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# SOME DATA CONCERNING THE DYNAMICS OF ALGINIC ACID AND MANNITOL IN THE BROWN ALGA CYSTOSEIRA BARBATA

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A b s t r a c t

The determinations of alginic acid and mannitol in the brown alga Cystoseira barbata, from the Romanian Blak Sea coast, from January 1971 to December 1971, indicate a significant seasonal variation of those compounds : there are two annual maxima of alginic acid, representing 17% and 21% of dry substance, in April and October, respectively, and two annual minima representing 8.5% and 21% of dry substance, in January and July; there are two annual minima of mannitol, representing 24% and 21% of dry substance, in April and October, and two annual minima, representing 7.7% and 12% in January and August.

The mannitol, a 6 C cyclic polyol, essential constituent of the cytoplasma of Pheophyta, is extremely important for their metabolism. Alginic acid is a constituent of cellular membrane of Cystoseira barbata, and its annual dynamics is extremely interesting because of economic importance of its salts - the alginates.

Some data, concerning content of alginic acid and of mannitol in Cystoseira, have been done by various authors : DALEV, DANCHEV and LIDZHI (1957); IATZENKO, (1963); PELLEGRINI and PELLEGRINI, (1971).

## Working technique

For the knowledge of dynamics of alginic acid and mannitol in the alga Cystoseira barbata at the Romanian Black Sea coasts, specimens picked up, in the same day, at Vama Veche, Jupiter, Costineşti and Agigea, have been monthly analysed.

This paper is based upon the analysis of 48 samples of Cystoseira barbata. The gathering in a homogenous population at a depth pf 1,5 m was done, and the size of sampled specimens was from 80 cm to 100 cm. The specimens for analysis were fresh sampled, without traumatisme, got rid of epiphytics and tap water washed. After removing of water traces from the thallus, by filter paper tamponing, the fresh specimens were homogenized under form of particles up to 2 mm and then, imediately, put in analysis.

The following determinations were carried out : humidity, mannitol,, alginic acid.

For humidity determination, samples of homogenized thallus were picked up and kept in a drying cabinet for 5-6 hours, at $105^{o}C$.

The mannitol dosage was accomplished according to the method of EVTUSHENKO and PANKRATOVA (1962)

The determination of alginic acid was accomplished according to PEREZ (1967), eith our modifications. These modifications are the following ones :

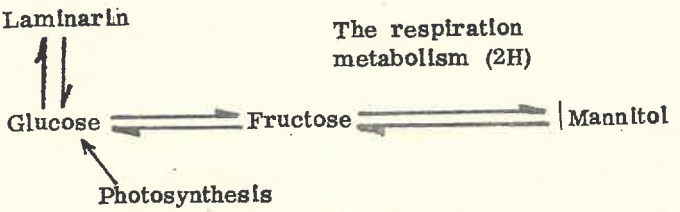
- the enlargement of demineralization time from 4 to 24 hours;
- repeated extraction of alginic acid, with sodium carbonate 2% (4 times, with weight ratio alga: liquid of 1:10 ;
- the ageing of alginic acid gel in the precipitation liquid, for 14 hours at $5^{o}C$ and pH = 2.

## Acquired results

Mannitol concentration in Cystoseira barbata per weight unit of dry alga, oscillates from 24% to 7,7 % and shows an important seasonal variation (Fig. 1), annual maxima being noted in April and October, their

values being 24 % and, respectively, 21 % of dry substance. Many authors were tempted to interpret these seasonal features of enlarged mannitol content in the summer time and of decreased mannitol content in the wintertime. In this way, QUILLET (1954-1957) points out that the respiratory metabolism and the photosynthesis play a leading part as for as those seasonal oscillations are concerned. In his opinion, photosynthetical reduction of $CO_2$, in Pheophyta, is not finished at organic acid and oses stadium, as it happens in Phanerogams, but that reduction goes on until the alcohol stadium because of the hydrogen additional atoms, allowing a more important liberation of utilizable energy per gram of synthesized glucidic substance.

According to scheme given by this author, explaining the mannitol synthesis in Laminaria digitata, the content of polyalcohols depends on the amount of fructose formed by the photosynthesis and by the hydrolysis and by the hydrolysis of polyholosides and also on the quantity of hydrogen delivered by respiration :




The seasonal fluctuation of the mannitol content in Cystoreira barbata, recorded by us ( Fig. 1), can be easily explained using the diagram given by this author and the data obtained by IATZENKO, (1962, 1964), SABININ and SCIAPOVA (1954), concerning the physiology of this alga.

So, during the autum, the mannitol reaches a maximum content of 21% dry substance in October. During this season at the same time as begins the development of new primary branches, the mannitol come to be used for the respiratory metabolism, while the photosynthesis activity rapidly decreases toghether with the diminuation of the light intensity This fact causes a sharp flexion of the curve ( Fig. 1 ).

