

CONTRIBUTIONS TO THE STUDY OF THE ELEMENTARY
CHEMICAL COMPOSITION OF THE PRINCIPAL
MACROPHYTES ALONG THE ROMANIAN COAST
OF THE BLACK SEA

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ABSTRACT:

The seasonal variations of Na^+ , K^+ , Ca^{2+} and Mg^{2+} contents of Enteromorpha linza, Cladophora sericea, Cl. vagabunda, Cystoseira barbata, Ceramium elegans and Zostera marina + Z. nana are presented; the concentration of these elements varies according to their taxonomic pertaining, provenience location and season.

With a view to ascertaining the mode and level of concentration of the chemical constituents by the marine algae and phanerogams, since 1977 we approached a seasonal study on the quantitative accumulations of the major inorganic constituents: Na^+ , K^+ , Ca^{2+} and Mg^{2+} .

The data from literature reveal the phenomenon of intense concentration of inorganic chemical elements from the sea water by the algae since the beginning of growth till their whole maturity period is over (3,4). The chemical composition of the marine macrophytes - on the whole - must be considered as a function of several determinant factors which decide and justify the ratio of the components as well as the presence or absence of a certain element.

Our research work provides the first data referring to the Na, K, Ca and Mg contents of the principal macrophytobental species along the Romanian coast of the Black Sea.

MATERIAL AND METHOD

Researches were carried up on five algal species: Enteromorpha linza, Cladophora sericea, Cl.vagabunda (Chlorophyta), Cystoseira barbata (Phaeophyta), Ceramium elegans (Rhodophyta) and on the phanerogams Zostera marina + Z.nana.

The vegetal material was collected in the period 1977-1979, during May-June and August-September, and the collection locations were as follows: for Enteromorpha linza - Agigea; for Cladophora vagabunda - Tekirghiol; for Cystoseira barbata - Vama Veche, in 1977-1978, and Jupiter, in 1979; for Ceramium elegans - Agigea; and for Zostera marina + Z.nana - Eforie Sud.

This vegetal material, dried at 105°C, up to a constant weight, was calcined in a calcinatory at 480°C; from the resulted ashes, Na⁺ and K⁺ were determined flamephotometrically, and Ca²⁺ and Mg²⁺, by complexation with EDTA-Na₂ in ammoniacal medium.

The seasonal values of sodium, potassium, calcium and magnesium concentrations in the above mentioned species are shown in Fig. 1-6; each value on the graph represents an average of five determinations.

RESULTS AND DISCUSSION

From the analysis of the data in Fig.1-6, the following results are obtained:

Our determinations point out a specific capacity of concentration of Na⁺, K⁺, Ca²⁺ and Mg²⁺ by the marine macrophytes.

Thus, the sodium content varies between 6.39-24.95 mg/g dry substance in the green algae, 7.86-22.68 mg/g d.s. in the brown algae and 15.61-24.70 mg/g d.s. in the red algae.

The potassium content oscillates between 7.00-40.56mg/g d.s. in the green algae, 22.89-34.33 mg/g d.s. in the brown algae and 24.71-46.41 mg/g d.s. in the red algae.

Taking into account the average of the data obtained during three years of study, it results that both sodium and po-

tassium are found in greater quantities in the brown and red algae.

Calcium concentration took values ranging within 10.15-59.33 mg/g d.s. in the green algae, 16.27-33.25 mg/g d.s. in the brown algae and 27.00-50.31 mg/g d.s. in the red algae. Of all the analysed species, it is in Enteromorpha linza and Ceramium elegans that the greatest quantities of calcium are to be found (25.15 - 59.33 mg/g d.s. and 27.00-50.31 mg/g d.s., respectively).

Enteromorpha linza is the richest species in magnesium (9.08-17.55 mg/g d.s.). The magnesium content varies as follows: between 1.69-17.55 mg/g d.s. in the green algae, 1.22-5.65 mg/g in the brown algae and 1.07-9.38 mg/g d.s. in the red algae.

Cladophora sericea collected in August 1979, presented higher sodium, potassium, calcium and magnesium concentrations in comparison with those collected in May (Fig. 1).

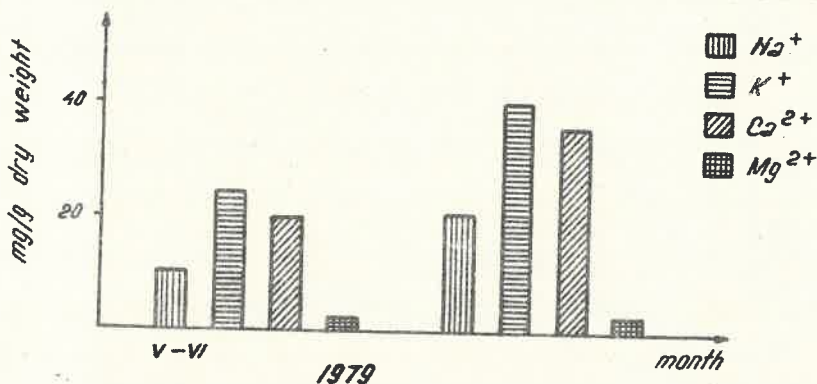


Fig. 1 - Seasonal variation of the Na⁺, K⁺, Ca²⁺ and Mg²⁺ content at Cladophora sericea

Determinations on the phanerogams Zostera marina+Z. nana indicate a sodium content within 9.77-14.73 mg/g d.s., potassium within 11.55-26.47 mg/g d.s., calcium within 23.69-50.83 mg/g d.s. and magnesium within 3.83-9.85 mg/g d.s.

