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Prasiola crispa (Lightfoot) Meneghini in Královská obora in Prague

JIŘÍ NEUSTUPA

ABSTRACT

The morphology and different stages of the life cycle of terrestrial green alga *Prasiola crispa* (Lightfoot) Meneghini found at a synantropic locality in Prague were observed. The potential relationship of *Prasiolales* with other groups of green algae is discussed.

INTRODUCTION

The order of *Prasiolales* includes contemporary 20 species of marine, freshwater and terrestrial algae. The monography of order was published by Knebel (1935).

This publication is based on the observation of the morphology and the life cycle of the terrestrial species *Prasiola crispa* found in Královská obora (King's park) in Prague. Hansgirg (1889) described the occurence of this species from whole of Bohemia in a number of localities varying from the lowland – Prague basin – to the mountains – Velká Úpa in Krkonoše. However, this alga commonly occurring at that time was overlooked later or it was confused with other species *(Klebsormidium, Ulothrix).*

In this publication relations of morphology of *Prasiola crispa* as well as the contemporary new view on the taxonomic position of *Prasiolales* within *Chlorophyta* are discussed.

MATERIAL AND METHODS

The rich population of the *Prasiola crispa* were found in the autumn of 1996. The alga formed a compact layer on the soil surface (pH 5,43) at the tree foot *(Robinia pseudo–acacia)* near a frequented path in the Královská obora (King's park) in Prague. The population persisted at the locality for the whole time of the observation (more than one year).

The thalli morphology and the life cycle were investigated on fresh material and on the material maintained on the natural substrate in the laboratory for several weeks.

RESULTS

The life cycle of *Prasiola crispa* involves three different ontogenetical stages:

- uniserial filaments without branching,
- bi-or multiseriate unbranched filaments,
- pseudoparenchymatic leaf-like thalli formed by one layer of the cell.

The uniserial filaments were the most common ontogenetical stage during the whole time of observation (Fig. 1).

All the cells forming the filaments are of similar shape and inner structure. No differences between cells on the opposite ends of the filaments were observed. Each cell contains one single stelate chloropast which fills up almost the whole inner space. The spherical pyrenoid with the starch envelope is embedded in the central part of the chloroplast. The outer surface of the chloroplast is divided unto several rounded lobes reaching the cell periphery. The chloroplast morphology closely resembles the chloroplast of *Trebouxia*. The nucleus is hardly visible in the living cells, it's located among the chloroplast lobes. The cell wall surface is provided by longitudinal wrinkles distinctly visible at higher magnification of the light microscope (Fig 2, 3). The wrinkles are the important character which distinguishe this stage of *Prasiola* from *Klebsormidium* and *Ulothrix*.

The filaments are of unlimited length (more than 300 cells). The width of the filaments varies from (5,5 -) 8,9μm to 12,5 (- 13,5)μm.

Development of the bi- or multiseriate filaments initiates independently and irregularly on various parts of the uniseriate filament (Fig. 4). The change of the division plane into two perpendicular directions is the fundamental basis for developing the multiseriate filaments. This stage can be considered as the intermediate. In suitable conditions the multiseriate filaments are continuously and quickly developing into the leaf-like thalli (Fig. 1). The cell structure does not differ from that previously described. The cell wall lost gradualy its longitudinal structure, and in young leaf-like thalli it disappeared completely.

The length of the multiseriate filaments does not differ substantialy from the uniseriate filaments.

Leaf-like thalli (Fig. 1) develops occasionaly, they were only once found in nature. The cell morphology remained similar as in previous stages. The cell wall structure is smooth and thin.

Maximum leaf-like thalli dimensions: length from basis to the upper rim 1 cm, width of the upper rim up 0,5 cm.

Fragmentation of filaments or thalli is the main type of reproduction. Neither zoids nor sexual reproduction were observed. Dried uni- and multiseriate filaments does produce spherical thick walled cells, similar to hypnoblasts (Fig. 3), described by Knebel (1935). The fresh leaf-like thalli produce hypnoblasts in the upper rim of the thalli. Hypnoblasts are probably the modified vegetative cells. Protoplast division, which preceds the hypnoblast formation was not observed. Released hypnoblasts develop into the aplanosporangium which is in the immature stage morphologicaly unrecognizable from cells of *Trebouxia.* Aplanosporangia contain 8-32 ovalshaped aplanospores. These are according to Knebel (1935) germinating to the uniseriate filaments.

DISCUSSION

The observed life cycle contains all the ontogenetical stages described by Knebel (1935). The uniseriate filaments he described as *Hormidium*-stage, multiseriate filaments as *Schizogonium*-stage and adult leaf-like thalli as *Prasiola*-stage.

However, the life cycle described should not be considered as complete. The morphological variability of different ecomorphs and shape diversity of different ontogenetic stages of *Prasiola crispa* complicates their clear position in the life cycle. Factors influencing and controlling the ontogenesis, especially the change of division plane of Hormidium-stage cells, remain unexplained.