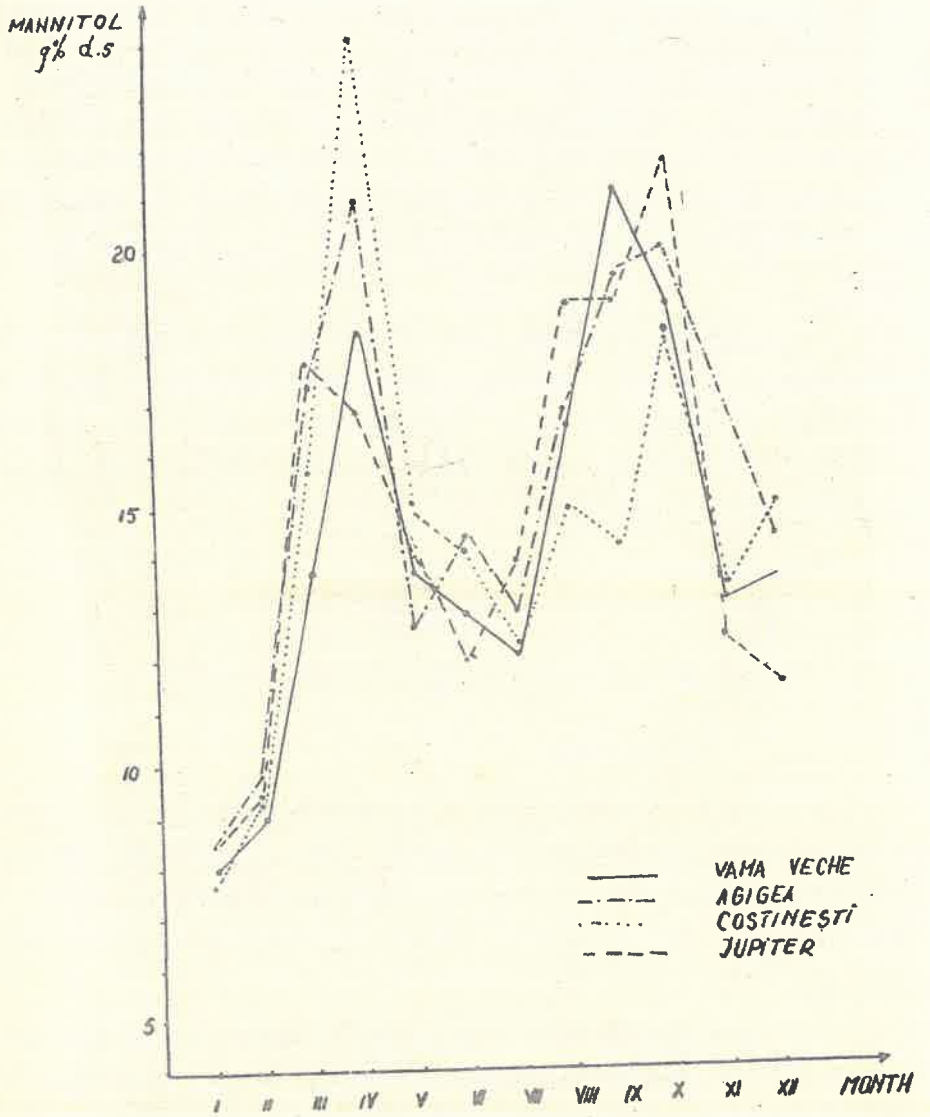



Fig. 1 - The seasonal variation of mannitol, in Cystoseira barbata during January - December - 1971

During the winter, because of the weak light intensity and low temperatures, the photosynthesis has a low level, causing the slowing down of mannitol synthesis. One part of the reserve substances are used for the metabolism necessities, particularly also this polyol, which-reaches a 7.7% minimum level of dry substance during January.

In spring time, the photosynthesis progressively grows up and at the same time the mannitol synthesis become more intensive. The obtained glucose is converted to fructose, which, in turn, is reduced to mannitol using the hydrogen delivered by the respiratory metabolism. The metabolism being more active during the spring time then in winter time. The mannitol has one maximum of 24 % in April.

In summer time, the mobilization of glucide reserves is determined by the forming of reproductive organs. At the same time, the mannitol is also used for the respiratory metabolism maintenance, when the photosynthesis is decreasing faster than this metabolism.

In Fig. 1 can be noticed a decreasing of the mannitol content in July-August.

Comparing with the species Cystoseira stricta from the Mediterranean (PELLEGRINI, 1971), the mannitol content of Cystoseira barbata is higher, but the results cannot be directly corelated because of the different analysing methods used.

The mannitol content of Cystoseira barbata samples collected, during the same day from 4 different points of the Romanian coast, dindn't register sensible variations, considering the samples taken during one gathering.

The alginic acid in Cystoseira barbata (Fig. 2) oscillates between 8.5% and 21 % of the dry alga weight.