In all the analysed species, calcium concentrations were higher as against those of magnesium, which had been found also by other authors (2, 4).

The variations of Na⁺ and K⁺ contents in the algae are strongly influenced by the zone of sampling - composition of sea

or lake water (1, 4). Thus, the variation senses of sodium and potassium concentrations are different in Enteromorpha linza, Cystoseira barbata, Ceramium elegans and the studied phanerogams, and the sodium content which was found out in Cladophora vagabunda is somewhat higher as against that in the marine species. Generally, higher sodium and potassium concentration values are found during the spring months, when, usually, an intensive development of the algal flora takes place along the Romanian coast - with the exception of Cladophora vagabunda in the Lake Tekirghiol and the phanerogams Zostera marina + Zostera nana.

Comparing the data obtained during the three years of study as concerns Ca^{2+} , a similar dynamics is found in Enteromorpha linza, Cystoseira barbata and Zostera marina + Z. nana, higher values being recorded in the spring months (Fig. 2, 3 and 4).

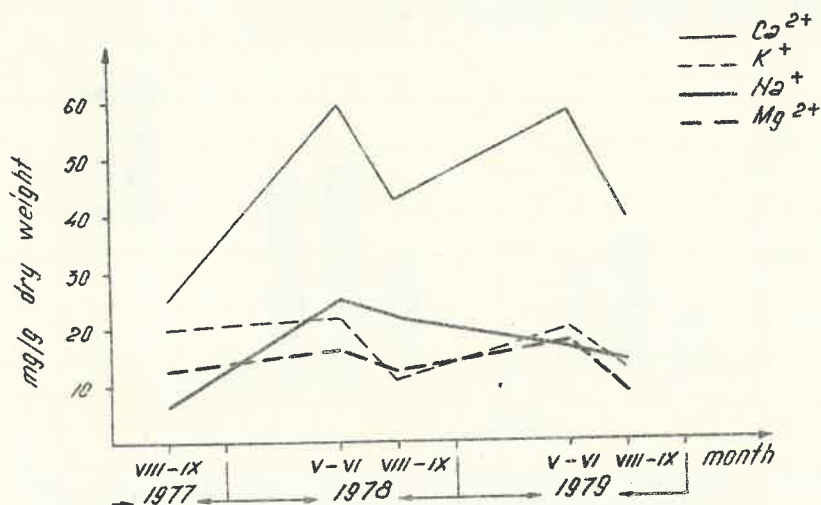


Fig. 2 - Seasonal variation of the Na^+ , K^+ , Ca^{2+} and Mg^{2+} content at Enteromorpha linza

In Cladophora vagabunda, high Ca^{2+} concentrations are found in summer; in 1979, an almost three times higher Ca^{2+} content was determined as compared with the other years (Fig. 5).

The seasonal dynamics of Ca^{2+} content has a totally different aspect in Ceramium elegans. The concentration of this chemical element rised gradually from 27.00 mg/g d.s., in 1977, to 50.04 mg/g d.s., in the summer 1978; it remained at a constant

value in the spring, 1979, after which a slight lowering followed during the summer, when it came down to 43.96 mg/g d.s. (Fig.6).

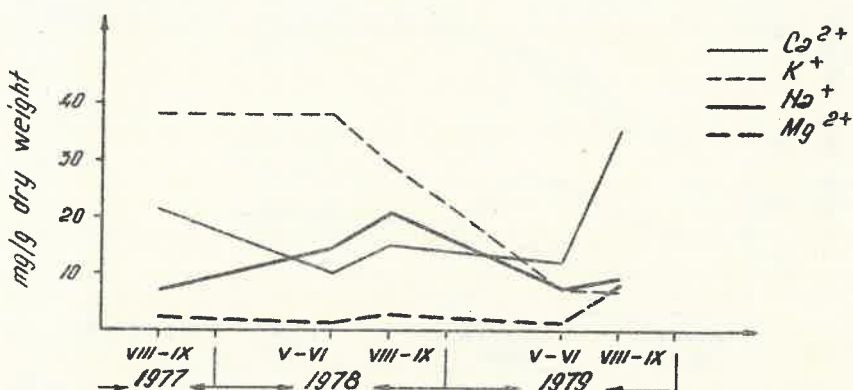


Fig. 3 - Seasonal variation of the Na⁺, K⁺, Ca²⁺ and Mg²⁺ content at Cystoseira barbata

