*Karszt és Barlang, Special Issue 1989. p. 69—72. Budapest*

# THE FLORA OF HUNGARIAN CAVES

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It is twelve years since paper on Hungarian cave botany (Hajdú 1977) was published under the same title on the occasion of the 7th Congress. This paper provides an account of the new results covering cave-dwelling green plants in Hungary.

### Entrance flora

The vegetation of cave entrances consists of plant species adapted to the special ecological conditions (reduced light, more constant temperature, higher air humidity). These plants, mostly lower plants, i.e. algae, bryophytes and ferns can be found not only in caves but in other wet and dark habitats such as in crevices, on shady wet rocks in woods, in deep narrow valleys, etc. A valuable collection of data on entrance flora is that of Á. Boros who collected very frequently in caves. In 1985 H.-Kovács produced a guide and a card file to these data by means of his itineraries covering 175 plant species in 213 Hungarian caves.

During the past 12 years 6 caves have been studied, one shaft (Komáromy 1977 — only algae), three thermal caves (Buczkó & Rajczy 1986) and two caves of archaeological importance (Rajczy & al. 1986).

### Darkness flora

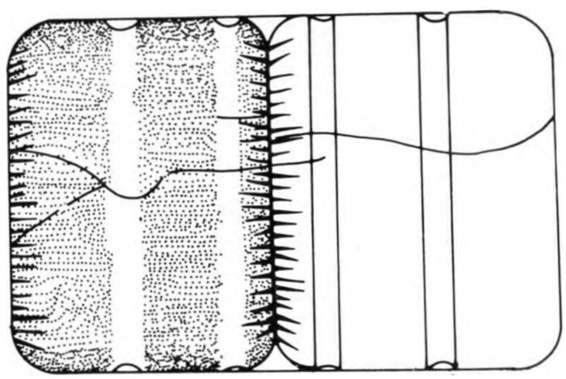
This ecological group of the vegetation of the caves is that which exists in total darkness. Though the algae of this flora have been studied in detail, nowadays this field is neglected. It is surprising that a comparison of the well-known darkness flora of the Baradla Cave at Aggtelek and its lamp flora sevealed no similarity in the two (Hajdu—Orbán 1981). The reason might be the inadequate conditions while cultivating the samples in the laboratory (lower air humidity, higher temperature), or that the propagating bodies are so few in the innermost part of the cave, that they cannot win in the competition with those ones introduced by the number of visitors (cf. Padisák & al. 1985).

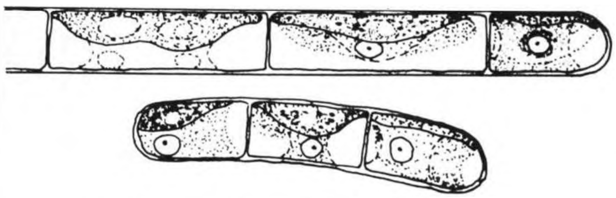
### Lamp flora

This flora — the green plants living in show caves around electrical lamps — was studied in detail in the period under consideration. These green coatings do not belong to the caves, moreover they hide their original beauties, the dripstone formations, helictites, crystals and other decorations. The green color itself is rather strange in this place. However, the danger is not only in the loss of aesthetic value of the decorations but in the disturbance of the cave-dwelling animal community. One of the main characteristics of the cave ecosystem is the low level of nutrient resources, i.e. these animals are living under the conditions of starvation. The fact that this habitat is poor in energy, results in few species in limited numbers living very disproportionately in the cave. A large influx of energy (i.e. nutrients) may introduce new species which have not been adapted to the special cavern conditions.

Lamp floras consists of lower plants, i.e. algae, bryophytes and ferns. One should expect similarities in species composition of lamp floras and darkness flora or lamp floras and entrance floras respectively. The "predictive value" of the darkness flora proved to be an inadequate supposition as I mentioned before. The other assumption, that the lamp flora originates mainly from the entrance flora can only be inadequately documented. Regarding the algae we can find only a few common species: the special

*A special diatom species in cave entrances, Melosira roeseana Rabh.*

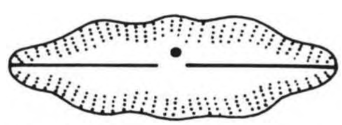




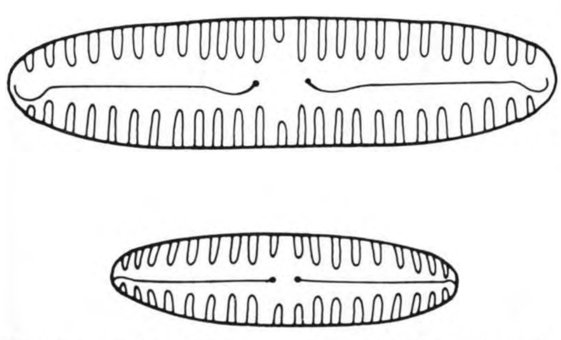
*Characteristic species in the lamp-lit areas, Chlorhormidium flaccidum (Kütz.) Fott*

