ADRIATIC ENDEMICS 2. CYANOBACTERIA AND LICHENS IN KARST SHORES

A. Z. LOVRIĆ, *Center for Marine Research "R. Bošković", Zagreb, YU 41001,*
and L. M. LOVRIĆ, *Faculty of Science, Zagreb-Buliceva 8, YU–41000*

ABSTRACT. The limestone shores in NE. Mediterranean have a maritime microzonation of lithophytic cyanobacteria and lichens: intertidal Hyelletalia, above Dalmatelletalia, upper Pleurocapsetalia, and apical Verrucarietalia with a lower Verrucarion adriaticae and upper Verrucario-Blastenion. Cyanobacteria depend of exposition and salinity, and lichens of salinity and humidity.

RESUME. Endémiques adriatiques – 2) Cyanobactéries et lichens du Karst maritime. Les côtes calcaires de la Méditerranée nord-est ont une microzonation maritime à lichens et cyanobactéries lithophiles: Hyelletalia intertidales, en haut Dalmatelletalia, plus haut Pleurocapsetalia et au sommet Verrucarietalia à Verrucarion adriaticae inférieur et Verrucario-Blastenion supérieur. Les cyanobactéries y dépendent de l'exposition et salinité et les lichens de salinité, humidité et substrats.

One studied the lithophytic microzonation in E. Adriatic shores, especially in the stormy archipelagos of Senj and Vis with a richest microflora, and by the preliminary comparations also in some other calcareous shores of E. Mediterranean.

A) *Supralittoral maritime Cyanobacteria*. Their belt incluses the lower intertidal *Hyelletalia cespitosae* Erc. (=Chthamaletalia + Acrochaetietalia auct.), then middle *Dalmatelletalia polyformis* Erc. (=Melaraphetalia), and upper supralittoral *Pleurocapsetalia gloeocapsoidis* Erc. They incluse a dozen of Adriatic endemics or disjunctive NE. Mediterranean subendemics of *Pleurocapsales* (especially Hyellaceae): *Hormathonema* with 5 endemics, *Dalmatella* (3), *Solentia* (3), *Scopulonema* (2), *Brachynema* (1), etc. Recently one confirmed, this microzonation previously indicated by synecological methods also is strictly correlated to the micro-gradients and hydrodynamic structure of waves in shore transect. The delimitation, coexistence, and limit sharpness between maritime and terrestrial cyanobacteria are defined by the coaction of salt spray and atmospheric freshwaters. One studied also the different coastal substrata: they are the poorest in iron, then in wood, sandstone, eruptives, flysch, gypsum, limonite, concrete, dolomite, and the pure crystalline limestones (96–99% $CaCO_3$) with a richest microzonation. The rock solidity is essential, and the origin of stone and pores are less important. The distribution of active boring endolithic forms and also of passive cryptoendolithes (microchasmophytes) in preexisting pores, both depend essentially of the wave exposition, and other proposed factors are found as few important: they are also present in sunny open cliffs as in stormy dark caves, in C. Adriatic with 260 mm rains only and in SE. Adriatic with 11 X higher humidity (2900 mm), in shores grazed by zoobenthos and in the azoic ones without grazers as in these exposed to the Bora hurricanes in Senj archipelago, and just there they are the richest, attaining an altitude of 5–8 m, exceptionally up to 20–25 m.

B) *Adlittoral submaritime lichens*. The lower supralittoral belt with cyanobacteria has 2 maritime lichens: *Lichina confinis* Ag. is the only characteristic, and *Verrucaria adriatica* Zahl. is not restricted but also widespread far above. Many other coastal lichens occur just above out of precedent belt, in a superposed aerosaline adlittoral belt (*Verrucarietalia* Lov.) characterised by the halocalciphilic endemics of *Verrucaria* (14 endemics), *Blastenia* (9), *Lecanora* (9), *Caloplaca* (7), including 2 lichen microzones or alliances. 1) *Verrucarion adriaticae:* lower adlittoral with a humide salt spray of dominating chlorides, characterised by hygrohaline chloridophilic lichens: V. adriatica 7s, Dirina repanda Fr. 3d, Collema latzelii Zahl. 2s. It incluses 3 stenoendemic local associations: Kvarner Gulf in NE. (*Solenopsoro-Lecanietum*) with Solenopsora marina Zahl. 1e, Ver. quarnerica Zahl. 2e, Lecania quarnerica Zahl. 1e; then central Adriatic (*Dirino-Lecanoretum*) with Dirina, Lecanora adriatica Zahl. 1e, L. latzelii Zahl. 2e, L. lagostana Zahl. 1e, Blastenia lagostana Zahl. 1e; and SE. Adriatic (*Verrucario-Caloplacetum*) with Caloplaca calcicola Zahl. 2e, Collema ragusanum Zahl. 2e, Ver. baumgartneri Zahl. 1e. 2) *Verrucario-Blastenion*: upper adlittoral with a dry aerosaline fumarea of dominating crystallised sulphates, characterised by xerohaline sulphophilic lichens as Verrucaria cazzae Zahl. 9d, V. sphinctrinella

Zahl. 9s, V. periphysata Zahl. 3s, V. attica Strn. 2d, Blastenia latzelii Serv. 1s. This supreme littoral belt is specific and subendemic of Adriatic, restricted to the internal isles and coast exposed to the dry Bora salt storms, ressembling the aride gypsum and semidesert microhabitats. It incluses 2 studied communities: NE. Adriatic (*Blastenio-Heppietum*) with Blastenia cretacea Müll. 2e, Heppia adriatica Zahl. 1e, H. schuleri Zahl. 1e, Ver. dalmatica Serv. 1e, and SE. Adriatic (*Blastenio-Caloplacetum*) with Bl. euthallina Zahl. 2e, Bl. paragoga Körb. 1e, Caloplaca squamescens (Zahl.) Serv. 1e, Lecanora omblensis Zahl. 1e.

Yugoslav coast has 63 endemic lichens. Such carbonatic karst shores are important not only in NE. Mediterranean, but also in 1/3 of other world coasts, especially in the few studied circum-tropical ones, and the analysis of their lithophytic microzonation may be interesting, too.