Fol. Hist.-nat. Mus. Matr. 6.1980.

DATA TO THE MORPHOMETRY OF THE SPECIES ANISUS VORTEX (L.) (GASTROPODA, PLANORBIDAE)

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Abstract: The biometry of *Anisus vortex* (L.): radial growth does not follow a logarithmic spiral but a power function. Up to whorl-numbers 4 or 5, with the 25-individual groups the deviation of the mode of the Balatonmária material is about 5 p. c. With *Anisus vortex* the growth-lines smaller in number than with *Anisus septemgyratus*.

Introduction — Several papers deal with cell-morphology and anatomy of the family Planorbidae (WAGNER, 1929; SOÓS, 1935; HUBENDICK, 1951; PARAENSE, 1956; SCHUTTE—EEDEN, 1959; FRANCK—MEYLING, 1966; HUDEČ, 1967; DOMOKOS, 1976, 1977, 1978). The morphology of the *Anisus* genus was studied more circumstantially by HUBENDICK (1951), HUDEČ (1967) and DOMOKOS (1977, 1978).

I have been studying the whorl-growth for years: the biometry of *Anisus septemgyratus* was published in two papers (DOMOKOS, 1977, 1978).

The results were compiled form literary data (WAGNER, 1929; THOMPSON, 1942; FRANCK—MEYLING, 1966), by means of a geometrical, or more precisely graphical evaluation, having presumed the theory of a growth according to a logarithmic spiral.

[$R_n = R_1 e^{2\pi m(n-1)}$ where R_n is the radius of the n^{th}, R_1 that of the first whorl, in a polar system of co-ordinates. m = constant, the value characteristic to the genus (Fig.1).]

By controlling the results it was proved that the growth does not follow a logarithmic spiral as presumed earlier by WAGNER. I tried to save the logarithmic evaluation by splitting up the function log lor — K(r = R, K = = WN = whorl number) into straight sections. Thus the results up to now are only of approximate character and can be regarded merely as an expedient. In reality, the two sections of growth are not separate, one passing gradually into the other.

Thus, did I begin to study the species *Anisus vortex* L. Having amassed a sufficient quantity of individuals for statistical studies (from two biotopes, both populations come from the southern shore of Lake Balaton) I proceeded.

1. loc.:Balatonmária
dat.: 15. 07. 1961
leg., det.: Á. KÁROLYI
sample: 100

2. loc.: Szántód
dat:. 11. 07. 1976
leg., det.: T. DOMOKOS
sample:59

Thanks are due to Dr. ANDOR RICHNOVSZKY for the Balatonmária sample.

I can give the characteristics and the associated species only for biotope 2.

Habitat: Lentic water, pH changes cyclically. Eutrophic, reed-grown area with close-set vegetation. Population density: 680/m^3. 61 pcs. *A. vortex* turned up from a 0.25 m^3 detritus.

Associated with species: *Valvata cristata* O. F. MÜLLER, *Bithynia tentaculata* (L.), *B. leachi* (SHEPPARD), *Acroloxus lacustris* (L.), *Lymnaea palustris* f. *corvus* (O. F. MÜLLER), *Physa fontinalis* (L.), *Planorbarius corneus* (L.), *Planorbis planorbis* (L.), *Bathyomphalus contortus* (L.), *Segmentina nitida* (O. F. MÜLLER), *Succinea elegans* RISSO, *Oxychilus draparnaudi* (BECK), *Zonitoides nitidus* (O. F. MÜLLER), *Euconulus fulvus* (O. F. MÜLLER), *Perforatella rubiginosa* (A. SCHMIDT), *Unio tumidus* RETZIUS.

By dividing the studied material in smaller groups (25 samples), I tried to determine the minimal number of individuals needed to a sampling that is still good, i. e. suitable for further investigations, since the main obstacle in satistical analyses is the small number of individuals available.

Measuring was made by means of a magnifying-glass with 0.1 mm scale division. When executing the measurings, it was problematic to choose the origo, marked with O in Fig. 1. (It is on the basis of guessing and eye for proportion, that is why I made unavoidably a permanent measuring-technical mistake.) Besides personal mistakes, one has to reckon also with mistakes issuing from the unequal growth of the shell. The permanent measuring-technical mistake is extenuated by a drawing-out between the measuring-points, even in the case of only one individual. The whole whorls and the half ones spread opposingly. With the growth of the whorl-number the percentage of the mistake decreases gradually up to a stretch, while the extent of the measur ing shows an increasing tendency. Because of the fewer number of the individuals disposing of larger whorls in the population the uncertainty is greater with the larger whorls.

