MICROBIOLOGICAL STUDIES AT THE SIGNY ISLAND FELLFIELD RESEARCH PROGRAMME (FERP) SITES DURING THE 1984–85 FIELD SEASON

D. D. WYNN-WILLIAMS

British Antarctic Survey, Natural Environment Research Council, High Cross, Madingley Road, Cambridge CB3 0ET, UK

In the 1984–85 season, microbiological research within the Fellfield Ecology Research Programme (FERP) at Signy Island was focused on microbial colonization processes in fellfield soils. It largely paralleled studies made at Cape Bird, Ross Island, in 1982–83 to provide a direct comparison between continental and maritime Antarctic fellfields.

Field and laboratory experiments on mineral fines from three diverse FERP sites (Jane Col, Moraine Valley and Factory Bluffs (British Antarctic Survey, 1982)) were conducted to determine the factors affecting the rate of soil crust formation by microorganisms and their effects on particle stabilization. Factors investigated included temperature, moisture, defined inorganic (N, P and Bold's mineral solution) and organic (glucose) nutrients and natural supplements (extracts of *Andreaea* moss, snow algae and penguin guano). Supporting micro-meteorological data were obtained from newly installed data loggers. The effects on soil crusts of increased higher field temperatures and moister conditions were tested by enclosing the central fines of solifluction polygons in plastic cloches. New moss shoots were detected in the cloches within six weeks.

The translocation of vegetative microbial cells and propagules in meltwater was monitored using three grades of sterilized carborundum paper to simulate inert substrata of known grain-size. Micro-niches of known size were also simulated using optically flat microslide tubes (pedoscopes) of five path lengths (0.05–0.4 mm). Microbes penetrated them in capillary water and could be observed directly or after staining. Sets of tubes were inserted in the fines of perturbation plots. The density of snow algae overlying the Jane Col site was counted, and their nutrient content assayed by gas chromatography (P. V. Tearle, pers. comm.).

Colonization by aerial propagules was monitored using fresh rock flakes of local quartz-mica schist and marble, supplemented as for mineral fines. The aerial microflora was monitored concurrently using Rotorod samples. Examples of endolithic microbial communities were collected from marble outcrops on Jane Peak for comparison with those in sandstone from the Beacon Mountains, Southern Victoria Land.

The microflora from all samples and experiments was examined and enumerated by epifluorescence microscopy using a new mountant, Citifluor (Citifluor Ltd.), which greatly retarded the photo-bleaching of pigments by UV light. This glycerol-based mountant preserved red and gold autofluorescence by green and blue-green algae (Cyanobacteria) respectively. This facilitated studies of sequential colonization of natural and simulated substrata. When used with Acridine Orange (AO)-stained bacteria, Citifluor accentuated green fluorescence against a dull orange background of mineral grains in intact crusts and soil smears. The bacterial counts obtained with AO were similar to those with fluorescein iso-thiocyanate (FITC), at a much lower cost and with less technical difficulty. The procedure has been used with a System III image analyzer (AMS Ltd.) which speeded up the quantification of bacteria and microcolonies.

The total bacterial population in fines at the Jane Col site was *c.* 400 times larger than the viable fluorescein diacetate-active population. The total bacterial and algal counts in fines at this exposed fellfield site were *c.* 5×10^8 and 4×10^5 g^{-1} d.w. respectively. Cyanobacterial trichomes of *Phormidium* spp, were conspicuous in soil crusts and formed extensive microcolonies on carborundum paper after 20–40 d of immersion in melt streams. These 'rafts' enmeshed other algae and bacteria embedded in mucigel. Such aggregations may help to stabilize discrete portions of frost-heaved mineral fines to provide a suitable substratum for the germination of cryptogam spores, and subsequent community development. Microbial 'rafts' have been observed in intact soil crusts, which substantiates this suggestion.

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Reference

British Antarctic Survey. 1982. Terrestrial biology. (*In British Antarctic Survey Annual Report, 1981–82*. Cambridge, British Antarctic Survey, 60–2.)