In autumn, during the growth of primary branches, an increasing of the alginic acid content until 21% dry substance is noticed (October).

In winter, during Nowember - February period, the percentage of alginic acid progressively decreases, reaching 8.5 %.

In spring, during April-May period, it is the second annual maximum of the alginic acid content 17% of dry substance.

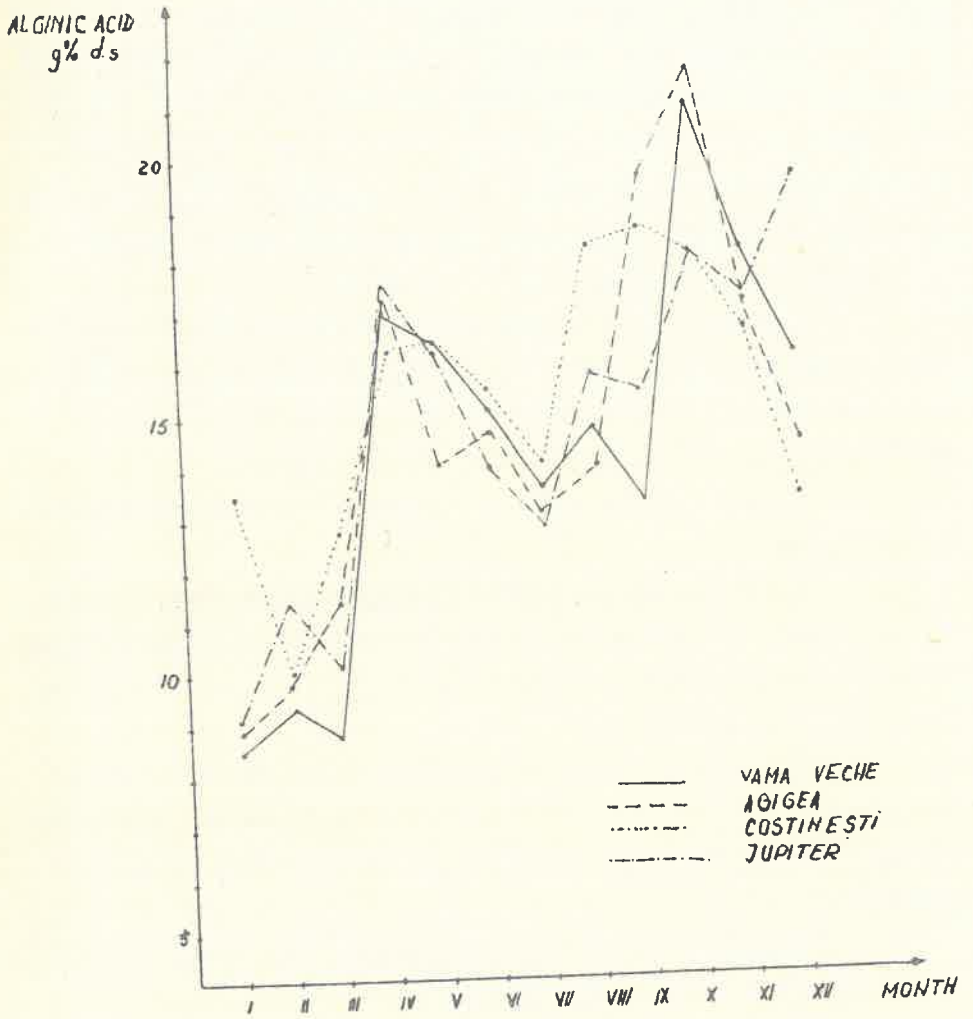



Fig. 2 - The seasonal variation of alginic acid in Cystoseira barbata during January - December - 1971

During summer time it is noticed a slight diminuation of the alginic acid content, which in July, reaches the value of 12,8% of dry substance.

The alginic acid being one component of the cellular membranes, all its seasonal variations are only relative ones, caused by the stopping or the resuming of this polyuronid synthesis.

We can, then, conclude that the seasonal oscillations of the content of mannitol and alginic acid in the alga Cystoseira barbata are strongly related to some physiological activities : growth, photosynthesis, respiration, reproduction.

The general scheme of the modification in the content of alginic acid and mannitol is the following : in spring time, the alginic acid and the mannitol has an annual maximum corelated with the photosynthesis proces intensification ; in summer, the mannitol reaches one minimum and the alginic acid a slight diminution because of the formation of reproductive organs and of the respiratory metabolism intensification; in autumn time the mannitol and the alginic acid have one maximum, followed by the decreasing in the same time as the formation of the new primary branches and the diminution of photosynthesis ; in winter, a minimum value of these two compouds content is recorded because of the lowered photosynthesis and of the partial consumption of these compounds for the metabolic necessities.

The content in mannitol and alginic acid of the alga Cystoseira barbata, gathered during the same day, in different points on the Romanian coast, records no sensible variantions from one sample to another.

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