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PERMEABILITY CHANGES ASSOCIATED WITH THE SCLEROTIAL ROOT ROT OF GROUNDNUT

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Altered permeability is known to be a characteristic of infectious plant diseases. This alterations in many cases are known to be enzymatically induced (Brown, 1915., Thatcher, 1942., Lai Ming-Tan *et al.*, 1968). *Sderotium rolfsii* Sac a common pathogen affecting a number of crops is well known for its enzymatic nature of tissue maceration (Bateman and Beer, 1965., Bateman, 1968). In the p'ersent study, permeability changes brought about by enzymes secreted by S. *rolfsii* and by infection in the hypocotyl region of groundnut plants were investigated in detail and the results are presented herein.

Materials and Methods

A very virulent isolate of *Sderotium rolfsii* obtained from sclerotial root rot affected groundnut hypocotyl tissues was used throughout the study. Culture filtrate was obtained by growing the fungus in potato broth pectin medium (potato 400g, glucose 20g citrus pectin 20g, distilled water 1000ml) for 8 days at room temperature (26 ± 2°C). Ten potato discs of 8mm diameter and 0.4 mm thickness were soaked for 4 hours in 10 ml of the culture filtrate buffered with 0.01 M tris HCL at pH 8.0. Permeability changes were measured as electrolyte loss from the treated tissues. The electrolyte loss was measured by determining the change in electrical conductivity (EC) using the conductivity bridge type CM 84.

For detecting permeability changes in host tissue 10g of hypocotyl tissue infected by 5. *rolfsii* was taken in a 500 ml Erlenmeyer flask and soaked in 30 ml deionised water. The flasks were then kept in a shaker for 24 hours. The leachate was collected at different intervals and their conductivities were recorded. Controls with healthy hypocotyls were also run along with the treatment. The leachate collected after 24 hours of leaching were analysed for the presence of such electrolytes like phosphorus, calcium, sodium and potassium. Leachate collected from healthy tissues under identical conditions served as control.

Total phosphorus was detected following the colorimetric method as described by Ward and Johnston (1962) using a Coleman colorimeter. sodium calcium and potassium were detected using a flame photometer as described by Jackson (1962).

Results and Discussion

1. Effect of culture filtrate of S. *rolfsii* on permeability changes in potato tissues.

The changes in electrical conductivity of the leachate collected by leaching the potato discs treated by the culture filtrate are presented In Table 1. The electrical conductivity was found to increase in the potato discs treated with the culture filtrate.

Table 1

Effect of culture filtrate of *S. rolfsii* on the permeability changes in potato tissue measured as changes in electrical conductivity (each value averages of three detections)

SI. No.	Treatment	Electrical conductivity in mhos/cm
I	Deionised water	350
2	Uninoculated medium	800
3	Culture filtrate	1000

2. Effect of infection on permeability changes of host tissue.

The electrical conductivity of the leachate obtained by leaching the infected hypocotyl tissues and also the healthy controls during different intervals are presented in Table 2

Table 2

Changes in electrical conductivity of leachate from infected hypocotyl tissues. (each value average of three replications)

SI. No.	Type of tissue	Electrical conductivity in mhos / cm / 10g of tissue, intervals in hours after leaching			
		0	8	12	24
1	Infected hypocotyl	300.0	400 0	500.0	800.0
2	Healthy hypocotyl	300.0	320.0	380.0	450.0
3	Percentage increase over healthy tissue	0.0	25.0	31.5	77.7

Electrical conductivity of the leachate collected from infected tissues was always higher than that of the healthy tissues. Electrical conductivity increased with increase in period of leaching. It was 77.7 per cent higher than that of healthy tissues, 24 hours after leaching.

3. Analysis of leachate collected from groundnut hypocotyl tissue infected with S. *roifsii.*

The data presented on table 3 indicated that the changes in permeability of the host cells cause loss of electrolytes like potassium, total phosphorus, sodium and calcium in appreciable quantities. Among the various minerals, potassium leached out in maximum quantity and calcium the lowest.

Table 3

Analysis of leachate from infected hypocotyl tissues (each value averages of 3 estimations)

Sl. No.	Name of the constituent	Contents as g/ml of leachate		
		Healthy	Infected	Percentage over healthy
1	Sodium	20.0	30.0	50 0
2	Potassium	28.0	52.0	87.1
3	Calcium	28.0	41.0	46.1
4	Total phosphorus	1.5	2.5	60 5

The culture filtrate of *Sclerotium roifsii* isolated from groundnut has already been demonstrated to possess macerating activity (Anandavally Amma *et al.,* 1975). In the present study it was found that rhe same could also induce electrolyte loss. The electrical conductivity of leachate obtained by leaching the inoculated hypocotyl tissues was found to increase from 25 to 77.7 per cent according to the period of leaching, Further, this leachate was found to contain accumulated ammounts of sodium, potassium, calcium and total phosphorus than those from healthy tissues. This loss of electrolytes from the infected tissues resulted in the increase of electrical conductivity of the leached solution. Similar release of electrolytes from infected tissues due to permeability changes have also been reported for many infectious plant diseases (Wheeler and Hanchy, 1968). A loss in semi permeability of plant cell membrane and/or cellular death have been observed to occur prior to lesion formation in plants attacked by the pathogens, *Botrytis cinerea, Sclerotina sclerotiorum, Sclerotium roifsii, Rhizoctonia solani* and *Bacterium aroidea* and in many of these

instances the alterations in permeability of host tissue appear to be induced enzymatically (Brown, 1915; Thatcher, 1942; Tribe, 1955; Lar Ming-Tan *et al.*, 1968; Mount *et al.*, 1970). The first act of the parasite on the host tissue appeared to result in an increase in permeability which made the nutrients available to the parasite. The available evidences suggest that the enzyme(s) secreted by S. *rolfsii* impairs the permeability of host cells, where by they release electrolytes to the fullest advantage of the invading pathogen.

Summary

Infection of groundnut hypocotyl tissue by *Sclerotium rolfsii* was found to alter the permeability of host tissue resulting in leaching out of large quantities of water soluble constituents. The culture filtrate of this orgainsm was found to alter cell permeability. The possibility of the enzymes secreted by the impairing pathogen in the host cell permeability is discussed.

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സംഗ്രഹം

സ്ക്ലിറോഷ്യം റോൾഫ്സി എന്ന ഫംഗസിന്റെ ആക്രമണം ഏറെ നിലക്കടലയുടെ ബീജ പത്രാധര കോശങ്ങളുടെ പാരഗമ്യത വളരെ ഏറെ വ്യത്യാസപ്പെട്ട കാണുകയുണ്ടായി. തൽഫലമായി വെള്ളത്തിൽ ലയിക്കുന്ന പല ഘടകങ്ങളും കോശങ്ങളിൽ നിന്നും നഷ്ടപ്പെടുന്നു. മാത്രമല്ല ഈ ഫംഗസു വളർന്ന ലായനിയുടെ അവസ്യന്ദകം തന്നെ മതി ഇപ്രകാരം കോശപാരഗമ്യതാ മാറ്റങ്ങളുണ്ടാകാൻ. ഇതിൽ നിന്നെല്ലാം തെളിയുന്നത് ഫംഗസ് ഉല്പാദിപ്പിക്കുന്ന ചില എൻസൈമുകളാണ് കോശങ്ങളുടെ ഈ പാരഗമ്യതാ വ്യത്യാസങ്ങൾക്ക് കാരണം എന്നാണ്.

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