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

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Bacteria are abundant in the atmosphere. Yet we know little about the diversity of the species present in cloud and rain water, and whether they possess ice nucleating and cloud condensing abilities. Cloud and rain samples were collected from two coastal mountains in the Outer Hebrides, NW Scotland. Community composition was determined using a combination of amplified 16S ribosomal DNA restriction analysis and sequencing. 256 clones yielded 100 operational taxonomic units of which half were related to bacteria from terrestrial psychrophilic environments. Cloud samples were dominated by a mixture of fluorescent *Pseudomonas* spp., some of which have been reported to be ice nucleators. However, the IN gene was not detected in any of 80 cloud and rain isolates using both the polymerase chain reaction (PCR) and freezing point. (To test for presence of the gene directly, we are currently using real-time PCR to measure the abundance of actively expressed and total IN genes in further cloud samples obtained from southern Scotland.) Interestingly, 55% of the Hebridean isolates displayed significant biosurfactant activity when analyzed using the drop collapse technique. Surfactants have been found to be very important in lowering atmospheric critical supersaturations required for the activation of aerosols into cloud condensation nuclei (CCN). They also influence cloud droplet size and increase cloud lifetime and albedo. Some bacteria are known to act as CCN and so it is conceivable that these fluorescent pseudomonads are using surfactants to facilitate their activation from aerosols into CCN. This would allow water scavenging, countering desiccation, and assist in their widespread dispersal.