

AZONAL MICROHABITATS OF LITHOPHYTIC CYANOBACTERIA IN STORMY COASTAL CAVES OF NE. ADRIATIC

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*Microbiotopes azonaux des cyanobactéries lithophiles dans les grottes maritimes orageuses de l'Adriatique nord-est. On a analysé 57 prélèvements à 33 cyanobactéries de 9 grottes maritimes du Golfe de Kvarner. La dominance des formes endolithes y est corrélée à l'hydrodynamisme orageux. La houle intérieure irrégulière en grottes provoque leur distribution homogène en mosaïque et la dominance des espèces plurizonales moins spécialisées et aussi une adaptation à l'ombre par l'augmentation du phycoérythrine. Elles sont les derniers végétaux des cavernes longues obscures.*

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The stormy coastal caves present a specific geomorphological type of the lithophytic microhabitats. Their effects on the distribution of micro-vegetation are chiefly indirect, by the obstruction of a free elevation of waves in their interior, and this also disturbs the microzonation in caves. The internal hydrodynamism is the dominating micro-ecological factor, and the multi-directional agitation of water results by a irregular and mosaic distribution of this micro-vegetation, and also a continuum of transition of the micro-settlements without any regard to the internal cave micro-relief. Instead of the usual altitudinal microzonation of open cliffs, in caves exist another longitudinal gradient resulting by 3 successive areas of cavernal microvegetation: trogloxenic, troglophilic, and troglobiontic zones.

1. Trogloxenic zone is a transition area of cave entrances, half-caves, and deeper overhangs: the wave dynamism here is modified, and the related transitive microzonation is more diffuse. Here exist also the last macro-vegetation: in sheltered places *Hildenbrandtia*, in exposed ones *Catenella* and sporadic maritime lichens. The salinity is there very important, and in the dropping rinstones occur also the freshwater species as f.ex. *Hydrocoleum lyngbyaceum*. This zone presents dense settlements but with a rather fragmentary floristic composition, very variable in connexion to the topography and irregular hydrodynamism. In this micro-

vegetation, *Plectonema* is often dominating.

2. Trogliphilic (sciaphilic) zone of the interior of darkish interior in caves: the sea surf here is completely tranformed in an irregular multi-directional hydrodynamism. The micro-zonation in there absent and replaced by a homogeneous azonal distribution of the micro-vegetation in mosaic pattern. The more sheltered caves include also the epilithic forms, but in exposed caves the endolithic forms with large filaments are dominating: *Solentia achromatica* Erc., *S. foveolarum* Erc., *S. stratosa* Erc., *Kyrtuthrix dalmatica* Erc., *Dalmatella buaensis* Erc., and *Hormathonema longicellulare* Erc., but *Plectonema* is there rare. This composition is rather similar to this one in exposed wave pools of open rocky shores, that is correlated to a greater and prolonged humidity both in caves and pools, but in the pools the thalli of endolithes are more condensed due to a periodical growth correlated to a fluctuating humidity. The rinns-tones in caves do not present a specific flora, except the permanent gutters with a domination of filamentose forms as *Phormidium*, *Microcoleus*, etc. From 33 registered species, not one has been strictly cavernal. The diminished lighth intensity and especially its spectral change toward a short-wave radiation, provoke in the cyanobacteria the increasing red pigmentation in phycoerythrine.

3. Troglobiontic (scotophilic) zone is the terminal, completely tenebrous area of elongated cavernes and coastal tunnels: the epilithic cyanobacteria that are simultaneously also sciaphileous, there present the last existing autotrophic plants that are paralled to a infralittoral cavernal fauna as f.ex. *Grammonus*, and *Petrobiona*. In this area the cyanophyta are almost decolorized. The last plant registered in extreme tenebrous cavities has been the *Pleurocapsa fissurarum* Erc.

This is the first detailed study of the micro-flora in Adriatic maritime caves. Before this one, existed only the very scarce preliminary indications, as f.ex. these of PIGNATTI & coll. (1967).

#### BIBLIOGRAPHIC

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