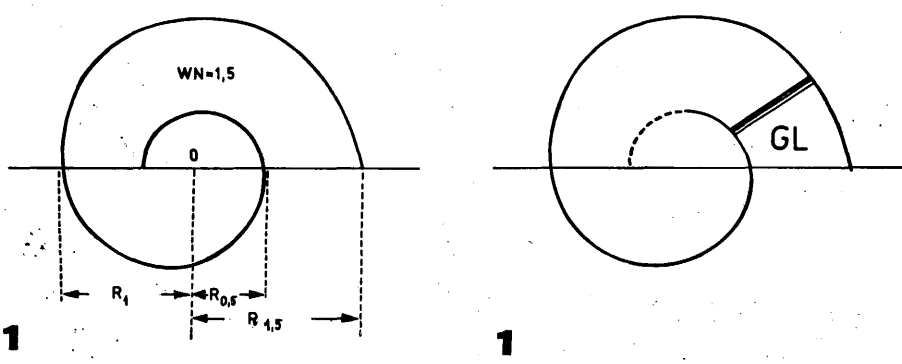
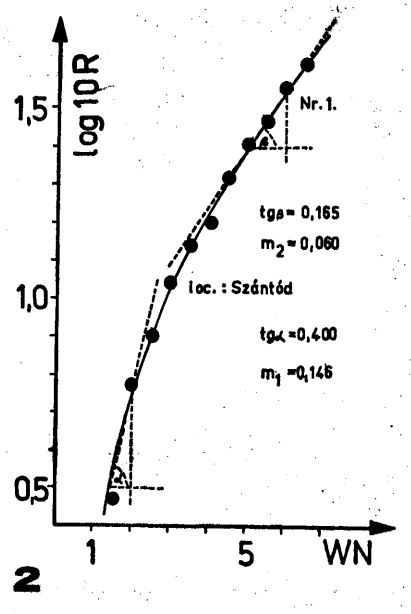


Fig. 1. a—b. Parameters of shell: O — origo, R — radius, WN — whorl number, GL — growth lines.

Results, conclusions — 1. During the exploratory analyses it was found that a significant deviation could arise during the evaluation according to the logarithmic spiral (Figs. 2, 3). Figure 2 shows clearly the unequal funcion curve that inspires a conception supposing two independant sections. The value of m_1 is higher than that experienced with *A. septemgyratus*, and the value of m_2 is



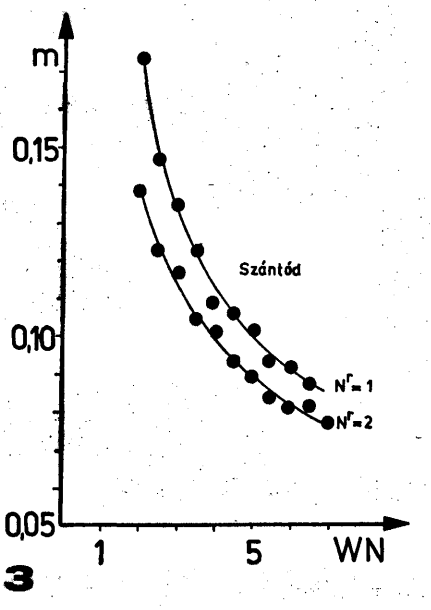


Fig. 2. Relationship between log 10R and WN. — Fig. 3. Relationship between m and WN.

similar to the higher values of Baja (DOMOKOS, 1977). Figure 3 shows unambiguously that the term (m), supposed to be constant, of the exponent characterizing the pace of growth changes gradually and decreases to about half. That means, naturally, that the radial growth of the whorls of *A. vortex* gradually slows down. The results connected with the characterization of the shell-spiral are contained in histograms R—WN, in graphs (Figs. 4—11), as well as in a table. The modes R of the two biotopes show a good agreement. The modes of the individuals of the Szántód biotope area perhaps somewhat greater (Fig. 10). The WN dependence of the parameter R of the Szántód material can be described with a good approach by the following power function: $R = 0.15\ K^{1,78}$ (Fig. 11). The approach is very good over WN = 3, and the deviation is only a few percent. On the basis os the figures (Figs. 4—9) and the table it can be found that the groups of 25 specimens already gie a relatively well reproducible result, and it is only with higher whorls that a more significant deviation is to be experienced.

