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Shell morphometry of Chondrula tridens (O.F. MÜLLER) from the surroundings of Békéscsaba (Gastropoda, Enidae) - Békéscsaba környéki Chondrula tridens (O.F. MÜLLER) héjmorfológiai vizsgálata (Gastropoda, Enidae)

ABSTRACT: The paper deals with the morphometry of Chondrula tridens. The individual samples are compared by statistical methods. It was found that there is no substantial difference between the statistical characters of populations in individual biotopes, within a small region.

Introduction

I have been dealing with the morphometry of the shells of Chondrula tridens /O. F. MÜLLER/ since 1979 /DOMOKOS, 1979a, 1979b, 1981/. The first study of this kind is due to ROTARIDES /1931/, by publishing statistical data on Chondrula tridens.

ROTARIDES considers this species as very variable. According to him there is a great difference not only in the linear measurements of the shell, but also in the growth rate of the whorls depending on climatic factors and environmental conditions. Due to its sensitivity to ecological factors, this species appears suitable to indicate climate. ROTARIDES /1931 p. 120/ shows a possible task of further research saying: "If we had many recent and fossil populations, their statistical comparison would enable us to draw conclusions as to the climatic conditions of the loess period". However ROTARIDES' statement is too wide giving no full information on the concept of climatic conditions. Probably he thinks of the elements of microclimate. In my opinion the study of climate simplifies in strata of similar exposure and cover. The morphometric and statistical characters of the species under study may reflect differences in mesoclimate, possibly even in macroclimate, too. In my paper published earlier /DOMOKOS 1979a/ neight measurements /H/ in a recent Chondrula tridens sample were compared to see differences among four biotopes. I found that the interclass height lines of the Békéscsaba and Szabadkigyós collected and studied by myself exhibit a transitional character. In particular, they fall between the frequency of the sample collected on the Dorozsma sand dunes and on the south clayey-slope of the Fellegvár, at Kolozsvár /Fig. 1./.

The mode of the Kolozsvár population falls between 13.0-13,5 mm, the mode of the Békéscsaba population falls between 9.5-10.5 mm and the population of Dorozsma between 7.5-8.0 mm. Having these data it is seen that the height of the studied species tends to decrease from east to west towards the interior of Alföld. In other words, the height values of the biotopes closer to each other are more similar. A 0.2 mm height change may be attributed to 10 km change in distance. So the gradient of height decrease is about 0.02 mm/km in the direction mentioned. Considering the precision of measurements /± 0,5 mm/ and the optimum sample size /50/ no greater deviation from H exceeding the limit of error is

expected within the region of 50x50 km^2 I selected. To support this, I tried to find sample sites close to Békéscsaba, wich fall within the 50 x50 km^2 region which, in addition, ensure the optimum sample size. The sampling is optimal if the variables /H, W, H/W/ derived a proportion from of the total sample agree with those from the total. I know by experience that in case of a sample size of 50, for example, the mean of H/W can show -4% deviation, H nearly ± 2% and W ± 5% deviation /DOMOKOS 1981/. It means that in the above case the deviations do not exceed the precision reguired.

Material and method

When collecting the material for this paper there was no possibility to measure the different factors of microclimate. So I will attempt a comparative study of o<u>Chondrula tridens</u> populations found in the different biotopes from which some macroclimatic data are available.

The four study areas are on the south-eastern part of Alföld, a reltively short distance apart /Fig. 2./. The altitude of the study areas is 85-95 m above the Adriatic Sea.

The Localities and dates of collections are:

1. Loc.: Biharugra fish-ponds, the southern side of the dam covered by grasses. It lies approx. 55 km north-east of Békéscsaba.
   Date: 28. 08. 1979
   Sample size: 50
2. Loc.: Körösladány, the shaded southern bank of Folyás-rill covered by grasses. It lies approx. 30 km north of Békéscsaba.
   Date: 04. 07. 1979
   Sample size: 68
3. Loc.: Békéscsaba, southern side of the ring-wall with lawn regularly mowed.
   Date: 28. 10. 1977
   Sample size: 300
4. Loc.: Szabadkigyós steppe, lower part of the railway-bed covered with herbs and grasses and exposed to the west, sometimes it is under water. It lies approx. 12 km south of Békéscsaba.
   Date: 31. 08. 1977
   Sample size: 63

The material from the study areas is found in the collection of Munkácsy Mihály Museum, Békéscsaba.

