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The atmosphere as an inoculator of a functional phyllosphere microbiota

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The aerial parts of plants constituting the phyllosphere are in constant interaction with the atmosphere and the microorganisms it transports. Some plants have specialized structures that allow them to collect rainwater, the phytotelms. *Dipsacus fullonum* is a pioneer plant found in the Auvergne region of France that forms water reservoirs around its stem, called phytotelms. Rainfall feeds these reservoirs with water and inoculate them with a particular microbiota, including a high population of anoxygenic phototrophic bacteria (APB), i.e. bacteria capable of utilizing light to generate energy, without fixing carbon dioxide and releasing oxygen. These bacteria often have an impressive capacity to fix atmospheric nitrogen, which is likely beneficial to the plant, which stimulates their development through specialized molecules and structures found inside the phytotelms: glandular hairs. A high concentration of bacteriochlorophyll, a photosynthetic pigment typical of APBs, has been identified by HPLC in reservoir's water. The *pufM* gene coding for the small subunit of the photosynthetic reaction centre of APBs was detected by PCR in DNA extracted from phytotelm water, and it was also found prevalent in cloud and rain water samples. Living APB strains were also cultured and isolated from cloud water samples. The prevalence of these bacteria in the atmosphere suggests that anoxygenic photosynthesis could represent a strong selective advantage for survival, and so for long distance microbial dispersion. These bacteria could participate to the fixation of nitrogen in clouds and wet aerosols, and contribute to the biogeochemical cycle of nitrogen by reducing atmospheric N₂ into NH₃/NH₄⁺ to an unsuspected extent globally.