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Histopathological Studies on Pearlmillet Infected with *Sclerospora graminicola* (Sacc.) Shroet.

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ABSTRACT Histopathological studies of the downy mildew / green ear infected pearl millet, the mycelium of the causal fungus was traced from the basal root to the apical meristem of infected seedlings indicating thereby that the infection is systemic. The mycelium was intercellular with finger shaped haustoria. The downy growth revealed stout, club shaped and asymmetrically branched sporangiophores seen emerging through the stomatal opening. The sections at different ages of oospore showed the development of the endo-and exospore walls. It was seen that the endospore wall of the young oospore was thin but gradually became thick with advancement in age. The exospore wall also showed similar development till maturity, at which the spores attained the normal shape and size.

Key words: *Pennisetum glaucum*, *Sclerospora graminicola*, Histopathology

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is a staple food crop of millions in Africa and India. A number of fungal, bacterial and viral pathogens are reported to attack this crop, of which *Sclerospora graminicola* (Sacc.) Schroet. causing downy mildew and/or green ear is the most destructive and devastating. Since the disease cycle reveals that the infection could be initiated from seed or soil borne oospores or from sporangial inoculum established in the downy growth on the neighbouring plants [1] an attempt was made to trace the location of the infection in diseased plants and also to see for structural differences, if any, between healthy and infected plants so as to know the exact site of infection initiation and location of the seed borne mycelium.

MATERIALS AND METHODS

Roots, apical whorl, leaves and stem of downy mildew infected as well as of healthy HB-3 seedlings were fixed in Formalin - Acetic acid-Alcohol (FAA). Similarly, shredding leaves, malformed spikelets and seeds produced on partially malformed ears were also fixed in FAA. Dehydration was done following ethyl alcohol and n-butanol series and subjected to infiltration in paraffin wax (MP 58-60°C) and embedding. Uniform sections of 10-14 µm were taken using Erma rotary microtome and stained by Safranin-Fast green or Hematoxylin-Safranin combinations [2]. Photomicrographs were taken using Leica photo automat.

RESULTS AND DISCUSSION

The mycelium of *S. graminicola* was observed in the sections of root, stem, leaf whorl, infected leaves, flower primordia, ovaries of malformed spikelets and 'leaf like structures' formed by the floral malformation of the infected seedlings and plants indicating thereby that the infection is systemic. The hyphae were prominent in the leaf whorl (Fig. 1) and at the apical region that happen to be the youngest tissues. The mycelium was traced [3] in all the parts of infected plants including seeds. In the present studies however, mycelium could not be detected in the seeds formed

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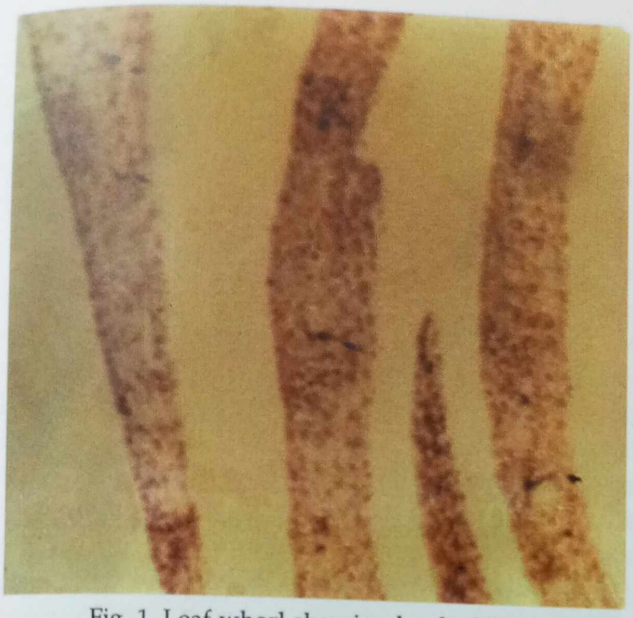