The mean annual temperature of the study area is between 10 and 11 °C. In the period between Apr. 1 and Sept. 30 the mean temperature of localities 1 and 2 nearly 1 °C lower. In these biotopes, the annual precipitation is also less, between ounly 520-540 mm. The prevailing wind is north-eastern on the study area.

I measured the morphometrical characters /H = height, W = wigth/ of specimens with fully developed teeth using a slide-gauge with an error less then 5%. The elongation characterized by the ratio H/W, was calculated from the H and W values obtained, and the following characters of the quantitive-line, were also determined:

Δ = range of measurements /difference between the largest and smallest value/

A.m. = $\bar{x}$ = arithmetic mean
Mo = mode /most common value of the frequency distribution/
Me = median /value dividing the occurring values into two parts/

$$\delta = \sqrt{\frac{\Sigma x^2 - \left(\frac{\Sigma x}{n}\right)^2}{n-1}}$$ = standard deviation

$$V = \frac{1}{n} / \Sigma x^2 - \bar{x} \Sigma x /$$ = variance

X = linear measurement or ratio
n = number of observations

Results

The order of H values obtained are slown in Fig. 3., the relative frequencies of W and H/W in Figures 4. and 5. grouped according to localities. The table summaries the characters belonging to the frequency distribution curves. Besides my own data I also used ROTARIDES' H/W data from his mentioned paper. I calculated and tabulated the statistical characters of them.

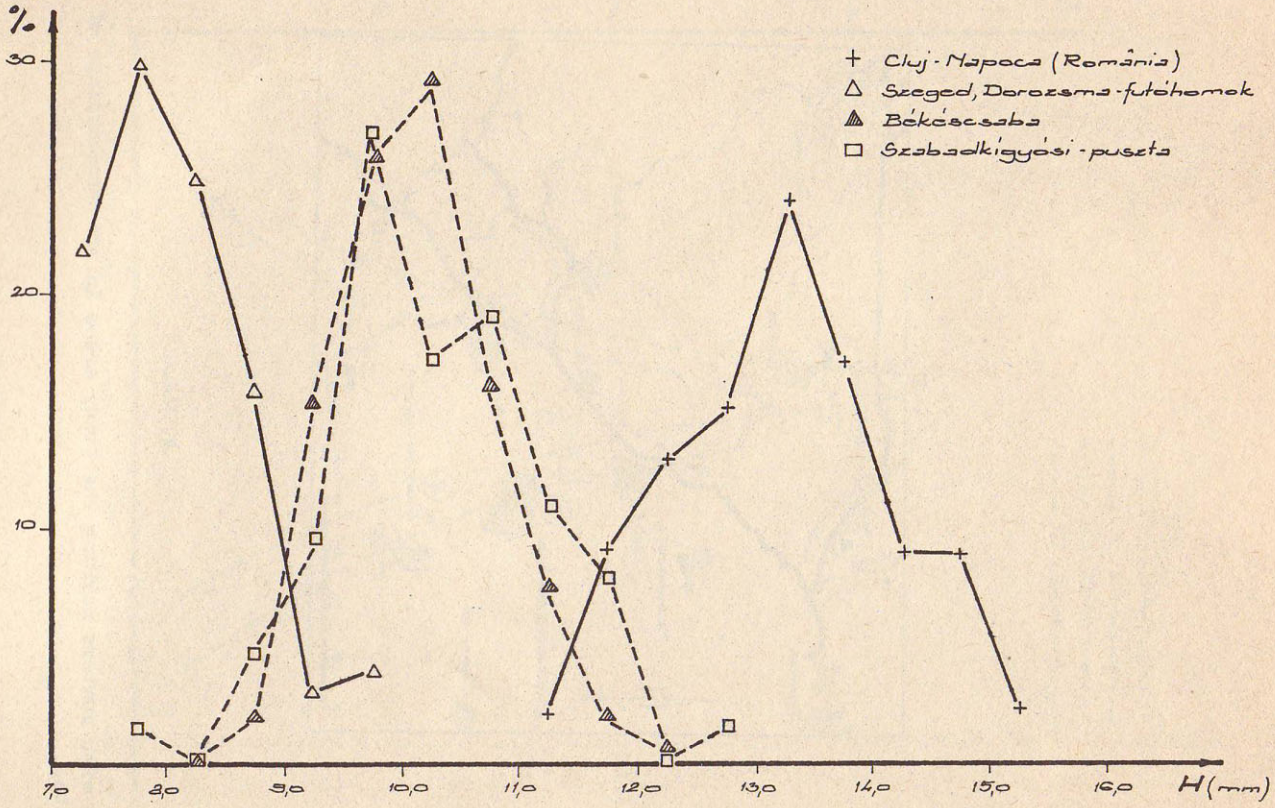
When comparing the Table with Fig. 2. and 3., it is proved that the frequencies of H from the four sample localities are in good agreement, since the derivation of some 0.1 mm-s between the individual biotopes is within the limit of error. The values of the standard deviation fall between 0.55 and 0.71 obtained so far, expect the biotope of Szabadkigyós /DOMOKOS 1981/. We have to consider the mixed character of the Szabadkigyós sample, because I collected it in locality covered temporarily by water from time to time. The curve of H/W ratio is more flattened than others, similarly to the curve of the fossil specimens found in the Öthalom loess, which also refer to this /Fig. 5., ROTARIDES 1931/.

