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Is *Drobacia maeotica* a phantom species? Data on the shell morphology, genital morphology, and autecology of *Drobacia banatica*[1] (Rossmässler, 1838) and *Drobacia maeotica* (Wenz, 1926), as well as some biophysical and biochemical notes

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Abstract: The author deals with the shell morphology, genital morphology, and autecology, as well as some biophysical and biochemical problems, of the species *Drobacia banatica* (Rossmässler, 1838) and *Drobacia maeotica* (Wenz, 1826). The analysed samples originated from Hungarian Lowland and Munţii Apuseni (Romania). It was found that recent *Drobacia banatica* and recent *Drobacia maeotica* are not regarded as two independent species; they have become morphologically (shell, genital) fused into each other, in other respects they are ecotypes or variants.

Keywords: normal distribution, linear width model, elongation as a function, zoogeography, Carpathicum, Praecarpathicum, optimal zone, Glandula pheromongena, chemotaxonomy

1. Introduction

In September 1972 and August 1974, Károly Bába and Gyula Kovács performed studies of the mollusc fauna in Pasul Pietra Craiului, Defileul Crişului Repede, and Cheile Turzii, learning of malacofaunistical correspondence between the Hungarian Lowland and the Apuseni Mountains (Romania).

In August 1974, I went with Gyula Kovács to the Vadu Crişului gorge. Here, close to a railway tunnel I experienced the expressive abundance of the *Drobacia banatica* species for the first time (BÁBA & KOVÁCS, 1975). After eight years in Vadu Crişului near Zicsy cave / Peştera de la Vadu Crişului, I set about a shell morphological investigation of the *Drobacia banatica* species. In ~ 40 years 46 samples/1839 specimens (approximately 40 specimens from a biotope) gleaned from the Hungarian Lowland and the Apuseni Mountain (Romania) were used partly or completely for comparative biometrical measures.

Before 1990, living specimens were measured at home; after 1990, they were measured in the course of field work. [The Hungarian Red Bookwas published in 1990 and the register of protected plants and animals in Hungary was published in 1993. Both of these registers include the *Helicigona/Drobacia banatica* species (DOMOKOS, 2007).] In my present papers, I sum up the results (DOMOKOS, 1986, 1987, 1992a, 1992b, 1994, 2001; BÁBA & DOMOKOS, 1992, SZABÓ & FINTHA, 1999, DOMOKOS & RÉPÁSINÉ, 2001, BÁBA & DOMOKOS, 2002, DOMOKOS, VÁNCSA & SÁRKÁNY-KISS, 2002, DOMOKOS, LENNERT & RÉPÁSINÉ, 2003, DOMOKOS, FINTHA & GASKÓ, 2005, DELI & FARKAS, 2006, DOMOKOS & DELI, 2006/7), and amplify these autecological, anatomical effects. In the course of investigation, I also aim to

[1] Earlier, these species were classified in the genera *Chilostoma*, *Helicigona*. Of late, it has been included in the genera *Drobacia* Brusina, 1904 based on anatimical and shell morphometrical studies (Ex verbis Subai).

reply to a *banatica*─*maeotica* dilemma raised by Lajos Soós. According to Lajos Soós, the morphological relation between *H.* (*Drobacia) banatica* and *H. (Drobacia) maeotica* can be not cleared up (SOÓS, 1943).

2. Shell morphological comparison of the two species

A/ Drobacia banatica

Among others height, with (large, small), elongation, spiral, suture, and whorl of the shell are used for the description of character of snail shell. I measured the height and width of the shell with callipers, and I calculated elongation from these data. While the measure of the width was accurate (± 0,2 mm, ~1%) this was inaccurate for the height values (±1 mm, ~ 6%) because of the adventitious location of the colummellar axis. After the measuring of morphometrical properties, I made frequency graphs and calculated statistical properties (Aritmatic mean, mode, standard deviation). If the number of samples reaches ~30 individuals, distribution is normal, is bell-shaped, by chance is obliquely dispersed (Fig.1.). I suppose that population was mixed in biotope.

Fig.1 shows that the relative frequency curves closely resemble each other. The bias is produced by a thickening of the lip.

If the number of samples is low, ecological factors have inhomogeneity the distribution is not normal; frequency curves are in zigzags. (Fig. 2. : ─■─ and ─□─, ─▲─ and ─●─).