2. While measuring the radii belonging to the whorls, I observed also the localization and the number of the growth-lines that are to be found on the shells. The appearance of the growth-lines is less characteristic of *A. vortex* than of *A. septemgyratus* (Figs. 12, 13; DOMOKOS, 1978). On 72. 4 p.c. of the Balatonmária *A. vortex* there is no growth-line, while the wrinkle is missing only on 18.6 p.c. of the *A. septemgyratus*. That can have ecological, genetical reasons. The reason has to be looked for either in the more balanced life conditions or in the makings of the species. The comparison is made more difficult by the fact that no or only few samples of *A. vortex* turned up in the biotope of the studied material of *A. septemgyratus*. With the Balatonmária individuals the number of growth-lines as well as the whorl-number (WN) of the individuals is higher than in Szántód (Fig. 14). This fact cannot be squared with the facts experienced with. *A. septemgyratus*. (Here the higher WN-values are attached to smaller of growth-lines; DOMOKOS, 1978.) In an interesting way, the value of the modes that can be read of the polygon (Fig. 14) is smaller than those published by SOÓS (1956). Consequently, further investigations are needed.

I should like to thank Mr. LÁSZLÓ PINTÉR and Dr. ANDOR RICHNOVSZKY for their help they gave me in preparing my paper. Thanks are also due to. Mrs. ÉVA MEGYESI for drawing the figures.

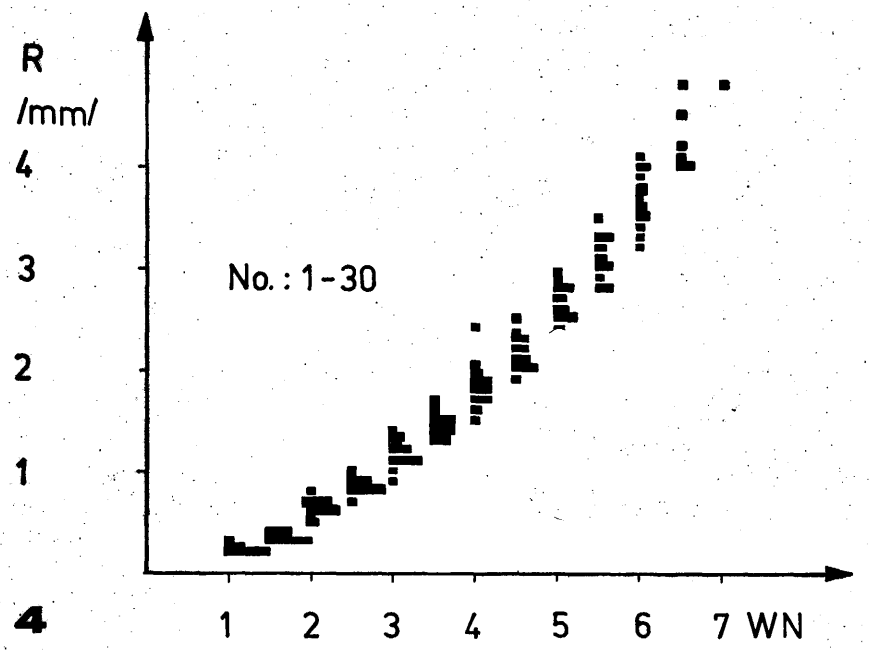
WN	R(mode) Balaton-mária	Balatonmária				Szántód	
		Serial number					
		1—25	26—50	51—75	76—100	1—30	31—59
		Devitations from mode					
1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
1.5	0.3	0.0	+0.1	0.0	0.0	0.0	0.0
2.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
2.5	0.8	0.0	+0.1	0.0	0.0	0.0	0.0
3.0	1.2	−0.1	+0.1	0.0	+0.1	−0.1	−0.1
3.5	1.4	+0.1	+0.1	0.0	0.0	0.0	0.0
4.0	1.9	−0.1	0.0	−0.1	+0.1	—0.1	−0.1
4.5	2.1	−0.1	0.0	0.0	+0.1	+0.1	+0.1
5.0	2.6	+0.1	+0.1	−0.1	+0.2	−0.1	0.0
5.5	3.0	0.0	0.0	0.0	+0.2	0.0	0.0
6.0	3.8	0.0	0.0	−0.3	−0.4	−0.3	—

