Fluorescent pseudomonads in Scottish cloud and rain water: diversity, ice nucleation activity and biosurfactant production

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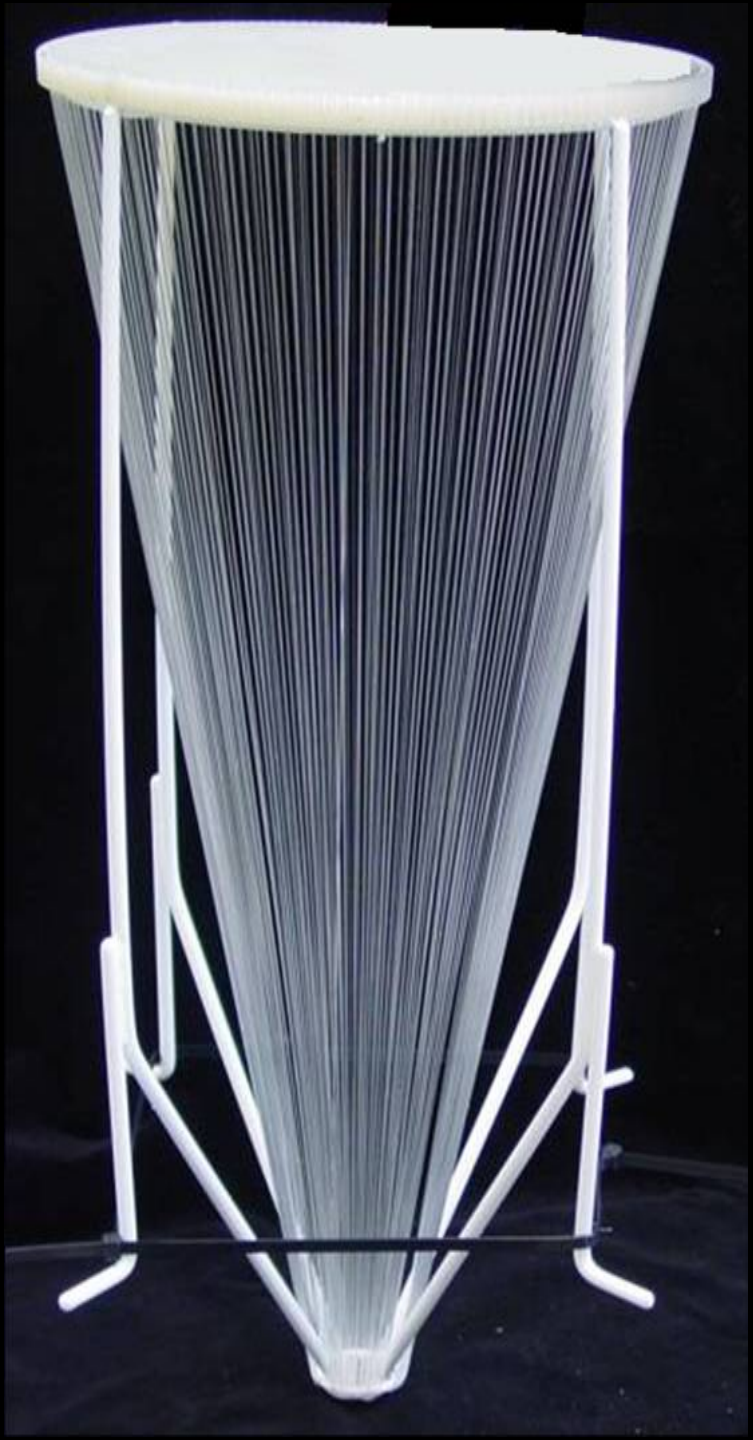
Aims

1. To describe the composition of the bacteria in cloud and rain samples in Scotland
2. To look for ice nucleating bacteria
3. To test for bacterial biosurfactant production
4. To see if the bacteria are metabolically active

