

Studies on Rhizosphere Mycoflora of Groundnut IV. A List of Fungi Isolated from Rhizosphere, Rhizoplane and Soil

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Introduction

A number of plants have been examined for quantitative and qualitative determinations of rhizosphere mycoflora. List of fungal taxa isolated from rhizospheres and rhizoplanes of various plants have been compiled by many workers: (1) Plants in sand dunes (Panwar *et al.*, 1969); (2) Mesophytic plants (Chinnayya and Agnihothrudu, 1953); (3) Forest plants including pteridophytes (Thornton, 1958; Ramchandra Reddy, 1959); (4) Crop plants (Adati, 1939; Agnihothrudu, 1958; Rangaswami and Venketesan, 1964; Rao, 1962; Youssef and Mankarios, 1968; Parkinson and Thomas, 1969). In the present investigation while studying the effect of agronomic treatments on rhizosphere mycoflora, fungal taxa isolated from the rhizosphere, rhizoplane and soil of groundnut (*Arachis hypogaea* L.) have been reported.

Materials and Methods

The rhizosphere mycoflora was studied by soil dilution plate count method (Timonin, 1940). Plants were carefully removed from the soil, shaken to remove excess soil and cut at the crown to separate the roots from the rest of plants, and were transported to the laboratory in sterile polythene bags. The roots were put into 500 ml distilled sterile water in 1000 ml conical flasks. The soil still clinging to the roots was removed by shaking the flasks. 20 ml of Waksman's synthetic agar (pH 4.5) was plated in triplicate with one ml of this dilution. Plates were incubated at room temperature ($26 \pm 3^\circ \text{C}$) for 10 days. Unidentified species were isolated on PDA (Potato dextrose agar) slants. Further observations for rhizoplane mycoflora were made by the serial root washing technique (Harley and Waid, 1955). Original root system was removed from the dilution flask. The root pieces (1 cm) randomly selected from different root regions were placed in a sterile test tube. They were washed 10 times with sterile water and were plated (5 pieces in each plate) on Waksman's synthetic acid agar medium to allow fungi to grow on the root surface. Soil mycoflora was studied by taking soil samples between two rows of groundnut crop up to the depth of 6 inches in sterile polythene bags. Approximately one gram of soil was added to the 1000 ml conical flask containing 500 ml distilled sterile water.

Table 1. Appearance of fungal species in the rhizosphere (R), rhizoplane (RP) and soil (S) of groundnut

| Species | Isolated from | | |
|--------------------------------------------------|---------------|----|---|
| | R | RP | S |
| Lower fungi | | | |
| * <i>Absidia corymbifera</i> (IMI 140380) | + | + | + |
| <i>Rhizopus stolonifer</i> | + | + | + |
| <i>Zygorhynchus moelleri</i> (IMI 148118) | + | - | - |
| <i>Mortierella</i> sp. (IMI 140381) | + | + | - |
| <i>Cunninghamella verticillata</i> | + | - | + |
| <i>C. echinulata</i> (IMI 140377) | + | + | + |
| <i>Syncephalastrum racemosum</i> (IMI 137652) | + | + | + |
| ** <i>Phytophthora rubra</i> | + | + | + |
| <i>P. marathwadensis</i> | + | + | + |
| Ascomycetes | | | |
| <i>Thielavia terricola</i> (IMI 148109) | + | - | - |
| <i>Chaetomium jodhpurensis</i> (IMI 148104) | - | - | + |
| ** <i>C. longirostrae</i> (IMI 137648) | + | - | + |
| <i>C. arcuatum</i> (IMI 148106) | - | - | + |
| <i>C. globosum</i> | + | - | + |
| <i>Sordaria bosensis</i> (IMI 140363) | + | - | - |
| <i>Neocosmospora vasinfecta</i> (IMI 137647) | + | + | + |
| <i>Aspergillus chevalieri</i> (IMI 148121) | + | - | - |
| <i>A. nidulans</i> | + | + | + |
| <i>Penicillium brefeldianum</i> | + | - | + |
| Deuteromycetes | | | |
| * <i>Phoma epyrena</i> (IMI 140362) | - | - | + |
| ** <i>P. herbarum</i> (IMI 137650) | + | - | - |
| <i>P. glomerata</i> (IMI 148124) | - | - | + |
| ** <i>Macrophoma minuta</i> (IMI 140369) | + | - | - |
| <i>Peyronellaea indianensis</i> | + | - | + |
| <i>Chaetomella raphigera</i> (IMI 137649) | + | - | + |
| ** <i>Colletotrichum capsici</i> (IMI 148115) | + | - | - |
| ** <i>Pestalotiopsis versicolor</i> (IMI 148114) | + | - | + |
| § <i>Cephalosporium sclerotiorum</i> | + | - | + |
| <i>Trichoderma lignorum</i> (IMI 140374) | + | + | + |
| <i>Aspergillus flavus</i> | + | + | + |
| * <i>A. kanagawaensis</i> | + | + | + |
| <i>A. aculeatus</i> | + | + | + |
| <i>A. fumigatus</i> (Strain I) | + | + | + |
| + <i>A. fumigatus</i> (Strain II) | + | - | + |
| <i>A. sclerotiorum</i> | + | - | + |
| <i>A. sulphureus</i> | + | - | + |
| ** <i>A. petrakii</i> | + | - | + |

