

THE EFFECTS OF HEAVY METALS ON THE GROWTH AND SOME CHEMICAL CONSTITUENTS OF THE BROWN ALGA FUCUS VIRSOIDES (DON.) J.AG. (PRELIMINARY EXPERIMENT).

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Abstract

The effects of different concentrations of Zn, Co and Mn on the growth rate and some chemical constituents of the brown alga Fucus virsoides (Don.) J.Ag. were studied under culture conditions. The average increase in length, dry weight as well as ash and mannitol contents were determined after four weeks. Increasing concentrations of these ions in the media exert inhibitory effects on growth and mannitol production, which were most pronounced in the case of Zn.

Résumé

Les effets des différentes concentrations du Zn, Co et Mn sur la croissance et sur quelques constituants chimiques de l'algue brune Fucus virsoides (Don.) J.Ag. ont été étudiés en culture. Après quatre semaines on a déterminé la croissance en longueur, le poids sec et la teneur en cendre et mannitol. Il était possible de mettre en évidence une relation entre la croissance et la teneur en mannitol avec la concentration des métaux dans les solutions, l'effet inhibitoire du Zn étant le plus évident.

Brown algae are known as a reliable indicator for metal pollution in estuaries and in the sea because of their ability to accumulate and strongly bind metal ions. Some trace elements are essential for the cell metabolism whereas others are more or less toxic. The effects of different metal ions on growth and metabolism of seaweeds are, however, an important task in elucidating the role of heavy metals in the aquatic environment. In the present experiment the effects of three essential trace elements on Fucus virsoides were studied.

Methods

Adult specimens of Fucus virsoides, originating from the North Adriatic were kept in seawater (salinity 38.6 ‰) enriched with different concentrations of Zn, Co and Mn salts at 5°C and constant illumination. Media were changed every third day. After four weeks the average increase in length was measured in all branches (n = 10 to 20) and the dry weight determined (drying at 105°C for 24 hours). Afterwards the dried material from all the parallel samples was mixed and ground in order to obtain average values. Aliquots were analysed for the ash (combustion at 400°C) and mannitol contents (method Cameronal.).

media:	% increase in length	Table dry weight (g/100 g fresh weight)		ash (g/100 g dry weight)	mannitol (g/100 g dry weight)
control	7.5 \pm 0.14	18.0	\pm 0.51	29.0	5.94
metal enrichment(mg/l)					
ZnSO ₄ x 7H ₂ O					
2	6.0 \pm 0.18	13.5	\pm 0.33	23.5	4.40
20	4.7 \pm 0.16	16.5	\pm 0.35	26.8	4.05
40	1.0 \pm 0.18	16.7	\pm 0.30	28.0	3.56
60	0.0 \pm 0.00	18.4	\pm 0.40	29.7	1.92
CoCl ₂ x 6H ₂ O					
2	7.6 \pm 0.15	13.3	\pm 0.35	23.9	4.51
20	6.7 \pm 0.17	15.0	\pm 0.42	24.3	4.12
40	4.5 \pm 0.14	16.6	\pm 0.31	27.1	3.66
60	2.8 \pm 0.19	19.0	\pm 0.35	27.7	3.24
MnCl ₂ x 4H ₂ O					
2	7.0 \pm 0.13	15.0	\pm 0.57	23.9	5.29
20	5.1 \pm 0.12	17.3	\pm 0.45	34.2	4.53
40	4.6 \pm 0.17	17.5	\pm 0.50	35.6	3.78
60	3.0 \pm 0.18	19.8	\pm 0.34	36.1	2.48

Results

A comparative study of the effects of Zn, Co and Mn on the growth and chemical composition of *Fucus virsoides* revealed a decrease in growth activity and mannitol content with increasing metal concentrations, which was most pronounced in the case of Zn. At the highest concentration applied here Zn stopped growth activity and reduced mannitol production to a minimum, indicating an inhibition of assimilatory activity. Mn and Co still allowed growth and mannitol production at all concentrations, but were somewhat inhibitory at higher ones. Lower concentrations of Co induced fruiting, a phenomenon which was likewise observed during experiments with Atlantic fucoids.

An increase in dry weight with increasing metal concentrations was found in all the series and the same trend was obvious for the ash content, which was highest in plants from the Mn series.