Sites

Outer Hebrides, W Scotland.
Oceanic cloud & rain

E Scotland.
Terrestrial cloud



Methods

Community composition

Amplified 16S rDNA Restriction Analysis

Properties of isolates

IN activity

- PCR of *inaW*
- Freezing temp

Biosurfactant prod'n

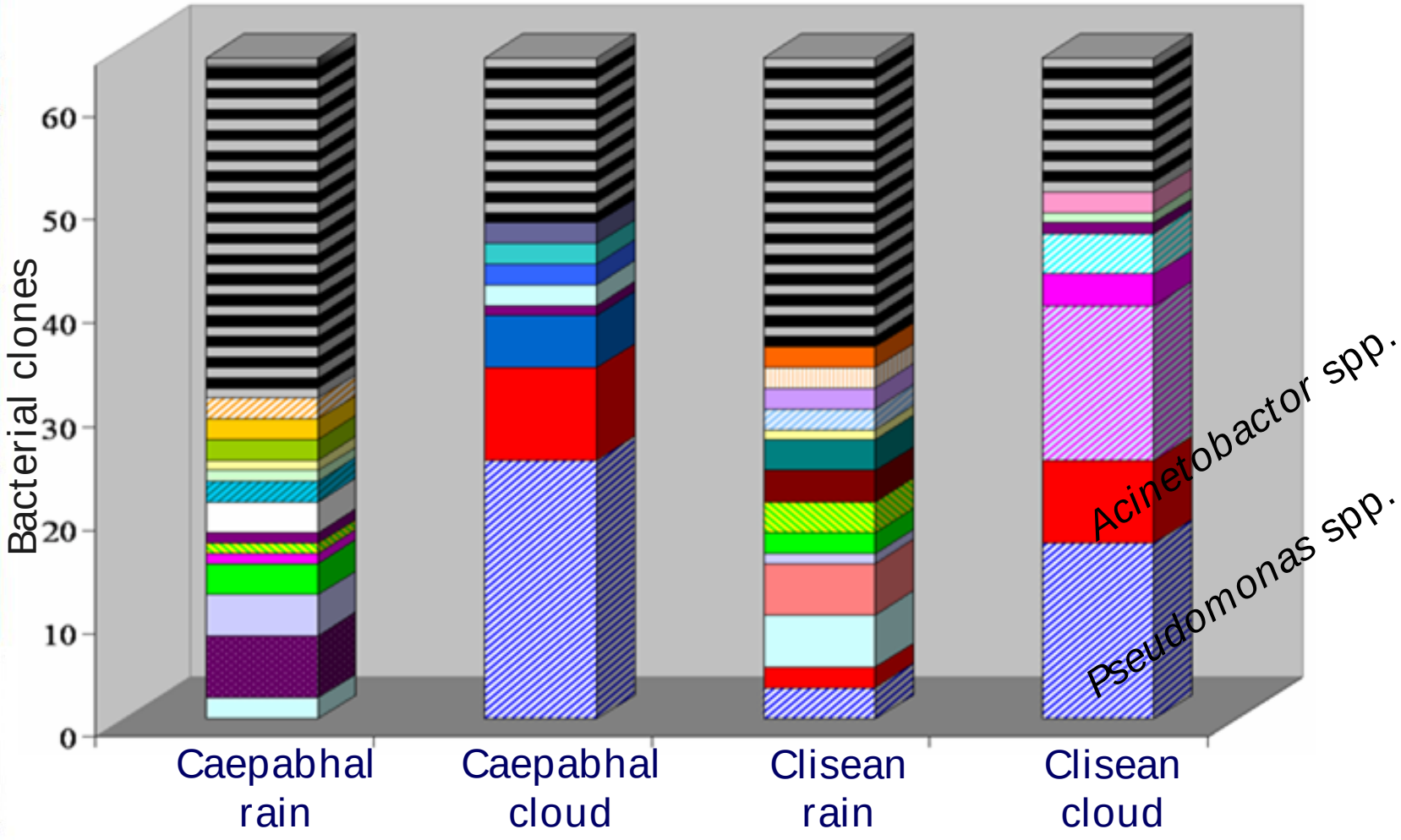
- Drop collapse

Metabolic activity

Quantitative PCR (RNA:DNA)

