

## Proteins in duckweed (*Lemna minor* L.)

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In view of the universal tendency to increase the proportion of animal products in the diet of the population, the problem of conversion of plant proteins into animal proteins is of great importance.

The majority of the world population actually consume from 12 to 15 plant species.

The main supply of plant proteins comes from cereal grains and legume seeds, but this does not exhaust the amount of protein available from vegetable sources. Proteins as a foodstuff in short supply can also be obtained from wild plants, which can substitute cereal proteins and could be fed to cattle (Altshull 1965).

Such water plants as *Lemna*, *Spirodella* and *Wolffia* belonging to the Lemnaceae are willingly eaten by poultry, particularly ducks. These plants have not yet been analysed as protein sources and their protein composition is unknown.

This paper is concerned with a preliminary analysis of the proteins in *Lemna minor*. Proteins were determined and then fractionated into albumins, globulins, glutelins and prolamins. The respective fractions were analysed by way of column chromatography.

### MATERIAL AND METHODS

*Lemna minor* cultivated in an aquarium in the laboratory was analysed. It was cultivated under natural aquarium conditions that is together with other water plants and fish. The *Lemna* plants were separated and analysed.

Proteins were fractionated by the method of Pleszkow (1968) using successively: 1 M NaCl in 0.5 M phosphate buffer at pH 7.3. After dialysis albumins and globulins were obtained. The globulins were dissolved in 0.2 M NaCl in the same phosphate buffer, glutelins — in 0.2% NaOH, prolamins — in 80% ethanol. The extracted protein fractions were determined by the Lowry method described by Mejbaum-Katzenellenbogen and Mochnacka (1968). The respective fractions extracted in the above mentioned way were placed in DEAE-SS cellulose (from Serva Laboratory) columns were prepared after Gorman and Levine (1966). The following gradients applied successively: 0.2 M NaCl in phosphate buffer at pH 7.3, 1 M NaCl in the same buffer, 0.1 M NaOH and 1% NaOH. Collection of the different zones into the fraction collector was made. Proteins were determined in the corresponding samples by the Lowry method.

RESULTS AND DISCUSSION

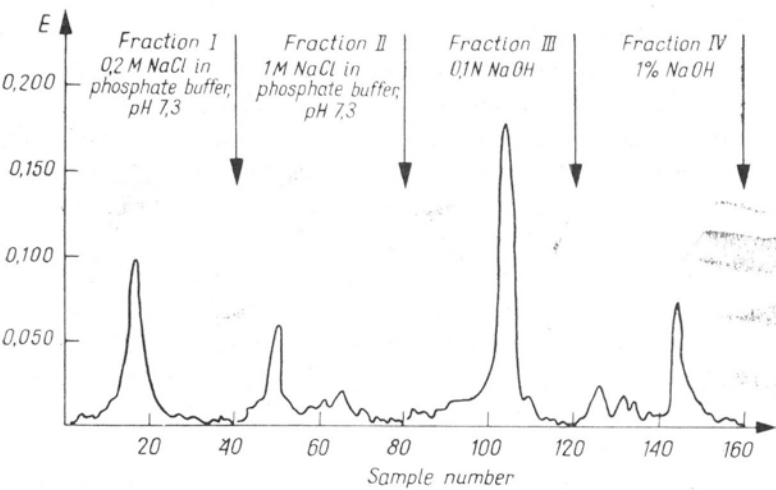
The results of our analyses showed a protein content of approximately 16 per cent for *Lemna minor*. This content is very high when compared with cereals in which it does not exceed 16%.

Duckweed protein is characteristic by its high content of albumins and a relatively low globulins content.

It seems interesting to compare these values found for duckweed with those obtained for other plants.

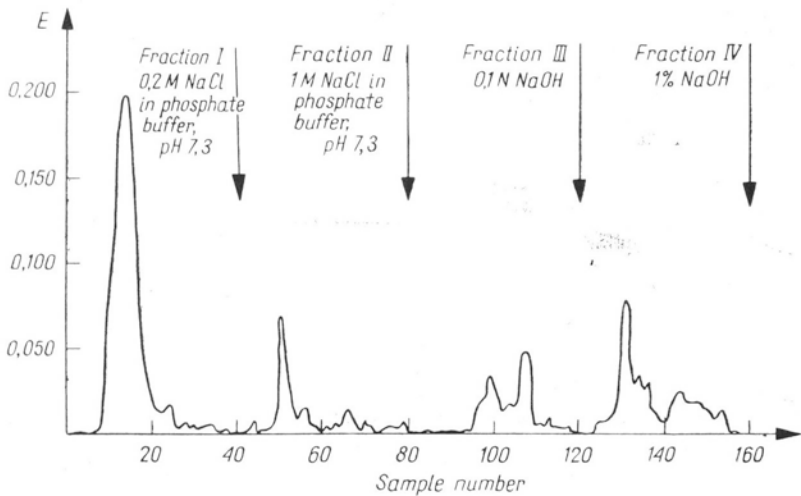
Protein content of some plant material (after Pleszkow — 1965) as compared with that of duckweed

Material	Total protein % in dry matter	Protein fraction as % of total protein			
		albumins	globulins	glutelins	prolamins
Seeds of:					
wheat	16	4— 7	20	25	20—40
oats	12	15	12—24	40	15
maize	10	6—14	7—23	30—45	50
rice	13	25	15—29	17	25
barley	12	13,9	5,8	31,3	35
sunflower	9—23	21,8	54,2	13,5	10,5
pea	28	34	60	6—13	not found
potato	8,75	not found	70—80	20—30	not found
duckweed	15,77	49,9	1,7	32,1	11,2



