MYCOPHAGOUS AMOEBAE IN A SUPPRESSIVE PASTURE SOIL IN RELATION TO THE TAKE-ALL DISEASE OF WHEAT

by

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SUMMARY

Amoebae were isolated, characterised and identified from soil of the Waite Institute permanent pasture plot which is suppressive in pot bioassays to the take-all disease of wheat. Nine species of amoebae belonging to eight genera were tested for their mycophagy against three plant pathogenic fungi including *Gaeumannomyces graminis tritici*. Members of the genera, *Gephyramoeba, Mayorella, Saccamoeba, Thecamoeba* and an unidentified species of the order Leptomyxida were mycophagous. All mycophagous amoebae, except the unidentified leptomyxid were able to feed on pigmented (melanised) fungal cells.

Populations of the various genera of soil amoebae were assessed from samples of the naturally suppressive pasture soil, a suppressive wheat-pasture rotation and three non-suppressive wheat-field soils. The suppressive soils showed higher populations of both mycophagous and other amoebae and a higher frequency of occurrence of mycophagous genera. Soil texture and water holding capacity were not related with population levels of amoebae in these soils.

Saprophytic survival of the take-all fungus was studied by burying fungal hyphae in suppressive and non-suppressive soils. Hyphal density and survival of pigmented hyphae declined at a faster rate in the permanent pasture soil than in the non-suppressive soils. Hyphae recovered from the suppressive soil showed a higher association of mycophagous and other amoebae and scanning electron microscopy of these hyphae showed extensive erosion and discrete perforations in their walls.

The decline in survival of the fungus was related to the rate of decline in the density of pigmented hyphae in suppressive soil, irrespective of the soil type.

Studies on the population dynamics of amoebae showed a higher rhizosphere population and a higher rhizoplane association of mycophagous and other amoebae in suppressive soils. Populations in the suppressive pasture-wheat soil did not correlate with soil moisture during two wheat crops and one inter-crop fallow.

Three mycophagous amoebae, *Gephyramoeba, Saccamoeba* and *Thecamoeba granifera* sub-species *minor*, alone or mixed effectively reduced take-all severity in pot bioassays. The reduction in disease rating and the increase in height and dry weight of plants were comparable to that obtained with the suppressive pasture soil. Higher populations of these amoebae in combination were able to further reduce disease severity and improve plant growth.

Mycophagous amoebae are proposed as a component of the suppressive factors in the permanent pasture soil. The observations that mycophagous amoebae associate themselves with the fungus in soils, can lyse both pigmented and hyaline hyphae during the pre-colonisation and parasitic phase of the fungus, and reduce take-all severity in pot bioassays substantiate this proposal.