The first statistical calculation of shell morphological parameters were connected with LUPU, 1966 as well as CLAUSS, 1979.

LUPU, 1966 determined height, width, elongations of the shell and the mouth item mean value of samples in case of 10 specimens of the *Drobacia banatica* (collected in the Southern Carpathians: Sinaia, Vaideeni-Horezu) and *Drobacia maeotica* (Apuseni Mountains: Stâna de Vale). Lupu' samples are indicated in Fig. 2. with pecked lines (■ and □). These lines are far off curves of the normal distribution. In my opinion, LUPU, 1966 made two mistakes: 1. Only a few populations have been examined anatomically. 2. His number of samples (n) is not quantum sufficient. (The *Drobacia maeotica* species was defined anatomically and chronologically by LUPU, 1966.) Distinctly visible for the different collection sites, the number of samples increase curves gradually change into normal distribution [●= n: 31 (2007), x= n: 29 (1984), ○= n: 63 (1985)!, ▲= n : 25 (1990)].

In 1961, CLAUSS naturalized a population of *Drobacia banatica* from the settlement Sîmbăta (Transsylvania, Munţii Făgăraş) in Quedlinburg (Germany, Harz Mountain). In 1979, he gave account of change of height, width, elongation of the population, followed during 12 as well as 16 years (CLAUSS, 1979). His study gives a number of samples (Sîmbăta,1961─ n: 11; Quedlinburg, 1973─ n: 33; Quedlinburg, 1977─ n: 130), mean value and extremes of samples (height: 16,9─17,0 mm, width: 28,7─28,8, elongation: 0,59). Mean value of samples in Sîmbăta as well as Quedlinburg inside limit of error agree with one another. CLAUSS, 1979 made the first step in statistical examination of the populations. In the year 2000, Richardt Hoffmann (member of the Parcul Natural Lunca Mureşului) told me at the beginning of the year it was possible glean *Helicigona (Drobacia) banatica* in necropolis of Quedlinburgian (HOFFMANN, 2008).

The shell morphological constancy experienced by Clauss can be interpreted with a fortunate accident of coincidence of the microclimate, but by fits and starts since 1982 results of my examinations rarely were constant. Fig. 3. shows a change of the average shell morphological parameters. Distinctly visible average weight and average width increase approximately in a monotonous rate during five years. The change of the average elongation is only a few hunredths, and I have the feeling in 1987 and in 1990 show a complemental trend with the other two.

With a view to the analysis of the complemental trend I investigated these parameters in a larger region and for years together. Research looked for answer shell elongation dependence on width. For the sake of better arrangement I illustrated separately shell parameters resulted from the Sitka Forest (445 specimens Fig. 4.), and Apuseni Mountains (Romania, 137 specimens Fig. 5). Samples gleaned from different regions of the Munţii Apuseni/Apuseni Mountain made possible the large range of the shell width. So there is a chance that method of continual approaches or linear model (H/W─W function) turned out a succesess (Fig. 4. and 5.).

Linear model in the regression is following:

H/W= 0,954 ─ 0,012W

The pecked lines running parallel to the regression line are transformed with ± 0,08. The biggest width and height of the *Drobacia banatica* found by me 35,6 mm respectively 17,7 mm (Munţii Zarandului, Săvîrşin ─ DOMOKOS & VÁNCSA, 2005). The quotient of these parameters is 35,6/17,7 = 0,497. Elongation is calculated by a linear model in the regression: 0,526. This is only a 6% difference.

Illustrated statistics of the morphometrical properties (width, height and elongation) of the living *Drobacia banatica* individuals are very varying. Literary data exept above-mentioned references very pitiable, from time to time literary data with references to shell morphological parameters are puzzling.