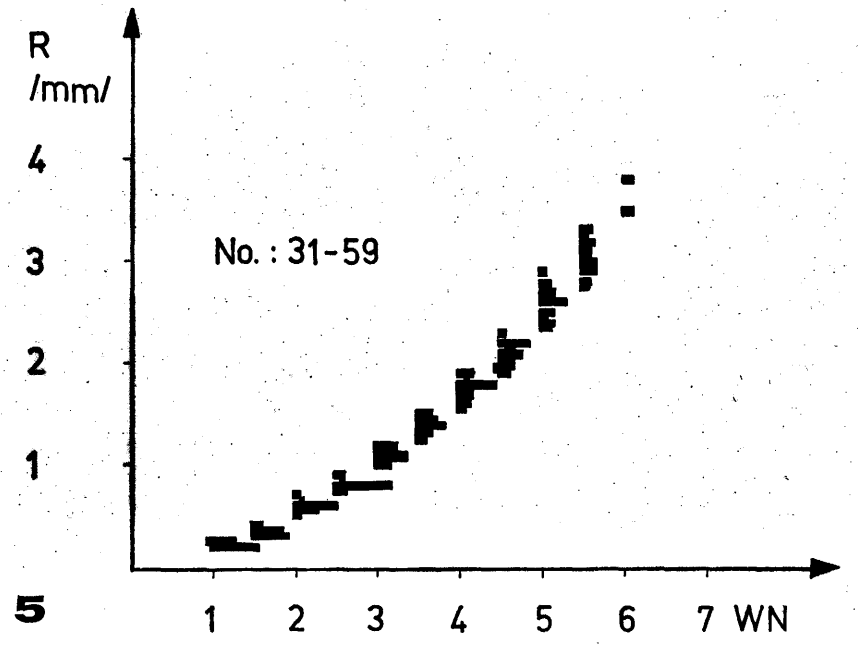
A year's production of the low shruos on one hectare area of forest is 161.553 kg organic material. Of this 24.84 % (40.137 kg/ha) is produced by *Ligustrum vulgare*, 15.81 % (25.546 kg/ha) by *Cornus sanguinea*, 15.13 % (24.444 kg/ha) by *Euonymus verrucosus*. The total production of the other species is 71.426 kg/ha (44.22 %). The distribution of the production according to species in shown is Fig. 1. The distribution according to fractions is a follows: foliage represents 63.808 kg/ha (39.50 %), a year old twig 55.377 kg/ha (34.28 %), branch 42,368 kg/ha (26.22 %), x (Fig. 2).

A year's old production of the different species was compared with the above-ground phytomass of the same species. The quantity of production generally amounts to 32—85 % of the above-ground phytomass.

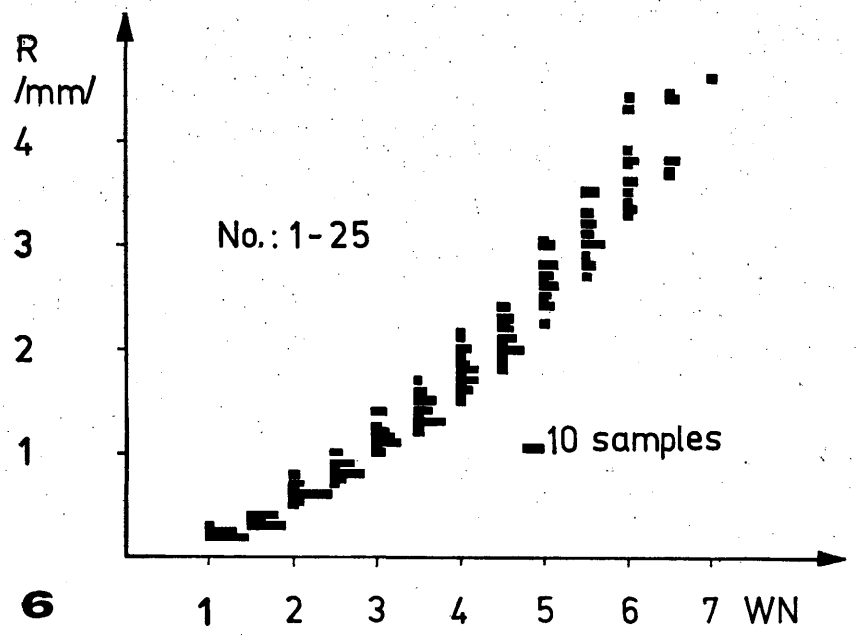
DOMOKOS, T.: ADATOK AZ ANISUS VORTEX L. FAJ MORFOMETRIÁJÁHOZ (GASTROPODA: PLANORBIDAE)

