ROOT MYCOFLORA OF COTTON

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Abstract

Root mycoflora associated with young and marure plants of healthy and *Fusarium*-wilted cotton from Pune, Maharashtra was studied for three successive years. Numerically fungi were less in case of diseased plants as compared to healthy ones. A positive rhizosphere effect was observed in the mycoflora of both healthy and diseased plants.

Introduction

Cotton is one of the most important fibre crops in India. In Maharashtra, it is essentially grown as a kharif crop. The mycoflora of various economically important plants have been studied by a number of workers like Catska *et al.* (1960), Edward *et al.* (1962), Rangaswamy and Vasantharajan (1962), Parkinson and Clarke (1964), Ranga Rao and Mukerji (1971), Ranga Rao (1972) and Dayal and Shrivastava (1973). However, mycoflora of cotton has not yet been investigated. Being an economically important plant, which is susceptible to fungal diseases like *Fusarium* wilt and *Rhizoctonia* root rot, it was thought worthwhile to study the mycoflora with a view to find out the fungi associated with these plants.

Material and methods

The root and soil samples of healthy and diseased (*Fusarium* wilted) cotton were collected for investigation of rhizoplane and rhizosphere and non-rhizosphere soil grown in two different plots from the College of Agriculture, Pune. Healthy and diseased (plants were selected randomly and uprooted) carefully from these two plots. Soil adhering to the root system was carefully separated and kept in sterile containers. Roots were collected separately. Along with this, non-rhizosphere soil was also collected. Dilution plate method was used for rhizosphere and non-rhizosphere soil and root washing technique for rhizoplane fungi. Inoculated plates were incubated for 3-6 days and the colonies were counted. Most of the fungi isolated were identified upto species level.

Results and conclusions

In all, 39 species of fungi belonging to 23 genera were isolated from the rhizoplane, rhizosphere and non-rhizosphere soil of healthy cotton plants (Table 1).

Four genera of Zygomycotina were identified and they were mostly present in rhizoplane and rhizosphere soil of young plants. This is in accordance with the report that younger plants have more members of Mastigomycotina and Zygomycotina and these forms start disappearing as the age of the plant advances (Catska *et al.*, 1960).

Ascomycotina was represented by two species of *Chaetomium*. Thirty one species of fungi were members of the Hyphomycetes. The genus *Aspergillus* included 11 species. *A. niger* was most dominant in both rhizoplane and rhizosphere. However non-rhizosphere soil showed comparatively more concentration of *A. nidulans*.

Of the three species of *Alternaria*, *A. alternata* was isolated from rhizoplane; *A. longissima* from the rhizosphere soil and *A. tenuissima* from both rhizoplane and rhizosphere. Non-rhizosphere soil did not harbour any species of *Alternaria*.

Three species of *Fusarium* were identified. *F. dimerum* and *F. oxysporum* were present in rhizoplane, rhizosphere and non-rhizosphere soil of both young and mature plants. However, *Fusarium* sp. was isolated only from

Table 1—Root mycoflora of healthy cotton

Name	Per cent Frequency				
	Rhizoplane		Rhizosphere		Non-
	Young	Mature	Young	Mature	rhizosphere
Circinella simplex Tieg.	—	—	0.003	—	—
Cunninghamella bertholiatae Pai.	—	—	0.003	—	—
Mucor sp. Micheli	0.03	—	—	1.97	0.05
Rhizopus nigricans var. *minutus* Ghau.	0.02	0.01	0.19	0.09	0.4
Chaetomium gracile Udagawa	0.03	0.12	0.01	—	—
Chaetomium sp. Kunz. & Sehm.	—	—	0.07	0.01	0.23
Alternaria alternata (Fr.) Keis.	0.002	0.06	—	—	—
A. longissima (Die.) MacGar.	—	—	0.03	0.13	—
A. tenuissima (Fr.) Wil.	0.007	0.007	3.33	—	—
Aspergillus flavipes (Bain. & Sart.) Thom & Chu.	0.14	0.34	0.48	0.48	0.04
A. flavus Link.	0.34	0.53	0.33	3.59	6.04
A. nidulans (Eidam) Win.	18.27	21.28	1.12	1.27	11.6
A. niger v. Tieg.	49.58	46.14	44.05	29.25	7.75
A. quercinus (Bain.) Thom & Chu.	—	—	0.04	—	—
A. sclerotiorum Huber	0.004	0.008	0.26	0.32	0.36
Aspergillus sp. (1) Mich. ex Fr.	—	—	—	3.48	—
Aspergillus sp. (2) Mich. ex Fr.	—	—	0.03	—	—
A. sydowi (Bain. & Sart). Thom & Chu.	0.14	—	—	0.19	—
A. terreus Thom.	0.05	0.18	0.57	1.97	4.2
A. ustus (Bain) Thom & Chu.	—	2.09	0.14	0.19	0.42
Cladosporium oxysporum Berk. & Curt.	2.21	3.00	2.64	7.76	13.7
Corynespora cassiicola (Berk. & Curt.) Wei.	—	—	0.03	—	0.04
Curvularia lunata (Wak.) Boe.	—	0.7	0.3	—	0.63
Fusarium dimerum Penzig	5.22	3.52	2.88	17.1	10.12
F. oxysporum Schl.	16.37	11.57	8.05	24.32	21.77
Fusarium sp. Link ex Fr.	0.03	0.02	—	—	—
Gliocladium catenulatum Gil. & Abb.	0.02	0.66	0.03	0.05	2.4
Humicola grisea Tra.	—	—	0.14	0–02	—
Memnoniella echinata (Riv.) Gal.	0.02	0.13	0.03	—	0.4
Paecilomyces varioti Bain.	0.51	0.16	3.43	0.59	4.0
Penicillium corylophilum Dier.	1.1	4.6	3.33	0.03	0.4
P. rubrum Stoll	4.87	0.59	2.05	0.47	6.9
Sclerotium sp. Tode ex Fr.	0.8	—	9.43	—	—
Scopulariopsis sp. Bain.	—	—	—	0.35	—
Stachybotrys chartarum (Eh.) Hug.	—	—	—	0.01	.005
Trichocladium asparum Harz.	—	—	—	0.35	2.77
Trichoderma viride Pers. ex Fr.	0.32	0.01	0.02	0.48	—
Phoma sp. Sacc.	0.06	2.7	0.02	1.65	4.48
Phomopsis sp. Sacc.	0.02	0.53	—	—	—

