EFFECT OF SORGHUM PHYLLOSPHERE FUNGI ON THE INCIDENCE OF HELMINTHOSPORIOSE DISEASE

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ABSTRACT

Eight dominant phyllosphere fungi viz. *Alternaria tenuissima*, *Chaetomium globosum*, *Cladosporium herbarum*, *Curvularia lunata*, *Fusarium moniliforme*, *Melanospora* sp., *Pestalotia* sp. and *Trichoderma viride* of sorghum were tested for their effect on the spore germination of *Exserohilum turcicum*, the incitant of helminthosporiose disease. Also, their effect on the incidence of helminthosporiose disease on a highly susceptible cultivar of sorghum Neerujola was studied. Significant inhibition in the spore germination and reduction in the percentage of infection was observed with *C. globosum*, *C. lunata* and *F. moniliforme*. Although the other five fungi stimulated spore germination and enhanced infection, the development of lesions was drastically restricted.

INTRODUCTION

SPORE germination of the pathogen in the pre-penetration phase of infection is an important event in the physiology of plant disease. The phyllosphere micro-organisms are known to play an important role in an associative/destructive manner on the germination of spores of pathogenic fungi. Many workers have also studied the interactions between pathogens and non-pathogens[1-9]. In the present investigation, *in vitro* trials were carried out to examine the effect of phyllosphere fungi on the spore germination of *Exserohilum turcicum* (Pass.) Leo *et* Sug., the causal organism of helminthosporiose disease (leaf blight) of sorghum. The reactions were then examined *in vivo* by inoculating sorghum seedlings. The following fungi isolated from sorghum leaves[10] were chosen for the study as they were the most dominant and abundant forms: *Alternaria tenuissima*, *Chaetomium globosum*, *Cladosporium herbarum*, *Curvularia lunata*, *Fusarium moniliforme*, *Melanospora* sp., *Pestalotia* sp. and *Trichoderma viride*.

EXPERIMENTAL

Healthy seeds of sorghum cultivar, Neerujola, were obtained from the University of Agricultural Sciences, Bangalore. A culture of *E. turcicum* was procured from the Division of Mycology and Plant Pathology, IARI, New Delhi.

Trials on spore germination were carried out in Van Tieghem cells. Test medium containing spore-cum-mycelial suspensions (1,50,000 spores/ml) of dominant phyllosphere fungi mentioned above and the spore suspension of *E. turcicum* (1,50,000 spores/ml) was placed at the base of the Van Tieghem cell. It was covered by a cover glass and incubated over water for 18 h. For the control, instead of phyllosphere fungal suspension, distilled water was used to germinate the *E. turcicum* spores. The percentage of spore germination was calculated after observing 100 spores from randomly chosen microscopic fields. Repeated observations were made at every 3 h intervals until no further change in germination occurred.

As 30-day-old sorghum seedlings of the variety Neerujola were found to be highly susceptible for the helminthosporiose disease[11], plants grown in paper cups containing sterilized soil were inoculated. The plants were first sprinkled with sterilized distilled water, and then the spore-cum-mycelial suspensions of the dominant phyllosphere fungi (mentioned above) were sprayed using an atomizer (1,50,000 spores/ml). For each fungus, a set of 10 plants in 10 replicates were treated. The suspensions were allowed to settle. All the plants were sprayed the next day with spore-cum-mycelial suspensions of *E. turcicum* (1,50,000 spores/ml). The inoculated seedlings were covered with wet plastic bags and incubated in a moist chamber. The bags were removed after 48 h of incubation. Control plants were just treated with *E. turcicum*. The percentage of infection was calculated and the number of spots per leaf counted on the 6th day after inoculation.

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RESULTS AND DISCUSSION

Spore germination trials

Only three of the eight phyllosphere fungi viz. *C. globosum*, *C. lunata* and *F. moniliforme* inhibited spore germination of *E. turcicum* to a significant level (table 1). Greater reduction in germination was observed with *F. moniliforme*. The germ tubes arising from the treated spores were invariably malformed showing stunted, thickened and profusely branched tubes. There was considerable delay (6–9 h) in the germination of spores treated with *C. globosum*. Frequent branching of the germ tubes was observed and the tips of the spores were swollen. Germ tubes developed even from the intercalary cells of the spore. Spore germination was not at all affected with the other five fungi viz. *A. tenuissima*, *C. herbarum*, *Melanospora* sp., *Pestalotia* sp. and *T. viride*. Germ tubes also remained thin, smooth and normal as observed in the distilled water (control).

