BIOCHEMICAL ASPECTS OF FUNGAL TAXONOMY,
MORPHOGENESIS AND HOST-PARASITE RELATIONSHIPS

by

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SUMMARY

I. A method was developed for extraction and electrophoretic separation of soluble proteins from fungi. Isolates of *Fusarium*, *Phytophthora*, *Pythium*, *Saccharomyces*, *Schizosaccharomyces* and *Thanatephorus* (*Rhizoctonia*) species were used. The main soluble proteins were detected by staining with acidic dyes after electrophoresis in starch gels with discontinuous citrate-borate buffers at various pH values from 8.2 to 9.5. Protein patterns differed markedly between different species of the same genus, but variation within a species was so small that the method should be a valuable aid in fungal taxonomy. Alcohol dehydrogenase, (EC 1.1.1.1), malate dehydrogenase (EC 1.1.1.37), glucose-6-phosphate dehydrogenase (EC 1.1.1.49), 6-phosphogluconate (EC 1.1.1.43), diaphorases \( \text{NADH}_2: \text{nitroblue tetrazolium oxidoreductases} \), peroxidase (EC 1.11.1.7) and catalase (EC 1.11.1.6) were detected in starch gels after electrophoresis of fungal protein extracts. The patterns obtained can be used in fungal taxonomy but different enzyme patterns have different taxonomic weight even in the same organism. Some patterns may be of value at the sub-specific level, some appear to be characteristic of species and some show interspecific similarities which indicate that they are characteristic of genera.

II. Yeast-like and mycelial (filamentous) forms of *Pullularia pullulans* were grown from single-spore isolates and conditions were
found for isolating both forms in sufficient quantity for biochemical investigation. Protein and enzyme patterns from extracts of the two forms were compared after electrophoresis of the extracts in starch gels. The two forms had qualitatively identical patterns of main soluble proteins, alcohol, glucose-6-phosphate and malate dehydrogenases and "oxidases". Differences between the two forms were found in their isoenzyme patterns of catalase, diaphorase and glucose oxidase (EC 1.1.3.4) activity. An electron-microscopic comparison of the two forms showed appreciable differences; the yeast-like form had convoluted mitochondria and vesicular endoplasmic reticulum not observed in the mycelial form and in addition the yeast-like form had much thinner cell walls. It was not found possible to demonstrate the reduction of cell-wall protein by mitochondrial reductases using published methods. The evidence for the involvement of protein disulphide reductase in fungal dimorphism is discussed and the necessity for a reappraisal of this matter is indicated.

III. Electrophoretic patterns of soluble enzymes and other proteins from wheat roots were measured at various stages of elongation and in various regions of the root. These patterns were compared with those from extracts of *Pythium ultimum* and with extracts of roots infected with this fungus. Differences were found between patterns of amylases (EC 1.2.1.1&2) in different regions of wheat.
roots and in root types at various stages of growth. These patterns were modified as a result of fungal infection; new bands of amylase were found that are not observed in extracts of root or fungus alone.