No one or two examples come in following order: author and date of year, number of whorl/height/width, ’’’ (1/10 Grecian thumb) respectively in millimetre:

ROSSMÄSSLER, 1838: 5,5 /17,4 (9’’’)/**27,0** (14’’’);
PFEIFFER, 1846: ─/13,51─15,4 (7–8’’’)/**28,9** (15’’’),1848: 5,5/15,5/**26─30**;
BIELZ, 1863, 1867: 6,0/11,6─17,4 (6–9’’’)/ **21,2─27,0** (11─14’’’);
CLESSIN, 1887: 6/18/**30**;
TRYON, 1888: 5,5/─/**30,0**;
WESTERLUND, 1889; 6/15─17/**30**;
M. KIMAKOWICZ, 1890: ─/20/**31** frm. *major*, ─/13/**24** frm. *minor*;
GEYER, 1927: ─/15,0─17,0/**30,0**;
SOÓS, 1943, 1959: 5,5─6,0/16,5–21/**22,3─36**;
LUPU 1966: ─/12,1─15,2/**27,5─31,9**;
CLAUSS, 1979: ─/16,9─17,0/**28,7─28,8**;
GROSSU, 1983: 5,5─6,0/16─17/**27─28** (max.17/31,9);
KERNEY et al., 1983: 5,5─6,0/14,0─18,0/**25,0─30,0**;
PFLEGER, 1984: 5,5─6,0/16─18/**24-30;**
Red Book of Ukraine 2009: 5,0─5,5/14─21/**18─34**
Animal Base 2010: 5,0─5,5/14─18/**25─30;**

According to BIELZ, 1863, 1867 smaller width value is 21,2 mm. It is real value, but in Fig. 4. shows the width data (445 individuals) of the Sitka Forest. Here the extremes are 22,3 and 28,8 mm, mean shell widths are between 25 and 26 mm. In Red Book of Ukraine to be found from Trans Carpathian Region, Rahiv districts a Lilliputian/18 mm shell width specimen.

Sum up the earlier results shell morphological end values of the shellparameters are following: Number of whorls = 5,5─6,0 mm; height =11,6─21,0 mm; width: 18─36 mm.

B/ *Helicigona (Drobacia) maeotica*

Shell morphological data are very humble. Known Lupu's classic sampling sites (LUPU, 1966, Stâna de Vale ─1100 m, annual mean temperature 4 ºC) and my samples from Cheile Someşului Cald (2007). Frequency curves of the specimens 31 are shown in Fig.2. [States of existence of 15 individuals was E1/E2 (DOMOKOS, 1995)] (Statistical data of great burdock is found of rock-glacier faces south are following: number of whorls = 5,0─5,5, height = 14,0─16,2, width = **22,3─26,2.** Similarity is surprising. (Deviation only ~5%)

KREJCI & WENZ, 1926: 5─5,5/14─17/**24─26**;
LUPU, 1966: 5,5/ 12,7─16,0/**23,3─25,6**/;
GROSSU, 1983: 5,5/12,7─16,0/**23,3─25,6;**
Animal Base 2010: ─/12,5─16,0/**23,0─25,5**

Sum up the preceding results: number of whorls = 5,5, height = 12,7─17 mm, width = 22,3─26,2 mm.

Are positioned on the above-mentioned data and Fig. 2. numerical values of shellmorphological parameters of *Drobacia banatica* and *Drobacia maeotica* are congruent, and it is hard to say relevant morphological difference (LENGYEL & PÁLL-GERGELY, 2010, WALTER- SCHULTES, 2012), because *Drobacia maetica* to regard as M. Kimakowicz's frm. *minor* (M. Kimakowicz, 1890), as well as Rossmässler's classical *Drobacia banatica* (Rossmässler, 1838) to regard as M. Kimakowicz's frm. *major*.

3. Contributions on autecology and zoogeography of the *Drobacia banatica*

The morphological variety of this species [H: 11,6─21,0 mm (increment per cent of lower extreme is 81), W: 18─36 mm (lower extreme increases 100%!)] is a reflection in a mirror of diversity found in biotopes. Fig. 6. goes to show that *Drobacia banatica* is generalist and it has a large ecological plasticity. From climatic variables was studied the influence of the precipitation. Constancy and frequency change together with the precipitation. (See the three cusps!)

Average width changes are investigated as functions of low mean temperatures for July and low annual precipitation in Vásárosnamény-Bagiszeg (Hungarian Lowland). The changes of mean width values are described by following linear regression line (DOMOKOS, 1987):

$W_{average}= - 0{,}22\ t + 30{,}2$ (t = the average temperature for the July months of the two years previous to collecting)

$W_{average}= 0{,}014\ h + 17{,}9$ (h = the average precipitation for the two years previous to collecting)