- Bacteria (16S rDNA)
- Pseudos (16S rDNA)
- IN (*inaW*)

Community composition



Isolates: PCR of *inaW*

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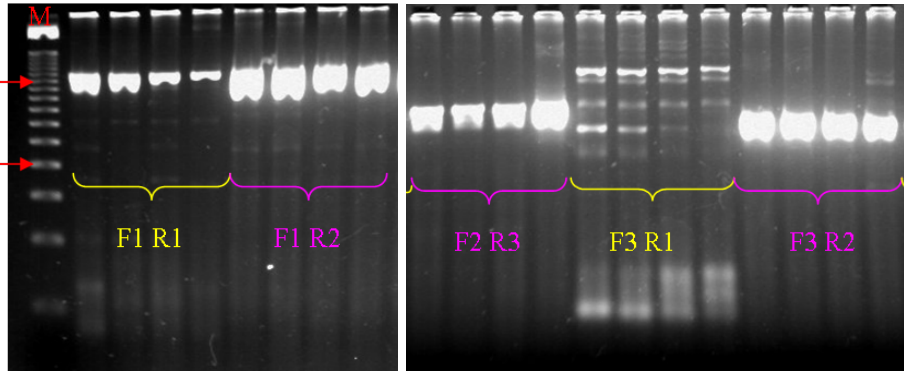
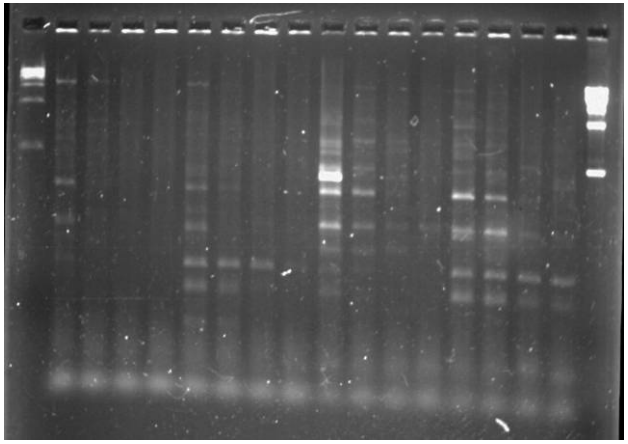
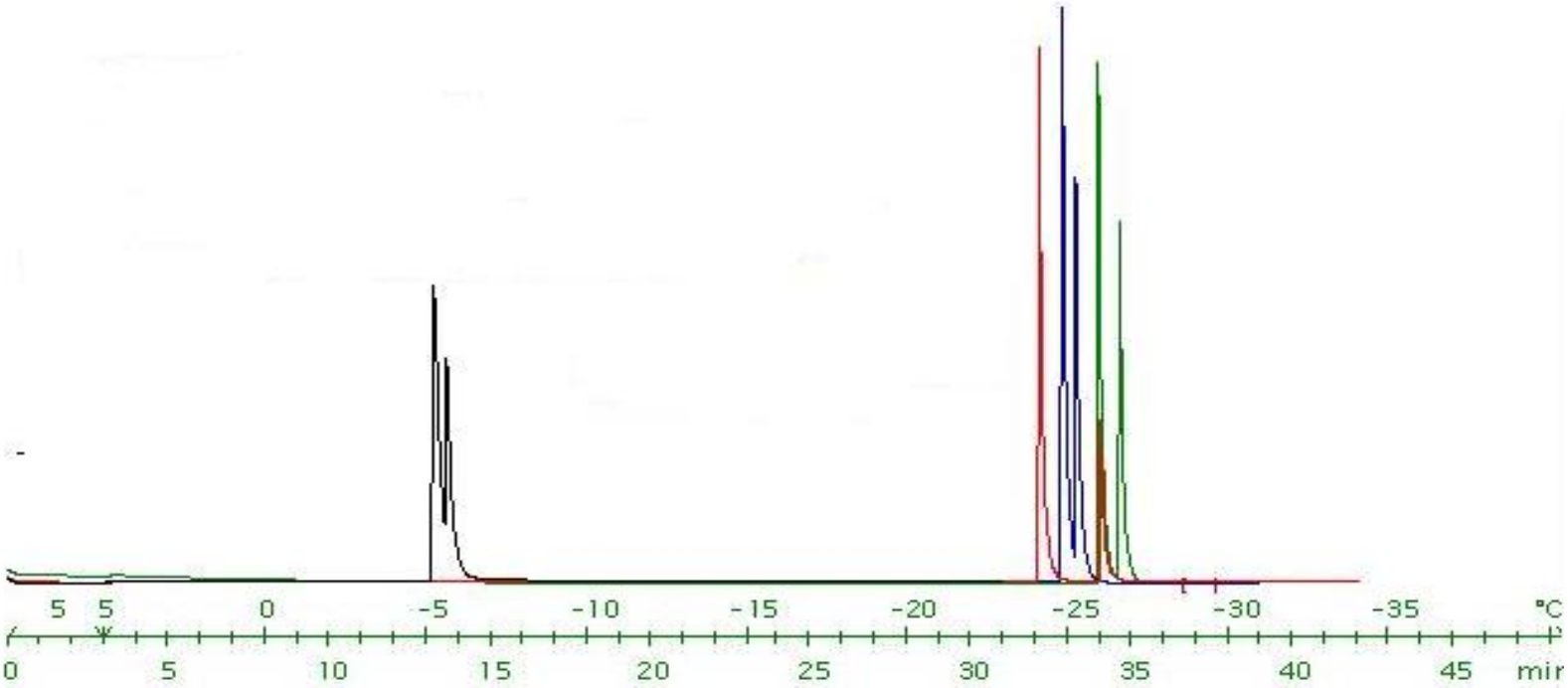