It is interesting that the frequency curves of W are differenct in shape, in spite of the slight differences among statistical characters /Fig. 4./. The width of the shell of individuals from Biharugra is mostly differ from the Békéscsaba individuals. The Biharugra individuals have weaker mouth in spite of the prezence of teeth because of the conditions are not favorable for a full development. This influence can be removed with sampling in alarger area and collecting more generations, to get larger sample sizes. But these conditions are difficult to consider for the collector.

The comparision of the frequency curves of H/W ratios gives surprising result. There are only centesimal differences in the A.m., and decimal differences in the Mo and Me, except the samples from Szabadkigyós, and Öthalom loess. The statistical characters of these two localities different from the others can be connected with the mixed character of the sample mentioned earlier. When the statistical characters of the several sample localities are ordered, we obtain different results. It means that the influences of several, unknown ecological factors are reflected in the measured H and W, and in the calculated H/W values.

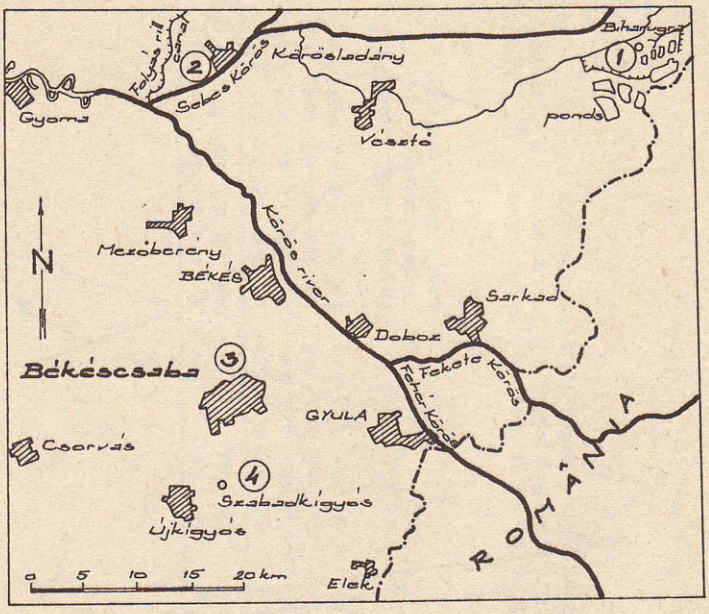
Localities /Specimens/	H						W						H/W					
	△ /mm/	A. m. /mm/	Mo /mm/	Me /mm/	σ	V	△ /mm/	A. m /mm/	Mo /mm/	Me /mm/	σ	V	△ /mm/	A. m /mm/	Mo /mm/	Me /mm/	σ	V
Biharugra /50/	2.9	10.10	9.7	10.0	0.72	0.52	1.2	3.93	3.9	3.9	0.18	0.034	0.6	2.50	2.5	2.5	0.13	0.018
Körösladány /68/	3.2	10.02	9.6-10.0	10.4	0.66	0.44	0.8	3.96	4.0	4.0	0.18	0.033	0.6	2.48	2.4	2.5	0.12	0.016
Békéscsaba /300/	4.0	10.18	10.0	10.5	0.67	0.46	1.1	4.12	4.2	4.1	0.19	0.037	0.8	2.42	2.4	2.4	0.13	0.018
Szabadkigyós /63/	4.1	10.38	9.7	10.8	0.83	0.69	0.8	3.99	4.0	4.0	0.20	0.042	1.0	2.54	2.5	2.6	0.19	0.036
							Szeged; Dorozsma, futóhomok /68/						0.9	2.46	2.5	2.5	0.15	0.022
							Kolozsvár, fellegvár /46/						0.6	2.43	2.4	2.5	0.14	0.020
							Szeged; Öthalom, 15sz /100/						0.9	2.79	2.8	2.8	0.18	0.035

Table. Basic statistics of morphological characters of G. frumentum specimens from various localities /H = height, W = width, H/W = measure of elongation, △ = range of values, A. m. = arithmetic mean, Mo = mode, Me = medium, σ = standard deviation, V = variance/.