* First report from the soils of India

** Reported from the rhizosphere soil for the first time

+ New strain of the species

§ New species

| Species | Isolated from | | |
|----------------------------------------------|---------------|----|---|
| | R | RP | S |
| <i>A. carbonarius</i> | + | + | + |
| <i>A. niger</i> | + | + | + |
| <i>A. asperescens</i> | + | - | + |
| <i>A. ustus</i> | + | + | + |
| <i>A. flavipes</i> | - | - | + |
| <i>A. terreus</i> | + | + | + |
| * <i>Penicillium charlesii</i> | + | - | + |
| <i>P. vinaceum</i> (IMI 140368) | - | - | + |
| <i>P. funiculosum</i> (Strain I) | + | + | + |
| + <i>P. funiculosum</i> (Strain II) | + | - | - |
| * <i>P. verruculosum</i> | + | + | + |
| <i>P. varians</i> | + | - | + |
| + <i>P. duclauxi</i> | + | - | - |
| <i>Gliocladium roseum</i> (IMI 148100) | + | - | + |
| <i>Paecilomyces varioti</i> (IMI 140367) | + | - | + |
| <i>P. fusisporus</i> (IMI 140357) | + | - | + |
| * <i>Cladosporium oxysporum</i> (IMI 140355) | + | - | + |
| ** <i>Nigrospora sacchari</i> (IMI 140373) | + | - | + |
| <i>Pullularia pullulans</i> (IMI 148113) | + | - | + |
| <i>Hormiscium bruennesporium</i> | - | - | + |
| <i>Curvularia lunata</i> | + | - | + |
| ** <i>Helminthosporium proliferatum</i> | + | - | + |
| <i>H. tetramera</i> | + | + | + |
| <i>H. halodes</i> (IMI 140364) | + | - | + |
| * <i>Acrospira fluctuata</i> (IMI 140354) | + | - | + |
| <i>Fusarium moniliformae</i> (IMI 140390) | + | + | + |
| <i>F. semitectum</i> (IMI 140384) | + | + | + |
| <i>F. solani</i> (IMI 140386) | + | + | + |
| <i>F. oxysporum</i> (IMI 140389) | + | + | + |
| <i>Myrothecium roridum</i> (IMI 140382) | + | - | + |
| <i>Mycelia sterilia</i> | | | |
| <i>Rhizoctonia bataticola</i> (IMI 140361) | + | + | + |
| <i>R. solani</i> (IMI 140360) | + | + | + |

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Observations and Results

Altogether 69 species belonging to 35 genera were isolated from the rhizosphere, rhizoplane and soil of groundnut (Table 1). They include 9 Phycomycetes, 10 Ascomycetes and 50 Deuteromycetes. Of the total species isolated, 63 were isolated from the rhizosphere, 27 from the rhizoplane and 59 from the soil. Quantitatively species of the genus *Aspergillus* and *Penicillium* were prevalent both in the rhizosphere and soil whereas

species of the genus *Rhizoctonia* and *Trichoderma* were frequently isolated from the rhizoplane. *Aspergillus chevalieri*, *Colletotrichum capsici*, *Macrophoma minuta*, *Thielavia terricola* and *Sordaria bosensis* were confined to the rhizosphere while *Aspergillus flavipes*, *Chaetomium jodhpurense*, *C. arcuatum*, *Penicillium vinaceum* and *Phoma glomerata* confined only to the soil. A new species of *Cephalosporium sclerotiorum*, a new strain of *Aspergillus fumigatus* and two new strains each of *Penicillium funiculosum* and *P. duclauxi* (Gangawane and Deshpande, 1971) were isolated from the rhizosphere or soil of groundnut crop.

Discussion

Different numbers of fungal taxa have been recorded by various workers from the rhizosphere and rhizoplane of different plants. Joffe (1969) recorded 157 species of fungi from the rhizosphere, geocarposphere and soil of groundnut in Israel whereas Rao (1962) noted only 16 species from the rhizosphere of 8 groundnut varieties in India. Most of the workers recorded the maximum number of the species of the genera *Aspergillus* and *Penicillium* in the rhizosphere and soil of various plants. The dominance of the species of these two genera in the rhizosphere of groundnut is also reported by Joffe (1969) and Rao (1962). Their dominance is explained on the basis of their heavily sporulating habit and their capacity to produce antibiotics. The maximum number (250) of fungal species is reported by Montegut (1956) from soil and by Simmonds and Ledingham (1937) from the rhizoplane (27 genera) of wheat. All these variations in the number of fungal taxa in the present studies and in the studies of different workers account for the variation in the nature of a plant, soil as well as the methods and media employed. The species of *Absidia corymbifera*, *Acrospeira fluctuata*, *Aspergillus kanagawaensis*, *Cladosporium oxysporium*, *Penicillium charlesii*, *P. verruculosum* and *Phoma eupyrena* are the first records from the soil of India while *Aspergillus petrakii* (Vörös, 1957), *Chaetomium longirostrae* (personal communication from Director, CMI), *Colletotrichum capsici* (Butler and Bisby, 1931; Dastur, 1934), *Helminthosporium proliferatum* (Deshpande, 1968); *Macrophoma minuta* (Saccardo, 1892), *Nigrospora sacchari* (personal communication from Director, CMI), *Phoma herbarum* (Saccardo, 1884) and *Phytophthora rubra* (Mantri, 1968) are the first records from rhizosphere or soil of groundnut as they are not reported from the soil by earlier workers.

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