Table 2—Rhizosphere and non-rhizosphere fungi of *Fusarium*-wilted cotton

Fungi	Per cent Frequency	
	Rhizosphere	Non-rhizosphere
Cunninghamella echinulata Pai.	0.01	—
Rhizopus nigricans var. *minutus* Chau.	0.92	9.09
Chaetomium olivaceum Cooke & Ellis	0.65	—
Chaetomium sp. Kunz. & Sehm.	0.09	—
Melanospora sp. Corda	0.81	—
Thielavia sepedonium Emm.	0.44	—
Alternaria alternata (Fr.) Keis.	0.37	0.18
Aspergillus flavipes (Bain. & Sart.) Thom & Chu.	0.95	—
A. flavus Link	16.92	9.09
A. nidulans (Eidam.) Win.	12.34	18.18
A. niger v. Tieg	9.49	27.27
A. sclerotiorum Huber	9.12	0.09
A. sydowi (Bain. & Sart.) Thom & Chu.	0.18	—
A. terreus Thom	0.55	0.90
Aspergillus sp. (1) Mich. ex Fr.	14.29	—
Cladosporium oxysporum Berk. & Curt.	6.20	9.09
Curvularia lunata (Wak.) Boe.	0.09	—
Fusarium dimerum Penzig	0.07	—
F. oxysporum Schl.	13.35	9.09
Gliocladium catenulatum Gil. & Abb.	0.44	0.36
Humicola grisea Tra.	8.77	—
Memnoniella echinata (Riv.) Gal.	0.01	—
Penicillium coryloplıyllum Dier.	2.63	0.09
P. rubrum Stoll	3.51	0.90
Torula herbarum (Pers.) Link ex Fr.	0.88	—
Phoma sp. Sacc.	0.37	0.18
Phomopsis sp. Sacc.	0.88	0.09

rhizoplane while, *F. oxysporum* showed maximum percentage in the non-rhizosphere soil.

Some fungi like *Aspergillus* sp. (2), *Humicola grisea* and *Scopulariopsis* sp. were present only in rhizosphere soil and absent in rhizoplane and non-rhizosphere soil. This shows that these fungi require soil supplemented with root exudates as a habitat to grow.

Only two members of the Coelomycetes were isolated. *Phoma* sp. was present in rhizoplane and rhizosphere of both young and mature plants and also in non-rhizosphere soil. *Phomopsis* sp. was isolated from rhizoplane only.

Numerically, fungi were more in rhizoplane whereas rhizosphere soil harboured maximum fungal species. Non-rhizosphere soil, however, showed both numerically and qualitatively less fungi. This difference may be due to the effect of root exudates which are present in the rhizosphere and rhizoplan zone and absent in the non-rhizosphere soil. These root exudates enhance the number of fungi near the root zone (Catska *et al.*, 1960; Peterson, 1958.) The age of plant does play an important role in influencing the quality of fungi.

From the rhizosphere of *Fusarium*-wilted plants, 27 species of fungi belonging to 17 genera were isolated. Two forms, *Cunninghamella* and *Rhizopus* were of Zygomycotina. Four members of Ascomycotina were present in the rhizosphere soil alone. It was observed that *Melanospora* sp. was always associated with *Fusarium* infected plants and absent in healthy plants and non-rhizosphere soil.

Aspergillus was one of the genera having maximum number of species in rhizosphere and non-rhizosphere soil just as in the case

of healthy plants. *A. flavus* was dominant in rhizosphere whereas *A. niger* was dominant in the non-rhizosphere soil. The two Coelomycetous fungi, *Phoma* and *Phomopsis* were present both in rhizosphere and non-rhizosphere soil.

Fusarium wilted plants also showed positive rhizosphere effect. However, the number of fungi in rhizosphere and non-rhizosphere soil of *Fusarium*-wilted plants was lesser than that of the healthy ones. Fusaric acid is reported as a weak antibiotic which can inhibit growth of some microorganisms (Gaumann, 1957). However, in our study in vitro activity of fusaric acid was not observed against fungi isolated from rhizosphere soil. Lesser number of fungi in the rhizosphere of *Fusarium* wilted plants might be due to the difference in the quantity and composition of root exudates of healthy and wilted plants.

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