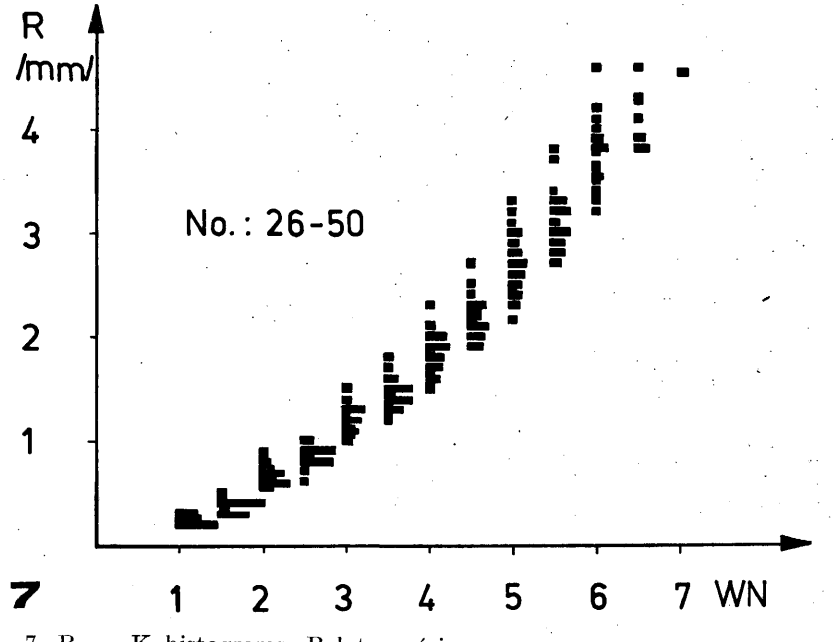
Az *Anisus vortex* L. faj sugárirányú növekedése nem logaritmikus spirál, hanem hatványfüggvény szerint történik. 4,5 kanyarulatszámig a 25 egyedes csoportoknál a modusztól az eltérés 5 % körüli érték. Az *Anisus vortex*-en a növekedési vonalak kisebb számban jelennek meg mint az *Anisus septemgyratus*-on.