Helicigona (Drobacia) banatica respond to the increasing of the average temperature for the July months with the decreasing of the average width of shell, as well as increasing of the average elongations/conicity. The increasing of the average precipitation however cause the increasing of average shell width. There are supported H/W ─W function (Fig. 5). Width values measured in the lowland Sitka Forest (Fig. 4., 89 m ASL) have risen by more mm in consequence of a few 100 m ASL/ growing of the precipitation (Lunca Sprie, Moneasa, Uileacu Beius, Borz ~300 m ASL). Width values experienced in Băia 1 mai/ Episcopiei resort biotope are larger than expected. I suppose that these are because of the mountain climate to be found at the lake. Cetăţile Ponorului (approximately 1000 m ASL) is a karstic cave-complex with fumy-rainy cool climate be protective of similar width values to warm and dry climate of the Hungarian Lowland (See. Fig. 4., 5.).

No common linear model in the regression can describe dependence on temperature and rain water of *Drobacia banatica* shell morphology in flood plain and inundation area of the river Tisa/Tisza, Mureş/Maros and Crişul Negru/Fekete-Körös (DOMOKOS, 1987, 1992a, 1992b).

On completion of our studies refer to average width frequency of *Helicigona (Drobacia) banatica* in 16 different biotopes interesting view burst upon our eyes. Except two cases (Şoimoş, Cégénydányád) well-separate fluctuating areas group (biotopes with width mean 25─28 mm) from contiguous areas ─ fluctuating belt ─ exclave group (biotopes with width mean 30–36 mm) to be found among mountain circumstance (DELI 1997, VARGA, 1970, 1971, 1975).

Ivied broken wall biotope findable in a ruins towered above the Mureş walley at Şoimoş settlemen (~ 220 m SLA). I suppose that in the shadow of southern wall, by the norther side of its the microclimate is Praecarpathian (Fig. 7.). This biotope is unique because here can be found a brown and a bandless greenish-yellow shade of *Helicigona (Drobacia) banatica*. The last-named shade probably M. Kimakowicz's *Campylea (Eucampylea) Banatica mut. viridana* „Ich sammelte auf Piatra Sipotului im Strellgebirge *mut. viridana* in einem Exemplar." (KIMAKOWICZ, 1890). M. Kimakowicz has found *mut. viridana* in the Munţii Şureanu at the Piatra Șipotului.

The biotope in Cégénydányád is a part of a quite young fluctuating areas. *Drobacia banatica* specimens sprung by the hidrochoria from a fluctuating belt or a exclave. The specimens hold in the beginning of the acclimatization, namely under the influence of warmer and dryer climate the specimens reduce among others shell width.

Very interesting to examine mean shell widths as a function of Adriatic sea-level (Fig. 8.). The reason for extensive dispersion are different tendency of macro- and microclimate, variant date of sampling and deviation of number of samples. In spite of deviations highest point of non-linear regression line is probability at 400 m ASL. From some of 100 metres „optimal zone" towards the Hungarian Lowland steeply decrease mean shell width and about 25 mm gets lower lethalitical value. (In the early 2000's step by step died of the *Drobacia banatica* that is one of „relevant species" of the Praecarpathian section in the Sitka Forest.) Over „optimal zone" ─ with full knowledge of the climatic variable ─ decrease shell parameters the influence of the decrease in temperature and the increase in humidity and precipitation. Most diminutive mean shell width by my experience is 24,46 mm measured near the Cheile Someşului Cald (~1300 m ASL). It is an upper lethalitical value which is smaller than 25 mm experienced on the opposite side of function. Enable the function to be precised with study of biotopes found between 400 and 1000 m ASL.

On Fig. 9. visible mean shell width of the *Helicigona banatica* specimens gleaned from 50 biotopes in different dates in one hour (h) as a function of m ASL. If we postulate that surface examination rate (examined surface in m^2/ period of examination in h) accessibility is constant, in that case number of samples be commensurate with abundances of biotopes. It is as much as saying that in those biotopes be composed of specimens with larger mean shell width abundances are accessibility smaller. In another connection:
Helicigona (Drobacia) banatica specimens had with larger width usually we are able to collect smaller number of samples.

In the course of microscale distribution analyse of land snails SÓLYMOS, CZENTYE & TUTKOVICS, 2006–2007 show: "The correlation was weak and not significant between the major shell dimension and the index of dispersion (Pearson's r = − 0,22). Although, the negative tendency indicates that the smaller is the species, the most aggregated is its distribution, in this case, we can not conclude that body size directly affects the dispersion in land snails (…)." It seems above-mentioned conclusion is not only in case of different species is correct, but also in case of polymorphism of the some kind may be right.

