

Abstract

The geographical situation of the Canary Islands (27° 37' - 29° 25' north latitude and 13° 20' - 18° 10' west longitude) near the coast of Africa, the influence of the trade winds and the Gulf Stream, together with the high altitude of some islands, provide a high climatic diversity, which has favoured the existence of an exceptionally rich nature with unique ecosystems. These environmental factors meant that in certain areas of the Western Isles, under a soft, moist and relatively uniform climate, a lush vegetation, a relic of the Tertiary, develops "*laurisilva*", a laurel forest, at higher altitudes.

Epiphytes in the laurel forest are abundant, wrapping the trees, and until now studies on this topic have focused mostly on lichens and bryophytes, not on microalgae. Based on studies carried out in humid tropical regions, it is known that cyanobacteria can colonize the leaves of the trees in the rain forest. The present study deals with heterocyst-forming cyanobacteria epiphyllous on leaves in the laurel forest of the Canary Islands. More specifically, the occurrence and biodiversity of such cyanobacteria is the main focus of this work. A culture collection of 102 strains of heterocyst-forming cyanobacteria was established using an enrichment culture medium lacking combined nitrogen.

A group of heterocyst-forming cyanobacteria, the Nostocaceae sensu lato, is widely distributed in the laurel forest of the Canary Islands. In this study 39 different genotypes (sequence-groups) of heterocyst-forming cyanobacteria are described based on 16S rRNA gene comparisons. Based on the 39 sequence-groups genotypes the morphological analyses of heterocyst-forming cyanobacteria were performed using the developmental succession of a clonal culture as a guide-line.

The phylogeny of the 16S rRNA gene in the present study revealed that the order Nostocales is monophyletic with moderate support. A concatenated 16S/23S rRNA gene phylogeny of 45 Nostocales sequences, including 16 sequences of heterocyst-forming cyanobacteria from the laurel forest, identified a subclade within the Nostocales that is provisionally termed Nostocaceae sensu lato.

In the current study, 20 morphological characters were comparatively evaluated and documented by light microscopy, based on the 39 sequence-groups. Each sequence-group differed in at least one morphological feature from another (with only four exceptions: L019, L012, L013 and L074). A cladistic phylogenetic analysis (PAUP) of the morphological characters was undertaken to identify plesiomorphic, synapomorphic character states as well as homoplasies. Two different morphological groups within the Nostocaceae sensu lato could be identified using the parsimony approach: The “*Nostoc*”-phenotype and the “*Tolypothrix*”-phenotype. Both phenotypes represent adaptations to a terrestrial habitat and comprise the great majority of the heterocyst-forming cyanobacteria on leaves in the laurel forest