

ring in *S. curvifrons* during the year. Qasim¹⁰ generalised such findings for other temperate fish species as well.

The vertebrae from 1-6 years of fish age had the average radii of 11.1 mm, 15.4 mm, 19.3 mm, 24.2 mm, 29.0 mm and 32.7 mm while the respective average radii of the otoliths measured 4.3 mm, 5.9 mm, 7.6 mm, 8.9 mm, 10.3 mm and 14.5 mm. The lengths of opercular bones were 8.7 mm, 12.9 mm, 16.1 mm, 20.3 mm, 23.1 mm and 24.3 mm in the individuals of age groups of 1-6 years. The margins of various hard parts in the present fish captured during different months of the year were examined carefully and it was observed that the periodic markings on these parts were laid annually. However, the higher percentages of completed marginal rings were discerned during winter months (as high as 88.31%).

The lengths attained by *S. curvifrons* as worked out by back calculations were estimated to be 130.5 mm, 193.1 mm, 251.5 mm, 306.5 mm, 361.9 mm and 404.7 mm in case of vertebrae; 132.3 mm, 193.5 mm, 261.8 mm, 312.9 mm, 380.1 mm and 399.5 mm in case of otoliths whereas 136.1 mm, 190.7 mm, 249.4 mm, 301.2 mm, 373.4 mm and 408.7 mm in case of opercula during 1-6 years of fish age. Not much of significant variations were observed when the age was worked out through the studies on different hard parts. These methods gave a good validity of age and growth in *S. curvifrons* based on high correlation between the growth parts and the growth of entire body, formation of markings on hard parts annually and by comparison of observed and back calculated lengths of the fish.

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SOIL FUNGI ANTAGONISTIC TO PLANT PATHOGENS

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BEING a heterogenous ecosystem, soil harbours a variety of microorganisms. It is generally recognized that antagonistic interactions of microorganisms constitute an important limiting factor for survival of plant pathogens in the soil. Many workers^{1,2} have reported antagonistic action of soil microorganisms on plant pathogens as also the possibility of their use in controlling plant diseases³.

While screening many soil fungi for their antagonistic action against some plant pathogenic fungi, the authors came across *Trichoderma viride*, *Aspergillus flavus* and another species of *Aspergillus* to be antagonistic to *Sclerotium rolfsii*, *Pestalotia mangiferae* and *Colletotrichum gloeosporioides*.

Spore suspension of antagonistic fungi was evenly spread in the petri plates containing potato dextrose agar medium. The plates were then inoculated with pathogenic fungi in the form of sclerotia in the case of *S. rolfsii* and mycelial mat on agar discs in the case of *P. mangiferae* and *C. gloeosporioides*. The plates were incubated for 7 days at room temperature ($28 \pm 1^\circ\text{C}$) and the growth of pathogens was observed.

All the three soil fungi except one showed antagonism to the pathogens but they varied in the degree of their antagonism.

Figure 1 shows that *S. rolfsii*, *P. mangiferae* and *C. gloeosporioides* in the control plates numbered 1, 2 and 3 respectively have grown profusely while the growth of the same in the presence of *T. viride* (A), *A. flavus* (B) has been suppressed markedly. Sclerotia did not germinate in the presence of these two fungi. It is interesting to note that there is not only a profuse growth of *S. rolfsii* but formation of numerous sclerotia in the presence of another species of *Aspergillus* (C) though it is antagonistic to some extent to *P. mangiferae* and *C. gloeosporioides*.