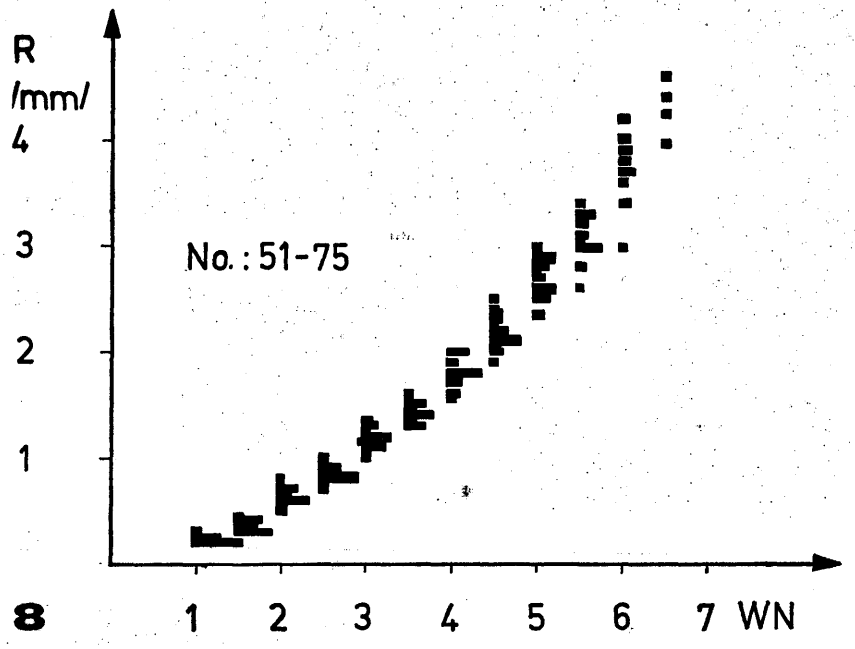


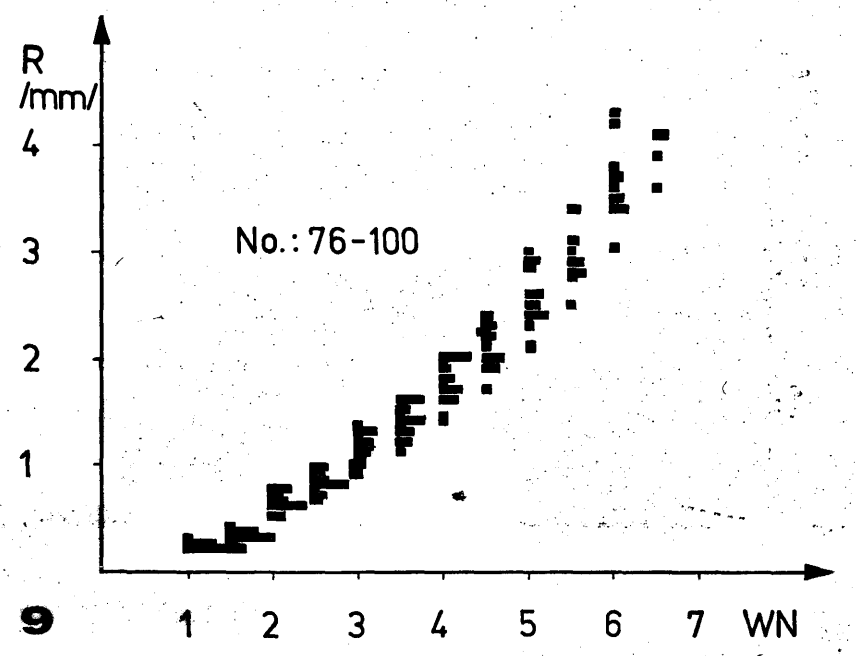
Figs. 4—5. R — K histograms. Szántód



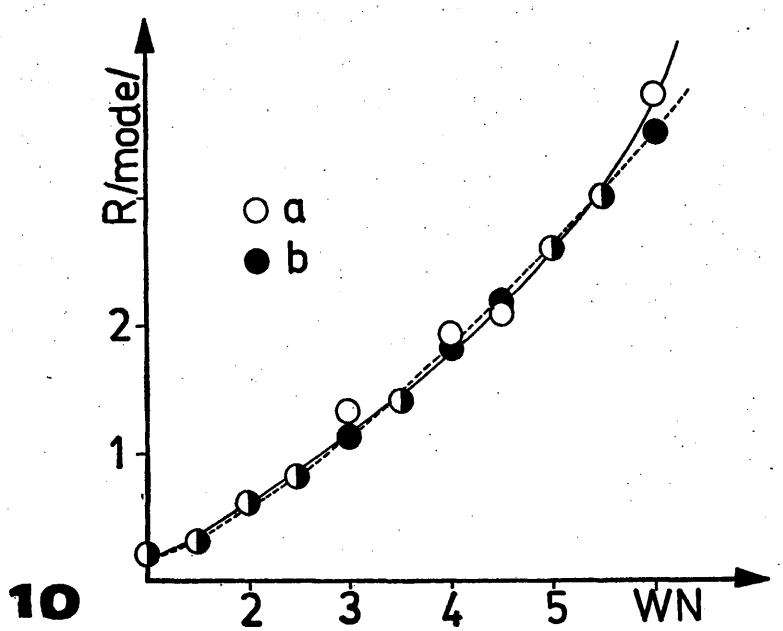


Figs. 6—7. R — K histograms. Balatonmária





Figs. 8—9. R —K histograms. Balatonmária



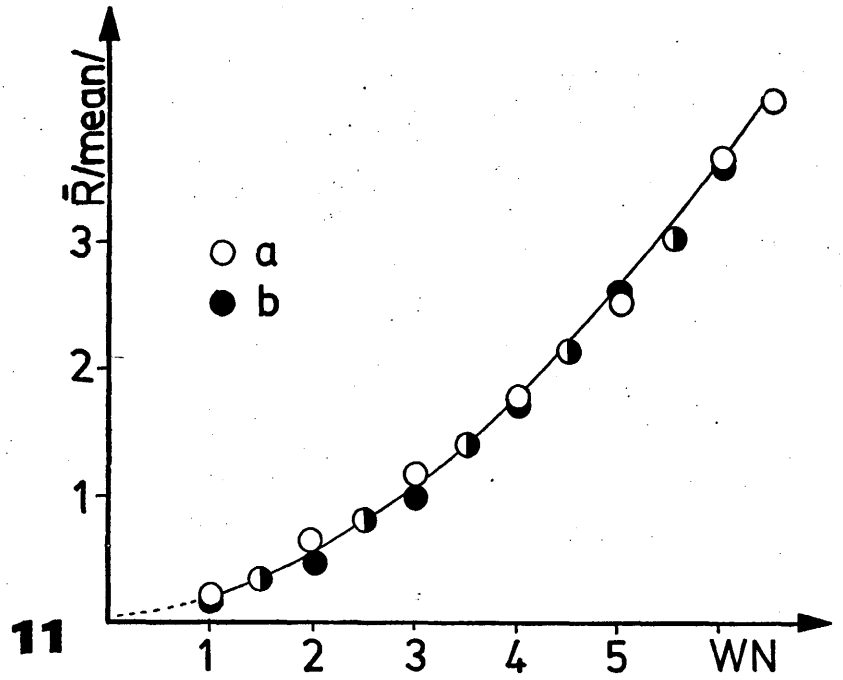
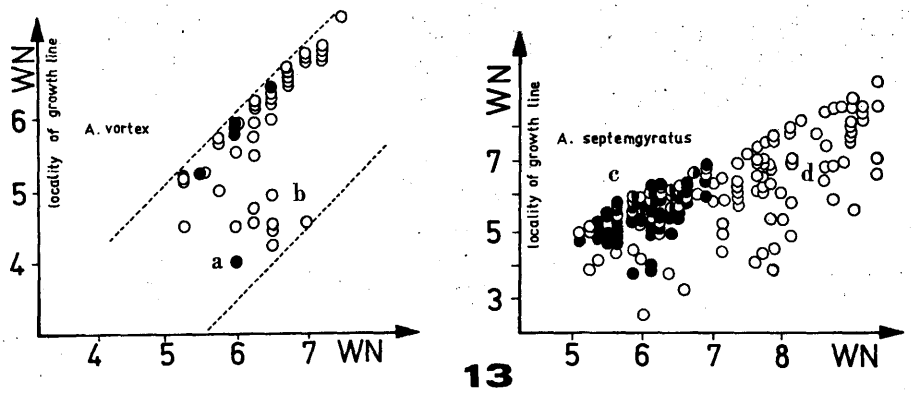


Fig. 10. Relationship R mode and WN. a — Szántód, b — Balatonmária (both Com. Somogy). — Fig. 11. Relationship between R (mean) and WN. a— measured value, b —calculated value.