Abundance values found of references (DOMOKOS, 1987:10─15; 1992b: >5; 1994: 8; 2001: 1; FINTA et al.1993: 2─25; Red Book of Ukraine 4─5 or 3─8 pcs/m²) ─ depending of ecological relation ─ are very miscellaneous. These facts arouse reflexion.

4. Anatomical setting side by side of the genital system of the two species

Analyse of *Drobacia banatica* genital system inter alia is related to STURANY & WAGNER, 1914, LUPU, 1966, HUDEC, 1972, GROSSU, 1983. After discovery of recent *Drobacia maeotica* individual LUPU, 1966 later GROSSU, 1983 determined on comparativ anatomical setting side by side of the genital system of taken for extinct species. GROSSU, 1983 categorically sunders *Drobacia banatica* from *Drobacia maeotica* on the basis of shell dimension (*maeotica* < 24 mm < *banatica*) and some elements (penis, glandula mucosa) of the genital system.

Special literary figures prove very diverse pending of their mode of preparation and those unprofessional people easily may be deceive. On the basis of stylistic marks may be create categories, respectively we can imagine countless transition from loose setting out to beautifying stretch.

Last decades András Varga and Péter Suba performed detailed anatomical analyses of the genera *Drobacia*. These analyses were more wide-ranging (juvenile, adult), more painstaking than predecessor and included radula, liver and some elements of the genital system.

András Varga and Péter Subai based traditional research of the genital system on dissection of several individuals (Number of copies: *D. banatica* ─ 9, *D. maeotica* ─5). Theirs examination method was following:

> Preparations taken from 70% ethanol previous to dissection were softened in water for 30 minutes. After mollification the preparation to be fixed under the atrium in dark coloured wax record. Thereafter – according to everyday habit ─ female part is laid out to the right, but male part to the left. After glandula fastening two parts were fixed in position. In the course of dissection laying out and fixing with minutia pin of genital system so it came about that be in full view origin points of the organs. That is the fundamental condition of exact comparison and measuring. Curve of some organs without stretching with the drawing must lay out ratios is not come deformed. Anatomical drawings in pencil on tracing-paper were made by a lucida camera attached to a stereomicroscope. Past possible correction permanent form of graphics get with redrawing by Rotring drawing pen (Fig. 10.)
>
> 14 traditional anatomical drawings were placed at disposal for me by András Varga and Péter Subai. This time I thank they for our noble gesture.
>
> Measurements were taken three-times on the drawings by a curvimeter tracing the mind-line of the organs. I publish arithmetic mean values of main characteristics (Fig.10.) of genital system in millimetre as can be seen in Table I–IV.
>
> I accept results under reserve, because of laying out and covering is doubtfull observation of origin points of the organ (glandula pheromongena, penis), and larger or smaller twist of the organ (epiphallus), respectively ab ovo twisting organs (flagellum, spermoviductus). Because these problems are absent from tables data on the glandula hermophroditica, ductus hermofroditicus, spermoviductus. If the mistake is more unimportant, in the tables to be found „!” or „–” near to measurement respectively in its column. Fault detection of origin points of the organs is preventable with different unfolding variants. Because of measurements, ratio of glandulae pheromongenae play a decisive part, and relatively exactly is measurable length of the

diverticulum and the pedunculus, I publish earlier two characteristics in unit of glandula pheromongena measure in the last two ranks. These ratios are exact and independent of possible fault of the amplification.

A/ *Drobacia banatica*

At present four issued (STURANY & WAGNER, 1914, LUPU, 1966, HUDEC, 1972, GROSSU, 1983), as well as unpublished genital system drawings (Subai and Varga) are shown in Fig.11. My aim to illustrate diversity of the interpretation. The scale bar uniformly 1mm.