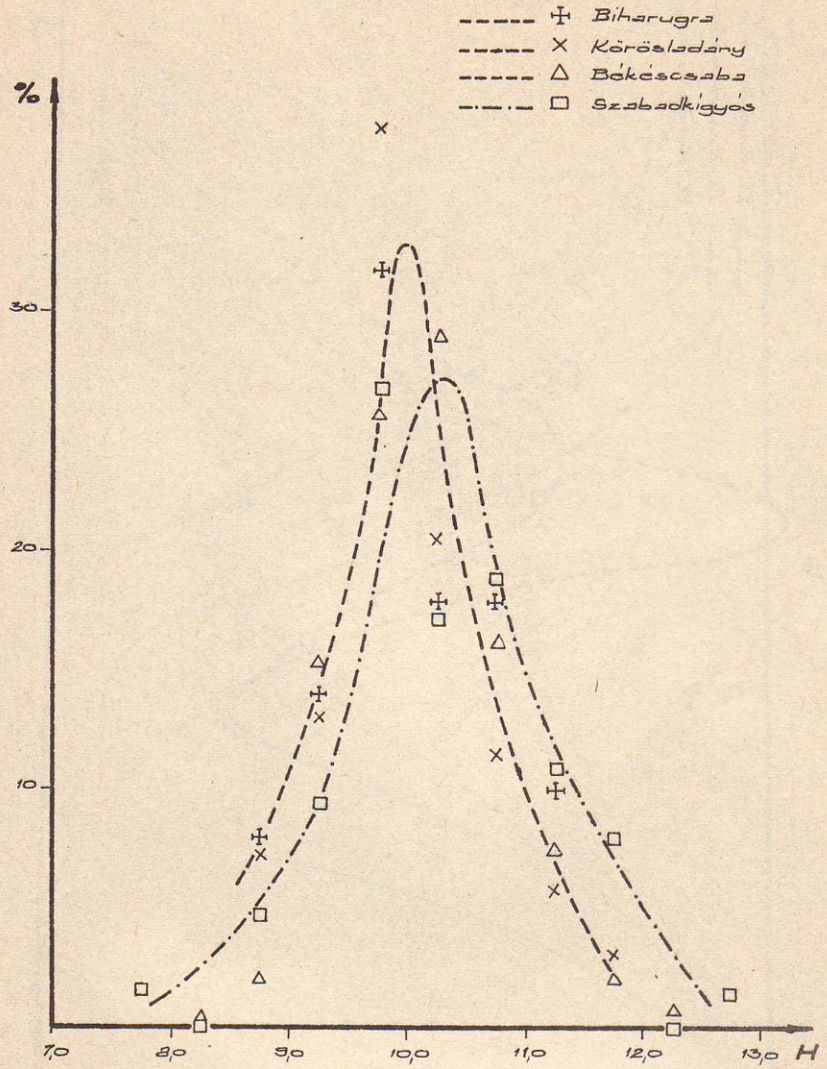
1. ábra

Frequency curves of height /H/ of Chondrula tridens coming from several study areas.