Graph 1. Chromatographic profile of albumins

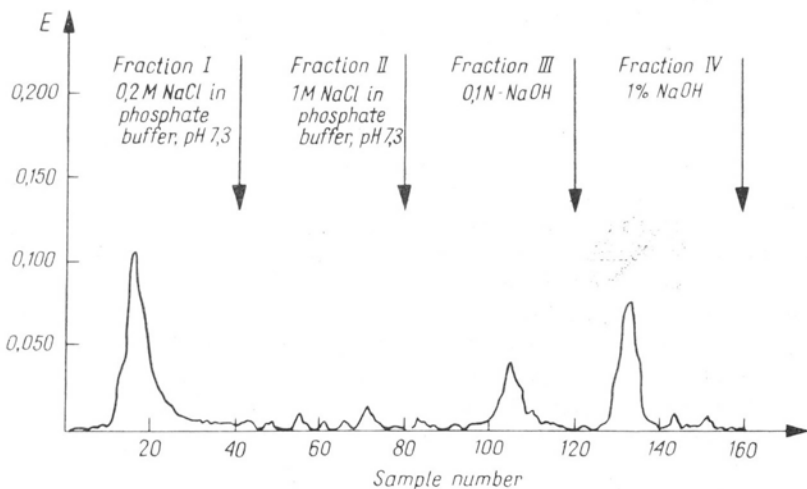
Such a high content (49.9%) of albumins as in *Lemna minor* is not met in other plants. Even protein-rich seeds of legumes contain only 34% of albumins. The prolamin content of *Lemna minor* is very similar to that of sunflower seeds, the glutelin content, however, is approximate to that found in barley and maize.



Graph 2. Chromatographic profile of globulins

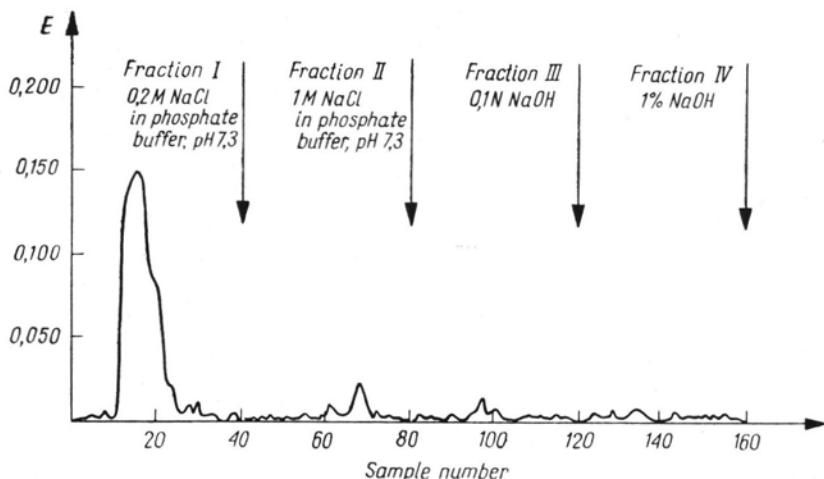
The results of the respective protein fractions separation on cellulose columns are shown in the graphs (figs. 1—4) representing the chromatographic profiles.

Taking into consideration the chromatographic profiles obtained, the high peaks of their first fractions should be emphasised, particularly in the case of globulins.



Graph 3. Chromatographic profile of glutelins

Among the proteins under examination albumins seem the most interesting because of their high level of the two fractions extracted with: 1) 0.2 M NaCl and 2) 0.1 M NaOH. There are only very few papers dealing with the separation of plant proteins on ion-exchange columns. Our results could be compared with those



Graph 4. Chromatographic profile of prolamins

of Pleszkow (1968) obtained for bean proteins characteristic by their high content of the corresponding fractions. A detailed separation of duckweed proteins on cellulose columns gives valuable information which fractions should be examined from the angle of their amino acid composition in connection with their nutritional value. The essential amino acid composition of the proteins occurring in *Lemna minor* will be the subject of our further investigations.

### SUMMARY

A preliminary analysis of the proteins in duckweed was made. Proteins were determined and then fractionated into albumins, globulins, glutelins and prolamins. The respective fractions were analysed by way of column chromatography.

The protein content in *Lemna minor* is very high: approximately 16%. This protein is characteristic by its high content of albumins and a relatively low globulins content.

Our results obtained for duckweed were compared with those found for other plants. The results of the separation of respective fractions on cellulose columns are shown in the graphs representing the chromatographic profiles.

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Białko *Lemna minor* L.

## Streszczenie

Dokonano wstępnej analizy białek rzęsy. Oznaczono białko całkowite oraz rozdzielono je na: albuminy, globuliny, gluteliny i prolaminy. Poszczególne frakcje analizowano metodą chromatografii kolumnowej.

Zawartość białek u rzęsy jest bardzo wysoka — wynosi około 16%. Białka te charakteryzują się wysoką zawartością albumin, a stosunkowo niską globulin.

Wyniki otrzymane dla rzęsy porównano z wynikami uzyskanymi dla innych roślin. Rozdział poszczególnych frakcji białek na kolumnach z celulozy ujęto w wykresach przedstawiających profile chromatograficzne.