CONTRIBUTION TO SOIL FUNGI OF WEST PAKISTAN

Part 1.—Karachi

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Soil fungi from three places, namely, Nursery of Central Laboratories, plot of land at the back of the Botany Section of Central Laboratories and Block A of North Nazimabad (Karachi) were studied. The media used were Czapek's agar and potato dextrose agar with Rose-Bengal in a ratio of 1:30,000. For the isolation of these fungi, Warcup and Streaking techniques were employed.

The fungi encountered for the first time in the soil from West Pakistan are *Absidia lichtheinii* (Lucet and Costantin) Lendner, *Cephaliophora irregularis* Thaxter, *Chaetomium spirales* Zopf., *Chaetomium olivaceum* Cooke and Ellis, *Fusarium chlamydosporum* Wollenweber and Reinking, *Humicola grisea* Traaen, *Penicillium cyclopium* Westling, *Penicillium purpurogenum* Stoll and *Penicillium funiculosum* Thom.

The study of soil fungi has been considered of great interest and importance in most of the countries, but in our country, the work done in this direction is not much. The gradual increase of this interest for the soil mycology is mostly based on the fact that numerous root diseases of crop plants are caused by fungi which inhabit the soil. Unless a thorough investigation about these organisms is made, it is usually not possible to take the remedial measures and reduce the crop damage.

Since the fungus flora of West Pakistan is very poorly known (soil source being no exception), a preliminary study in this direction was undertaken. Some of the recent work on soil fungi from this area is given in Refs. 1–10 and 12.

In the present work a total of 31 species belonging to 14 genera have been isolated. These species are: *Absidia lichtheinii* (Lucet & Costantin) Lendner, *Alternaria tenuis* Nees ex Pers., *Alternaria tenuissima* (Nees ex Fr.) Wiltshire, *Aspergillus flavipes* Bainier and Sartory, *Aspergillus flavus* Link ex Fr., *Aspergillus fumigatus* Fresenius, *Aspergillus nidulans* (Eidam) Winter, *Aspergillus niger* Van Tieghem, *Aspergillus quadrilineatus* Thom & Raper, *Aspergillus sydowii* Thom & Church, *Aspergillus tamarii* Kita, *Aspergillus terreus* Thom, *Aspergillus ustus* (Bainier) Thom & Church, *Botryodiplodia theobromae* Pat., *Cephaliophora irregularis* Thaxter, *Chaetomium spirale* Zopf., *Cunninghamella echinulata* Thaxter, *Curvularia siddiqui* Ahmed & Quraishi, *Fusarium chlamydosporum* Wollenweber, *Fusarium equiseti* (Corda) Sacc. *Fusarium solani* (Mart.) Sacc., *Helminthosporium hawaiiense* Bugnicourt, *Humicola fuscoatra* Traaen, *Humicola grisea* Traaen, *Macrophomina phaseoli* (Maublanc) Ashby, *Paecilomyces varioti* Bainier, *Penicillium citrinum* Thom, *Penicillium cyclopium* Westling, *Penicillium funiculosum* Thom and *Penicillium purpurogenum* Stoll.

Based on the available information, the fungi reported from West Pakistan for the first time are *Absidia lichtheinii* (Lucet and Costantin) Lendner, *Cephaliophora irregularis* Thaxter, *Chaetomium spirale* Zopf., *Chaetomium olivaceum* Cooke and Ellis, *Fusarium chlamydosporum* Wollenweber and Reinking, *Humicola grisea* Traaen, *Penicillium cyclopium* Westling.

For each species (excluding those which were also found in the aerial survey, and described in our previous paper[11] as well as *Alternaria tenuissima* (Nees ex Fr.) Wiltshire, *Cephaliophara irregularis* Thaxter and *Helminthosporium hawaiiense* Bugnicourt, a brief description is provided. It is expected that in the presence of acute shortage of mycological literature and herbarium specimens, such description would be sufficiently helpful to the working mycologists.

Materials and Methods

The places from where soil samples were collected are: (1) Nursery of the Central Laboratories, (2) plot of land behind the Botany Section of the Central Laboratories and (3) Block A of North Nazimabad (Karachi). For obtaining such samples, a hole about 12 in deep was dug. Soil was collected uniformly at a depth of 6 in by inserting a sterilized tube horizontally. This was withdrawn along with the sample and the mouth was plugged by sterilized cotton.

Using Warcup and Streaking technique, inoculations of soil samples were made the same day. The media used are potato dextrose agar and Czapek's agar. For each of the soil sample, four petriplates (two of potato dextrose agar and two of Czapek's agar) were used for the Warcup technique

and likewise four plates for the Streaking technique. To inhibit the growth of soil bacteria and fast growing fungi, Rose-Bengal in a ratio of 1:30,000 was used with these media.

One gram soil was taken by sterilized spatula and placed into a sterilized petriplate. 2 ml sterilized water was poured over the soil and shaken gently to obtain soil suspension. 20 ml melted medium was added to this suspension and the petriplate was rotated gently for uniform mixing of soil particles.

For the streaking method, nearly 1 g soil was taken and a paste was made by adding 1 ml sterilized water. By the help of an inoculating needle, this paste was streaked on the surface of the medium. The petriplates were examined every 24 hrs and isolations for pure cultures were made at the appropriate time.

Descriptions

1. *Absidia lichtheinii* (Lucet and Costantin) Lendner.—Colonies white, felt-like. Sporangiophores prostrate, branched in corymbs. Sporangia terminal, hyaline, pear-shaped, 25–50μ in dia; columella hemispherical to globular, large, smooth, 10–20μ in dia. Spores spherical to subspherical, colourless, small, 7.5–10×3.75–5.0μ.