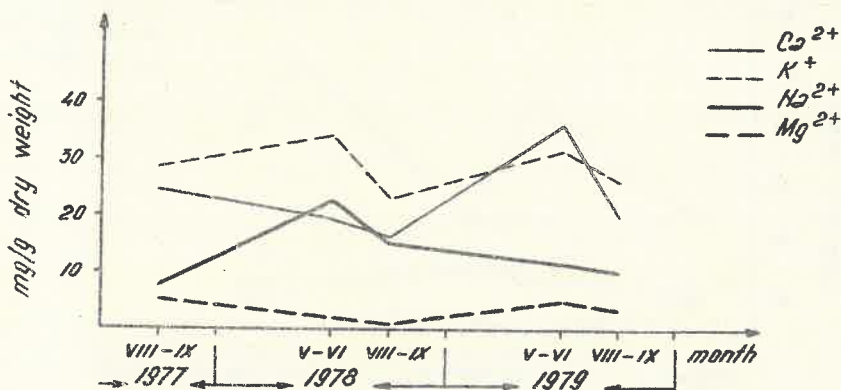


Fig. 4 - Seasonal variation of the Na⁺, K⁺, Ca²⁺ and Mg²⁺ content at Zostera nana + Zostera marina

As concerning the Mg²⁺ content, the species Enteromorpha linza, Cystoseira barbata and Ceramium elegans present similar seasonal dynamics, with higher values in spring, while in Cladophora vagabunda, which develops at high salinity, the variation sense is invers, with higher Mg²⁺ concentrations in summer; it is the same in the phanerogams Zostera marina + Z. nana (Fig.2-6).

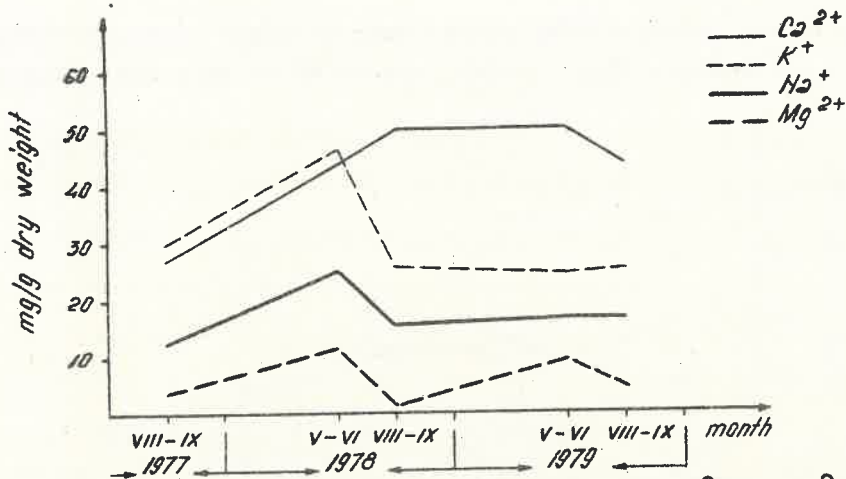


Fig. 5 - Seasonal variation of the Na⁺, K⁺, Ca²⁺ and Mg²⁺ content at Cladophora vagabunda

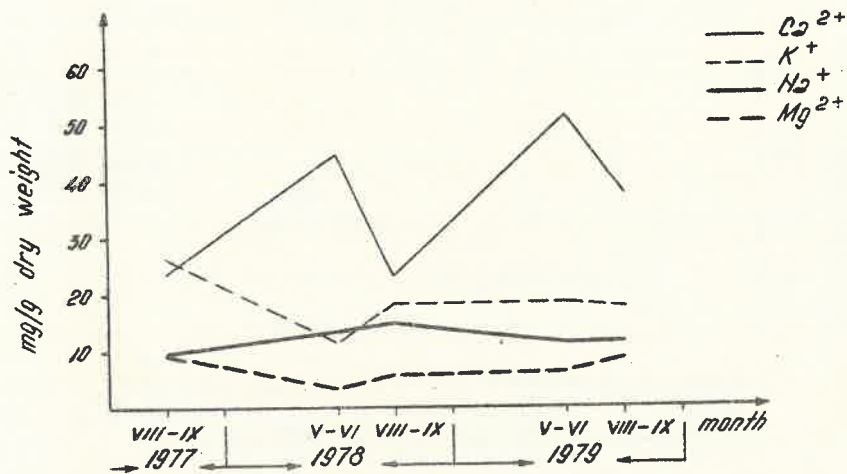


Fig. 6 - Seasonal variation of the Na⁺, K⁺, Ca²⁺ and Mg²⁺ content at Ceramium elegans

However, from our data, these seasonal fluctuations of sodium, potassium, calcium and magnesium concentrations are not well defined yet.

CONCLUSIONS

1. The chemical composition of the marine macrophytes

is determined by several certain factors; sodium, potassium, calcium and magnesium contents are variable as a function of their taxonomic pertaining, sampling area and season.

2. The sampling area (sea or lake) has a stronger influence on the sodium and potassium contents than on the calcium and magnesium contents.

3. The biochemical changes occurring during the vegetation period as a function of season are reflected in the variation of the content of different chemical elements; generally, in the analysed species, the sodium, potassium, calcium and magnesium contents are higher in spring.

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