Isolates: Freezing temp



Positive Controls

Hebrides Isolates

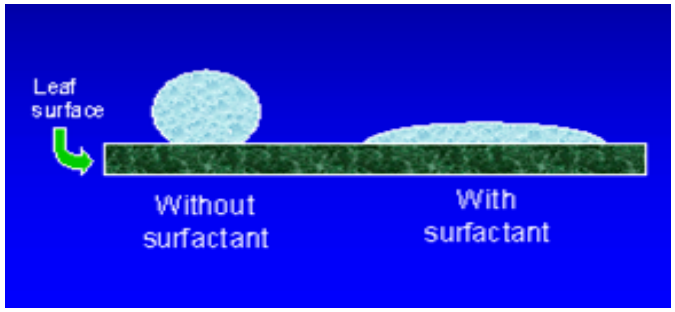
Isolates: surfactant production

Aerosol

Aerosol activation requires critical atmospheric supersaturation. Surfactants lower this.

All 85 fluorescent pseudomonad isolates produced biosurfactants (75 other isolates didn't)

Cloud condensation nuclei



Cloud droplet

Metabolic activity

Bowbeat windfarm. Cloud sampled for 3 h. 100 ml cloud water collected directly into solution that preserves RNA and DNA.

All bacteria using bacteria 16S rRNA primers (copies of the gene ml^{-1})		Pseudomonas spp. using Pseudo 16S rRNA primers (copies of the gene ml^{-1})		*inaW* using several *inaW* primers (copies of the gene ml^{-1})	
DNA	RNA	DNA	RNA	DNA	RNA
8300	3900	150	70	0	0

Take- home messages

- Clouds dominated by fluorescent pseudomonads
- Rain much more diverse than clouds
- No IN gene in 85 fluor. pseudomonad isolates
- But all 85 significant biosurfactant producers
- qPCR suggests low activity of cloud bacteria?