Pot culture studies with unsterile soil also indicated

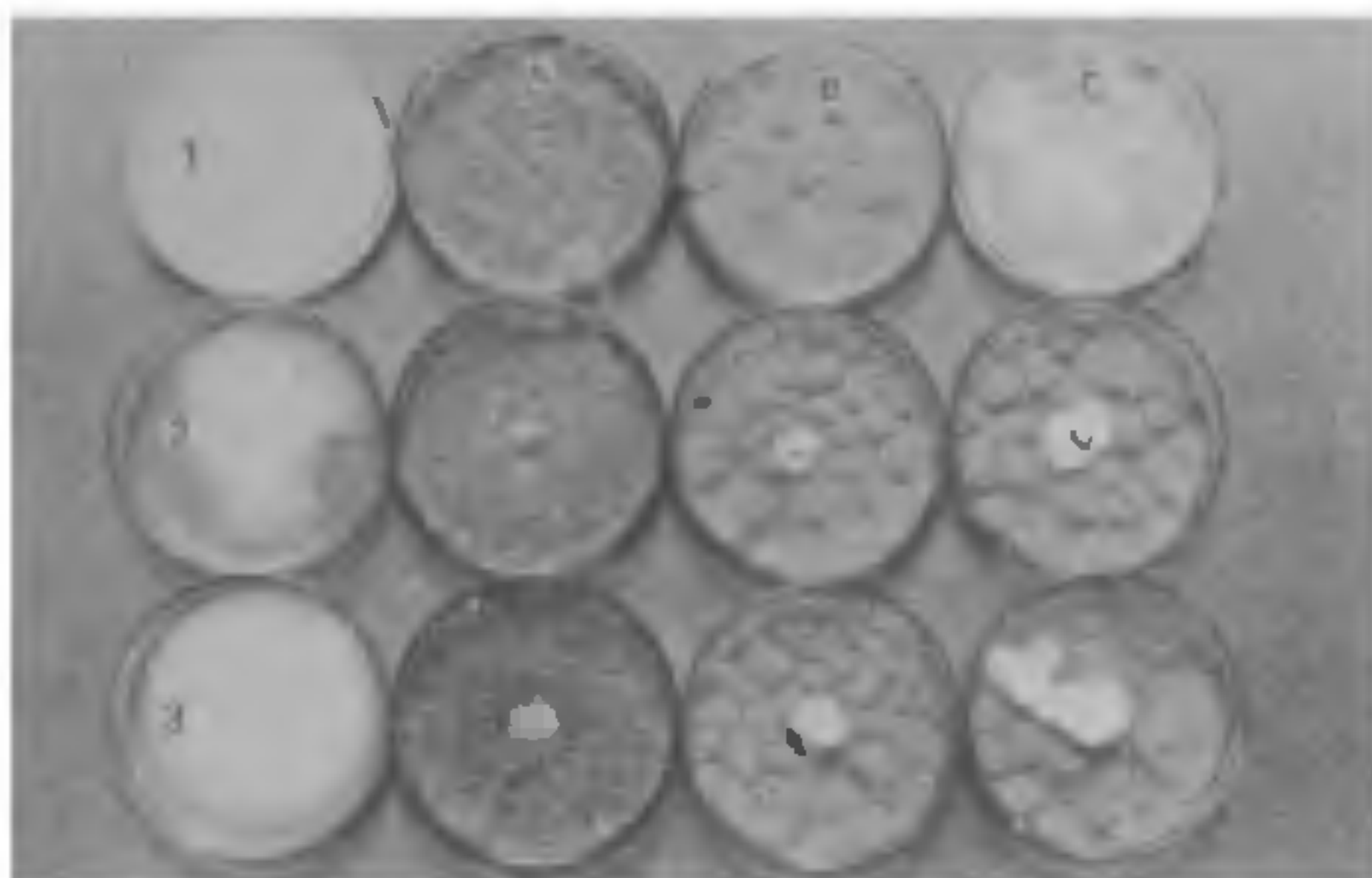


Figure 1. Antagonistic effect of soil fungi on plant pathogens.

that *T. viride* inhibits the germination of sclerotia of *S. rolfii* and checks the growth of mycelium. Young mycelium of this fungus was found to become black or brown in the presence of this antagonistic fungus within 48 hr of inoculation.

The results indicate that *T. viride* and *A. flavus* can be used through some base material to control soil-borne diseases caused by *S. rolfii*. Sterilized groundnut shell powder was found to promote their growth.

Application and efficacy of these antagonistic fungi in controlling diseases caused by *Pestalotia* and *Colletotrichum* should be further investigated.

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NEW RUSTS ON THE GENUS *POPULUS*—II

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DURING a monographic study of the genus, *Melampsora* the authors came across four new species of rust fungi parasitizing the host genus, *Populus*. Of these, two were holomorphs viz *Melampsora cumminsii* and *M. osmaniensis* and the other two were anamorphs viz *Uredo theumenii* and *U. zillerii*. The two anamorphic species were reported earlier¹ where as in the present paper the two remaining holomorphic species are described

Melampsora cumminsii Bagyanarayana and Ramachar sp. nov. (figure 1)

Pycnia et aecia ignota.

Urediniis minutis, hypophyllis, sparsus, subepidermalibus, erumpentis, pulverulentis, 0.2 mm in diam, aurantiaco flavescentis; urediniosporis 21–32 × 12.5–21 μm, stipitatis, globosa, subglobosa, ovato ad ellipsoidea, membrana 1.5–2 μm crassa, echinulata; paraphysibus clavatis ad spathulatis, usque ad 45 μm longo, 10–20 μm in latitudo.

Teliis minutis, hypophyllis, dense, arte aggregatissimus, subepidermalibus, nonerumpentis, 0.3 mm, vel fortasse pluris, atro cinnamomeo brunneis; teliosporis 24–40 × 18–16 μm cylindraco prismatic, membrana 1.5–2 μm in crassa apicalis angulae incrassatus usque ad 3–5 μm, brunneis.

Holotypus: In foliis *Populus* sp., Echo lake, North Conway, U.S.A., Farlow Herbarium (F.H), Harvard University, JFC 16054.

Pycnia and aecia are not known.

Uredinia minute, hypophyllous, scattered, subepidermal, erumpent, pulverulent, upto 0.2 mm, orange yellow; urediniospores 21–32 × 12.5–21 μm, stalked, globose, subglobose, ovate to ellipsoid, wall 1.5–2 μm thick, echinulate; paraphyses clavate to spathulate, upto 45 μm long and 10–20 μm wide.

Telia minute, hypophyllous, dense, very closely aggregated, subepidermal, not erumpent, 0.3 mm, or may be more due to fusion, dark cinnamon brown; teliospores 24–40 × 8–16 μm, cylindraco prismatic, wall 1.5–2 μm thick, apically the corners are thickened upto 3–5 μm, brown.

Holotype: On *Populus* sp., Echo lake, North Conway.