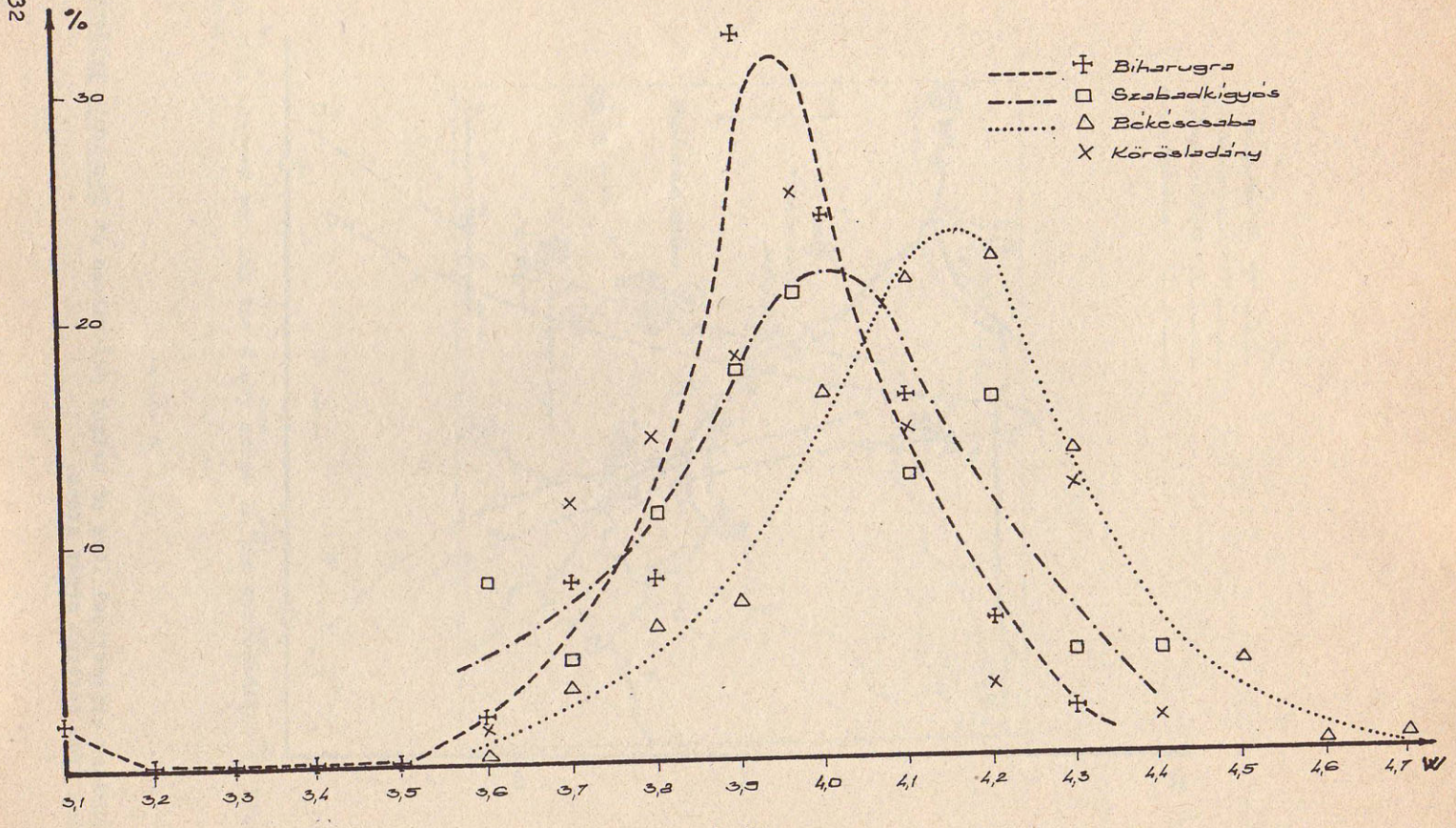
2. ábra

Map with numbers marking the study areas in the surroundings of Békéscsaba.