Fig. 1. Leaf whorl showing hypha X62.5

Fig. 2. Aseptate intercellular mycelium with haustoria X312.5

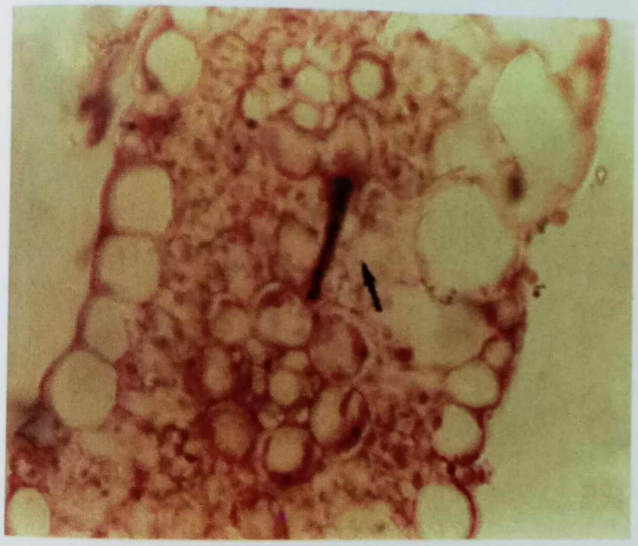

Fig. 3. Hypha in mesophyll region X125

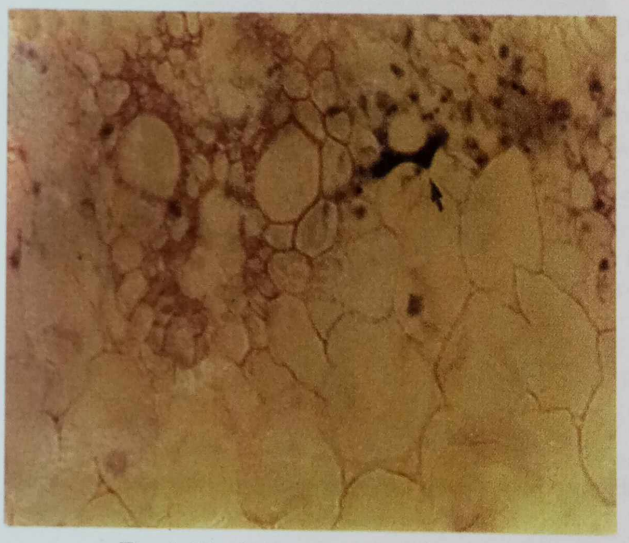

Fig. 4. Hypha in ground tissue X125

Fig. 5. Hypha in stomatal region X125

Fig. 6. Sporangiophore with sporangia of varying size X197

Fig. 7. Leaf like structure with distorted epidermis

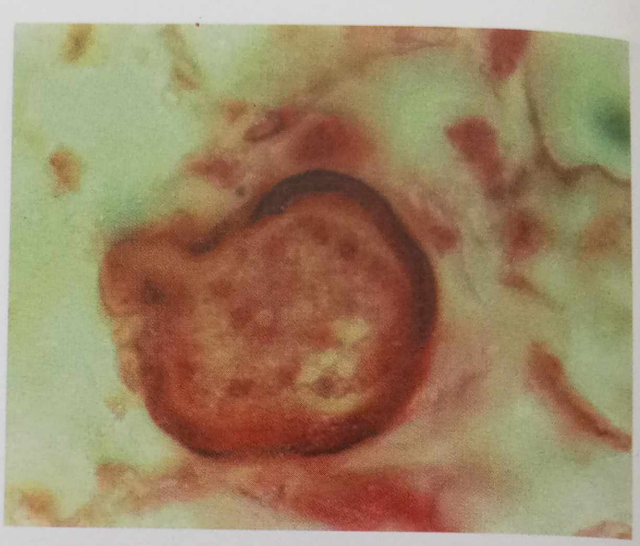

Fig. 8. Young oospore with many nuclei X312.5

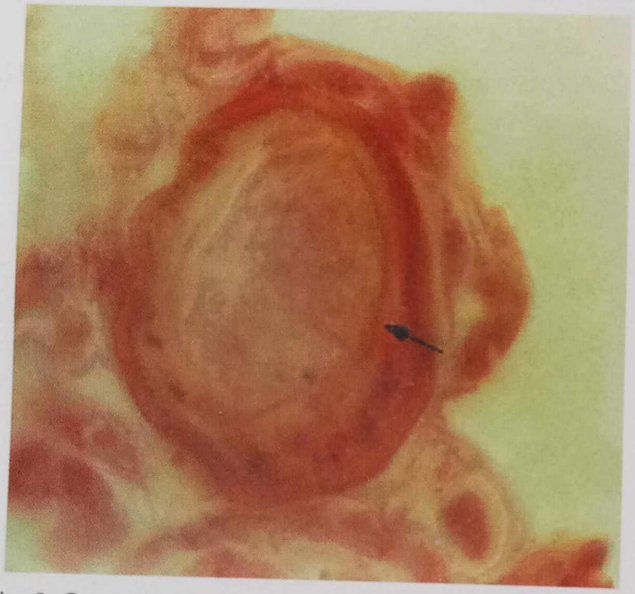

Fig. 9. Oospore with initiation of smooth endospore wall X312.5

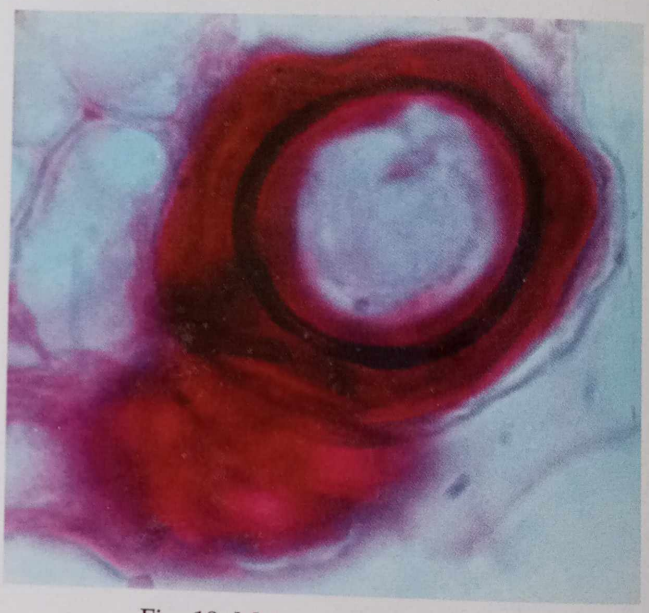

Fig. 10. Maturing oospore X400

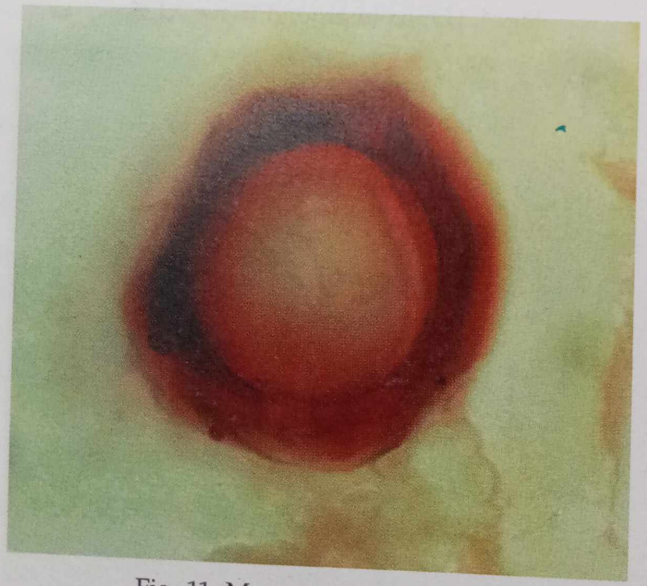

Fig. 11. Mature oospore X312.5

Fig. 12. Malformed mature spikelet with large number of oospores

on the partially malformed ear heads. The mycelium was detected [4] in the ovary wall but could not observe the same in the roots and seeds, and stated that the hyphae look prominent in younger parts of the host that become inconspicuous in older parts.

The mycelium seen in different plant parts was coenocytic and intercellular sending finger shaped haustoria into the adjacent cells (Fig. 2). Similar intercellular hypha was observed [4]. It is reported [5] that the mycelium of all the members of Peronosporaceae is intercellular. In the leaf tissues, the mycelium was found between the cells of the mesophyll (Fig. 3), bordering the vascular bundles (Fig. 4) but without penetrating the latter. It was also seen in the region below stomata (Fig. 5). Stout, club shaped and asymmetrically branched sporangiophores were seen emerging through the stomatal opening (Fig. 6). These sporangiophores terminated in the formation of sterigmata that bore sporangia at the tips. The sporangia formed were variable in size representing differential age [4].

Sections of the 'leaf like structures' from the malformed ears showed distorted and compressed epidermal cells (Fig. 7), with the hypha still limited outside the vascular bundles. Anatomical differences were also noticed [6] in the epidermis of normal leaves and 'leaf like structures' from the green ears.

The young oospore with a number of nuclei was observed (Fig. 8). The sections at different ages of oospore showed the development of the endo- and exospore walls (Fig. 9). It was seen that the endospore wall of the young oospore was thin but gradually became thick with advancement in age (Fig. 10). The exospore wall also showed similar development till maturity, at which the spores attained the normal shape and size (Fig. 11). In the leaf like structures on malformed ears also, numerous oopspores were seen (Fig. 12).

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