Seedling inoculation experiment

As observed in spore germination trials, there was significant reduction in the percentage of infection and also the number of lesions in the plants treated with the species of *Chaetomium*, *Curvularia* and *Fusarium* compared to other treatments over the control (table 2). In addition it was found that the treatments caused a reddish-brown discoloration, particularly on the veins, during the 2nd day of incubation. This may probably be due to the hypersensitive reaction[11–14] of the host plant, triggered by the phyllosphere fungi towards the pathogen, *E. turcicum*. Although the other five fungi viz. *C. herbarum*, *Melanospora* sp., *Pestalotia* sp. and *T. viride* enhanced infection over the control, the lesion development was siginficantly minimized. The number of spots per leaf of the infected plant was also drastically reduced except in those plants treated with *A. tenuissima*, where the number of lesions developed was the same as that found in the control plants.

Table 1 *Effect of sorghum phyllosphere fungi on the spore germination of Exserohilum turcicum*

Fungi	Percentage germination
A. tenuissima	100.00
C. globosum	36.70
C. herbarum	100.00
C. lunata	38.80
F. moniliforme	20.88
Melanospora sp.	100.00
Pestalotia sp.	100.00
T. viride	100.00
Distilled water	100.00

Table 2 *Effect of sorghum phyllosphere fungi on the incidence of helminthosporiose disease*

Fungi	Percent infection	Mean number of spots/leaf
A. tenuissima	100.00	16.66
C. globosum	45.40	4.80
C. herbarum	95.65	8.69
C. lunata	47.60	6.66
F. moniliforme	40.00	3.03
Melanospora sp.	100.00	8.33
Pestalotia sp.	100.00	8.07
T. viride	100.00	5.33
E. turcicum (control)	92.00	16.66

CONCLUSION

Leaf surface myco-organisms have been found to influence foliar infections by stimulating or inhibiting the spore germination of pathogens. Results of the present investigation indicated leaf mycoflora of sorghum to be a factor in restricting the development of the pathogen. The helminthosporiose disease of sorghum caused by *E. turcicum* can be controlled by applying a 'combination' of mycoflora inoculum. However, the conditions of the experiments vary considerably from those associated with the fungi on the leaves in the field. It is the balance between the inoculum of the pathogen and mycoflora which must be examined under field conditions before any measures could be taken to control the disease. There are two possible ways in which saprophytes might interfere with the development of the disease in the field: by inhibiting infection or by modifying the course of the disease after infection. Since very little is known about the relative numbers of saprophytes and pathogens in the natural inoculum it is extremely difficult to relate these results to field conditions. It is also suggested that some inhibitory substances are produced by some of the phyllosphere fungi and there is a possibility of biological/chemical control of the disease[1,6,15–19]

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NEWS

INSA AWARDS FOR SCIENTISTS

The INSA S. N. Bose Medal for Physics: Prof. A. N. Mitra of the University of Delhi, has been awarded the S. N. Bose Medal for Physics.

K. R. Ramanathan Medal for Atmospheric Studies: Prof. Ms. Anna Mani, Raman Research Institute, has been awarded the K. R. Ramanathan Medal for atmospheric studies.

K. S. Krishnan Medal for Natural Sciences: Prof. S. K. Joshi Director, National Physical Laboratory, New Delhi has been awarded the K. S. Krishnan Medal for Natural Sciences.

The INSA Prize for Materials Science has been awarded to Prof. T. R. Anantharaman of Banaras Hindu University, Varanasi.

The Chandrakala Hora Memorial Medal has been awarded to Prof. N. B. K. Nair, Chairman, State Committee on Science and Technology and Environment, Kerala.

The Homi J. Bhabha Medal has been awarded to Prof. S. Chandrasekhar of Raman Research Institute, Bangalore.

The P. C. Mahalanobis Medal has been awarded to Prof. U. R. Rao, Chairman, Department of Space.

The Bires Chandra Guha Award for Nutrition has been awarded to Dr Mahtab S. Bamji, National Institute of Nutrition, Hyderabad.

INSA Vainu Bappu Memorial Award in Astronomy has been awarded to Prof. Govind Swarup of the Radio Astronomy Centre, Tata Institute of Fundamental Research, Bangalore.

The Meghnad Saha Medal has been awarded to Dr Sukh Dev, Director of Malti-Chem Research Centre, Nandesari.

The Vainu Bappu Medal Lecture has been awarded to Prof. Martin John Rees of the Institute of Astronomy, Cambridge.