Knebel (1935) described *Prasiola crispa f. radicans* which differs from the typical form by the numerous rhizoidal outgrowths on filaments. There are no similar formations appearing on the studied population. The occurence of *P. crispa f. radicans* reported Knebel (1935) from the scandinavian coast. However, absolute absence of rhizoidal outgrowths by typical forms allows for possible future description of *P. crispa f. radicans* as separate species.

Some of the aquatic species of *Prasiola* produce zoids as well as different types of sexual reproduction (Van den Hoek et al., 1995). However, by *Prasiola crispa* neither zoids nor sexual reproduction was ever described. Possible absence of these features could be considered as adaptation for terrestrial environment.

The *Prasiola*-species were classified into different groups of green algae *(Ulotrichales, Ulvales, Chaetophorales)* in the past. Modern systems of *Chlorophyta* include *Prasiolales* as an isolated group with an unclear taxonomical position (Melkonian et al., 1990; Van den Hoek et al., 1995). A contemporary molecular biological investigation based on sekvence analysis of 18S rDNA indicates the possible relations of *Prasiola*les to the class Trebouxiophyceae (Friedl et al., 1997). Some morphological features could support it. One stage of the life cycle of *Prasiola crispa* – the released young aplanosporangium is morphological unrecognizable from *Trebouxia* species. Belcher (1969) described similar cell and chloroplast morphology of one-cell stages of the life cycle in a relative terrestrial species *Prasiococcus calcarius* found in South Sandwich Islands.

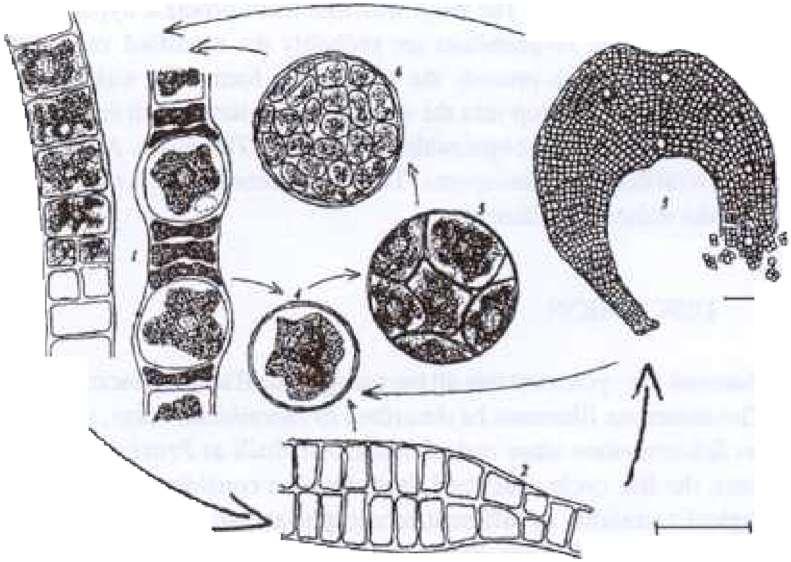

Fig. 1: Life cycle of *Prasiola crispa.* **1:** uniserial filaments, within one of the filaments the formation of hypnoblasts; **2:** biserial filament; **3:** leaf-like thalli, scale: 1000 µm; **4:** released hypnoblast; **5:** developing aplanosporangium; **6:** mature aplanosporangium; scale: 10 µm

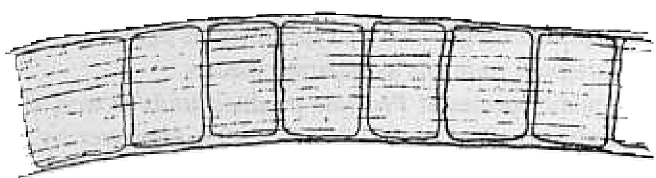

Fig. 2: Longitudinal wrinkles of cell wall surface in stage of uniserial filaments; scale: 10 µm

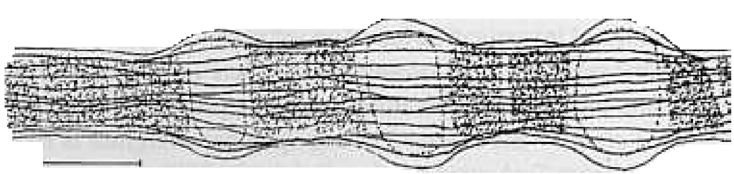

Fig. 3: Longitudinal wrinkles of cell wall surface in dried uniserial filaments with hypnoblasts; scale: 10 µm

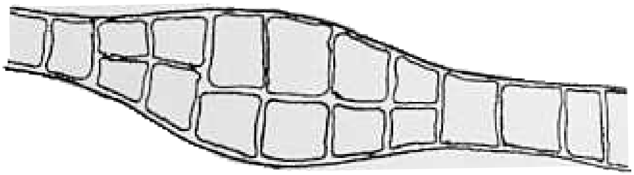

Fig. 4: Initiating stage of developing biserial filament; scale: 10 μm

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Jiří Neustupa
katedra botaniky PřF UK
Benátská 2
Praha 2 CZ – 128 01