells were elongated, mesophyll cells developed lysogenous cavities, colonized by fungal mycelium. Coleoptile and seminal leaves were thin, poor in contents and invaded by fungal mycelium. The root axis including coleorhiza was much elongated with narrow elongated cells without apparent cell contents which lacked further differentiation. However, the vascular supply was conspicuous (Fig. 8). In one seed embryo appeared as formless mass of small parenchymatous cells with clumps of mycelium. Mycelial aggregation completely masked the host cells which showed evident sign of stress, absorption and disintegration. Lysis of cell wall, depletion of cell contents, induced elongation of epithelial cells and premature xylogenesis in mesocotyledonary node region have also been observed in wheat seeds infected with *Drechslera sorokiniana* and *D. tetramera*.

This is the first study on histopathology of naturally field infected sorghum seeds suggesting its colonization in different components of moderately and heavily infected seeds.

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