2. *Aspergillus flavipes* Bainier and Sartory.—Colonies on Czapek's agar white at first, becoming yellowish, compact yellow masses containing thick-walled hulle cells present in abundance; reverse yellow to orangish brown. Heads columnar, conidiophores smooth, vesicles 20–30μ, subglobose. Phialides in two series, primary measuring 5.0–8.0×1.5–2.0μ; conidia subglobose, hyaline, 2.0–3.0μ in dia.

3. *Aspergillus nidulans* (Eidam)Winter.—Colonies on Czapek's agar dark cress-green; reverse purple red in the beginning, becoming dark in age. Cleitothecia globose, 100–175μ in dia, the outer layer yellowish, consisting hulle cells, becoming dark reddish-purple. Ascospore purple-red, lenticular, smooth-walled with two equatorial crests. Conidial heads short columnar, 40–80× 25–40μ; vesicles 8.0–10μ in dia. Phialides in two series, primary 5.0–6.0×2.0–3.0μ, secondary 5.0–6.0×2.0–2.5μ; conidia globose, rugulose, green in mass, 3.0–3.5μ in dia.

4. *Aspergillus tamarii* Kita.—Colonies on Czapek's agar colourless in the beginning, becoming brown through shades of yellow, reverse colourless. Vesicles 25–50μ in dia; heads columnar to nearly globose, vary greatly in size, up to 350μ in dia; phialides in one series in the small heads, in two series in large heads. Primary phialides 7.0–10×3.0–4.0μ, secondary phialides 7.0–10×3μ.; conidia pyriform to globose, 5.0–8.0μ in dia, rough.

5. *Botryodiplodia theobromae* Pat.—Pycnidia black, 200μ in dia, more or less hairy. Conidiophores hyaline; conidia elongate, 2-celled, slightly brownish, 25–34×12–15μ.

6. *Chaetomium olivaceum* Zopf.—Colonies dark brown to black. Perithecia globose, dark olivaceous brown to black, 300–400μ in dia. Terminal hairs long, undulate, distinctly roughened, long, undulate, loosely interwoven, 3.0–5.0μ in dia. Lateral hairs are more or less similar to the terminal ones but are slightly flexed, ending in a hyaline blunt tip. Asci club-shaped. Ascospores broadly ovoid, dark olivaceous brown, 9.0–12.5× 7.5–9.0μ.

7. *Chaetomium spirale* Zopf.—Perithecia globose or ovate with a bluntly pointed base, dark brown to black. 150–300μ in dia, attached to the substratum by rhizoids; terminal hairs sparsely septate, olive-brown, roughened with minute spines and warts, spirally coiled above with 6–14 turns; lateral hairs long, nearly straight to slightly flexed, septate, dark olive-brown, usually roughened by irregular, hyaline bodies of different shapes and sizes, sometimes smooth; Asci club-shaped. Ascospores lemon-shaped, slightly apiculate at both the ends or irregularly oval to spherical, olive-yellow to olive-brown, 9.0×7.0μ.

8. *Fusarium chlamydosporum* Wollenweber and Reinking.—Colony fluccose, pink in the beginning, finally carmine to red. Macro and microconidia present. Macroconidia small, spindle-shaped to ellipsoid, usually nonseptate, sometimes up to 3-septate. 0-septate: 4.0–11×2.5–4.0μ; 1-septate: 11–16×3.0–4.0μ; 3-septate: 27–32×3.5–4.0μ. Chlamydospore globose to pear-shaped, intercalary or terminal, single or paired, 10–16μ in dia.

9. *Fusarium equiseti* (Corda) Sacc.—Colonies white in the beginning but later on yellow to pink. Micro as well as macroconidia present. Macroconidia in tuberculate sporodochia, spindle to sickle-shaped, commonly 5-septate but may be up to 10-septate. 0-septate: 7.0–18×3.0–6.0μ; 1-septate: 12–24×2.0–4.0μ; 3-septate: 12–44× 3.0–5.5μ; 5-septate: 26–75×3–5.5μ; 7-septate: 45–80×4.5–5.5μ. Chlamydospores present on old conidiophores and conidia, intercalary, terminal, in chains and masses, globose, brownish, 6.0–14μ in dia.

10. *Humicola fuscoatra* Traaen.—Colonies on Czapek's agar quickly growing, finally becoming black due to the formation of chlamydospores in the aerial mycelium. Conidiophores erect, more or less straight. Conidia single, apical, globose to subglobose, brown, 1-celled, 10–12.5μ in dia.

11. *Humicola grisea* Traaen.—Colonies on Czapek's agar dark grayish with whitish superficial hyphae, reverse of the colony greenish black to black. Hyphae septate, hyaline, bearing masses of yellowish brown conidia. Conidia single, apical, typically globose, yellowish brown, 9.0–16μ in dia.

12. *Macrophomina phaseoli* (Maublanc) Ashby.—Pycnidia globose to subglobose, 100–200μ in dia, ostiole inconspicuous, truncate. Conidia 1-celled, hyaline, thin-walled, elliptical or oval, 16–29×6.0–9.0μ; sclerotia minute, black.

13. *Penicillium cyclopium* Westling.—Colonies on Czapek's agar broadly spreading, coremiform, light blue-green, reverse light buff to orange. Conidiophores arising as coremia directly from the substratum, unbranched or dichotomously branched. Conidial heads long, columnar, metulae 8.0–10×1.8–2.5μ, phialides 4.0–6.0×1.5–2.0μ; conidia globose to ovate, smooth, 2.0–3.0μ in dia.

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