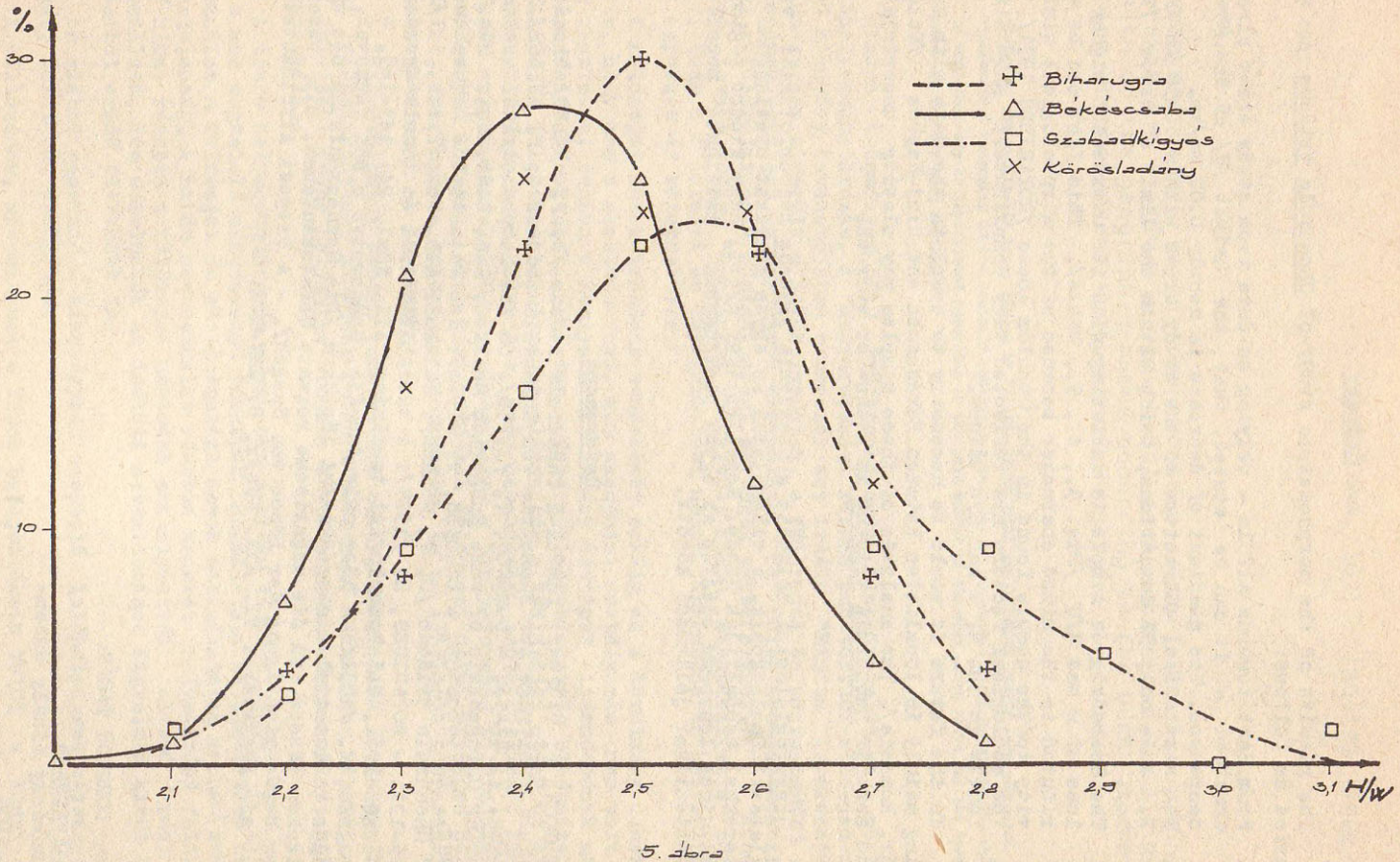
3. ábra

Interclass aritmetical line of height /H/ values of Chondrula tridens coming from several study areas.



4. ábra

Frequency curves of width /W/ values of Chondrula tridens coming from several study areas.



5. ábra

Frequency curves of elongation /H/W/ of Chondrula tridens coming from several study areas.

Sammary

The results of the morphometric study of Chondrula tridens are summaried as follows:

1. From East towards Alföld - relying on data from study areas already examined - it can be stated, that the height /H/ of the shells decreases. The gradient of decrease is nearly 0.02 mm/km.
2. The statistical characters of the study areas within 50x50 km /Fig. 2./ show only 5% deviations, being within the limit of error /Table/.
3. The Szabadkigyós sample is deviating with its unexpected higher values of H and H/W /Fig. 3., 4., 5., Table/. This fact can be attributed to the mixed character because of the morphological similarity to the sample found in the Öthalom loess /ROTARIDES 1931/.
4. The ecological factors are reflected very complicately and differently in the H, W and H/W values.

In the future it would be necessary to complete the data with sampling mainly in localities between Békéscsaba and Cluj-Napoca /Kolozsvár, Romania/. The analysis of these samples may clavity uncertainties, and show if Chondrula tridens is steno- or euryoek.

Összefoglalás: A dolgozat a Chondrula tridens héjmorfológiai vizsgálatával foglalkozik. A vizsgálatok az egyes mintákat statisztikai módszerekkel hasonlitják össze. Megállapitást nyert, hogy kisebb régión belül nincs lényeges eltérés az egyes biotópokban található populációk statisztikai jellemzői között.

References

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