*Diatom species living in caves, Hantzschia amphioxys (Ehr.) Grun.*

*Diatom species living in caves, Fragilaria brevistriata Grun.*



*Diatom species living in caves, Navicula mutica var. nivalis (Ehr.) Hust.*



*Diatom species living in caves, Pinnularia borealis Ehr.*

species very characteristic of the entrances are completely lacking in lamp floras. The typical participants of lamp floras originate from the soil and rock surfaces outside the caves. Lichens could not be found in Hungarian lamp floras though there is a very common genus living in almost every cave entrance. Regarding hepatics we find the same situation — no hepatic was found in Hungarian caves though they are not rare in cave entrances. Among mosses there are some species which can be typical either of cave entrances or of lamp floras. There are many moss species, of course, which originate from other habitats. Even photophylous plants are living in the lamp floras (Hajdu & Orbán 1981, P.-Komáromy & al. 1985, Végh 1985). The reason for this interesting phenomenon is, that the limiting factor at cave entrances is low light intensity, only sciadophylous plants can survive there. On the contrary, the surfaces around the electric lamps are mostly well illuminated.

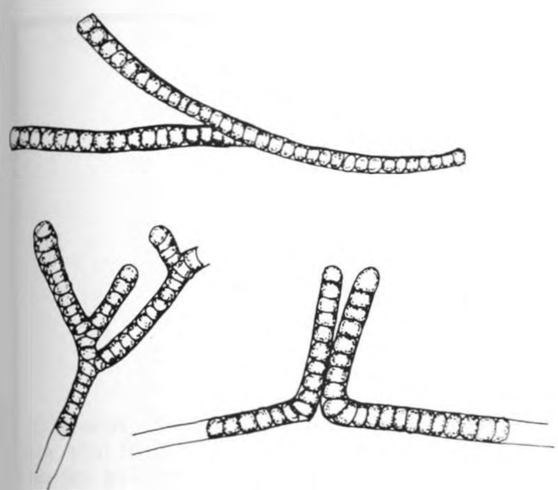
Analysis of the floristic composition of the lamp floras and the study of the dynamism of early succession led to the conclusion that the species of the lamp flora originate from the wider vicinity of the cave entrance, the most common, good propagating species have the highest possibility of inhabiting the cave interior (P.-Komáromy & al. 1985).

**How to protect caves from green plants?**

Padisák & al. (1985) described the endangering factors in detail. Besides the well-known factors of light intensity, length of illumination (Hazslinszky 1975) and the water supply of the surface the importance of several new ones can be proved. The most significant among these circumstances is the introducing (infection) probability. As the cave air contains extremely few propagating bodies and the dripping, seeping waters are very well filtered, the main introducing power is man (visitors, cavers, technicians). Another important factor is the role of the substrate. The softer and more divers the surface the faster is the development. The clay deposits or muddy floors are among the first places where lamp floras appear.

In my opinion the strategy of the war against the "green enemy" consists of the following parts:

1. The reduction of light intensity and the time of illumination — Use pressure-operated buttons and as short sections in the illumination system as possible.
2. Better choice of illuminated surfaces and lamp types — Avoid illuminating wet or soft surfaces. The vicinity of the lamp must remain in darkness (do not put security lamps in natural or artificial cavities). High pressure mercury lamps and sodium bulbs and spot-like light sources recommended.
3. The reduction of infection probability — Illu minated surfaces must not be available to the visitors, cavers may use only dark paths, techni-



*Characteristic species in the lamp-lit areas, Plectonema schmidlei Limanowska*

cians should not touch bright places during work if possible. The possible foci of infection — the developing lamp floras must be sterilized as soon as possible.

It is evident that effective protection depends on the illuminating system itself. It seems to be very important to take this strategy into account while planning the system. It is cheaper to modify existing systems than to remove the green coatings each year. The modification of systems often results in savings of a considerable amount of electricity! Such a modification (not radical at all) in the Szemlő-hegyi-barlang resulted the disappearance of many dangerous infection foci which could not be sterilized (Buczkó & Rajczy 1987, 1988). An important part of this suggested strategy is the removal of lamp floras in their initial stage. A developed lamp flora can spread rapidly from lamp to lamp as the propagation depends mostly on the distance under cave conditions. You can use less chemicals when sterilizing small spots. This way it will be cheaper and will endanger cave-dwelling animals less. The last is very important for the protection of the rare and unique fauna of the caves. The removal of existing green coatings by brushers and water is not only very expensive but very dangerous: this way we ourselves disperse the propagating bodies over large surfaces. The result will be a rapid and extensive growth.

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