Figs. 12—13. Locality of growth lines as a function of the last whorl a — Szántód, b — Balatonmária (both Com. Somogy), c — Baja (Com. Bács-Kiskun), d — Csurgó (Com. Somogy).

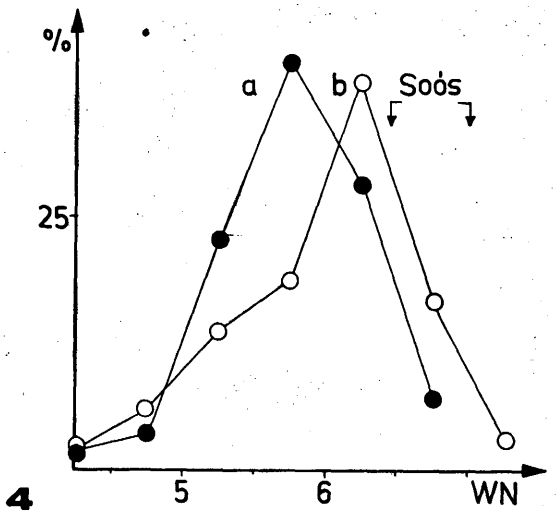


Fig. 14. Frequency curves. a — Szántód, b — Balatonmária (both Com. Somogy).

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Received: 1979. X. 10.

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