Drobacia banatica parts of the genital system	STURANY & WAGNER, 1914	LUPU, 1966	HUDEC, 1972	GROSSU, 1983
1.Vagina	6.3	7.1	8.2!	6.0
2.Penis	13.3	5.9	11.0!	3.1
3.Epiphallus	15.7	7.3	5.5!	10.0
4.Flagellum	spir.	spir.	spir.	spir.
5.Vas deferens	26.1	22.0	21.3	21.0
6.Bursa teloris	10.1	7.7	7.4	4.5
7.G. pheromongena 1.	**31.6**	**10.5**	**spir.**	**8.3**
8.G. pheromongena 2.	**30.3**	**10.6**	**spir.**	**7.6**
9.Scapus	21.5	10.1	–	12.8
10.Pedunculus	28.1	23.3	17.7	16.8
11.Bursa copulatrix	7.4/5.0	1.1/1.1	3.2/2.7	2.0/2.0
12.Diverticulum	38.8	32.0	–	20.1
13.Glandula albuminea	20.1	21.5	13.1	11.1
Diverticulum/Glandula ph.	**1.22**	**3.07**	–	**2.42**
Pedunculus/Glandula ph.	**0.88**	**2.19**	–	**2.02**

Table I.: My measurements (in mm) and main characteristics of the genital system of *Drobacia banatica* species based on the drawing coming from the different authors (In my opinion Grossu iused Lupu's ratio)

Drobacia banatica parts of the genital system	Varga	Subai			
		1.	2.	3.	4.
1.Vagina	–	3.4	3.0	3.1	3.9
2.Penis	9.6	5.2	6.9	6.8	7.0
3.Epiphallus	8.6	10.2!	7.1	16.6	7.3
4.Flagellum	18.7	22.0!	21.5	24.0	24.1!
5.Vas deferens	16.0	12.5	13.0	13.8	11.0
6.Bursa teloris	9.4	7.5	6.7	6.4	8.4
7.G. pheromongena 1.	**18.9**	**24.6**	**26.4**	**23.6**	**22.6**
8.G. pheromongena 2.	**19.6**	**22.1**	**26.3**	**21.9**	**22.1**
9.Scapus	10.7	16.1	10.9	9.0	13.4
10.Pedunculus	14.8	19.3	17.2	19.7	22.4
11.Bursa copulatrix	6.7/3.9	6.0/4.0	4.2/3.0	6.0/2.7	5.2/3.5
12.Diverticulum	31.0	29.6	24.9	40.0	38.7
13.Glandula albuminea	–	–	23.6	22.7	22.9
Diverticulum/Glandula ph.	**1.58**	**1.20**	**0.94**	**1.69**	**1.71**
Pedunculus/Glandula ph.	**0.75**	**0.78**	**0.65**	**0.82**	**0.99**

Table II. Main characteristics and my measurements (in mm) of the genital system based on Subai's and Varga's drawings

Drobacia banatica parts of the genital system	Subai			
	5.	6.	7.	8.iuv?
1.Vagina	9.7	6.7	9.6	6.7
2.Penis	10.4	9.6!	9.2	7.5
3.Epifallus	9.1	11.3!	10.9	7.6
4.Flagellum	spirál	spirál	spirál	spirál
5.Vas deferens	16.9	17.7	14.0	14.1
6.Bursa teloris	7.5!	9.8	10.0	5.5!
7.G. pheromongena 1.	**24.3**	**26.4**	**11.5**	**10.7**
8.G. pheromongena 2.	**22.6**	**25.5**	**11.7**	**11.6**
9.Scapus	12.6	14.0	7.6	6.8
10.Pedunculus	20.3	20.5	18.97	–
11.Bursa copulatrix	5.5/3.8	7.6/3.8	4.1/3.0	–
12.Diverticulum	31.9	42.5	30.5	28.7
13. Glandula albuminea	10.4	19.1	15.6	16.1
Diverticulum/Glandula ph.	**1.31**	**1.61**	**2.60**	**2.40**
Pedunculus/Glandula ph.	**0.83**	**0.77**	**1.62**	–

Table III. My measurements (in mm) of the genital system of the *Drobacia banatica* on the strength of Subai's drawings

B/ *Drobacia maeotica*

Drobacia maeotica parts of the genital system	Lupu 1966	Grossu 1983	Varga		Subai		
			3.	4.	1.	2. iuv.	3.iuv.
1.Vagina	5.7	5.1	6.4	4.3	5.2	7.5	6.9
2.Penis	9.5	6.3!	8.2!	6.2	8.5	11.2	4.3!
3.Epiphallus	14.5	6.3!	2.3!	6.0	10.2	9.9	9.1!
4.Flagellum	spir.	spir.	8.6	13.2	27.9!	23.4	8.3
5.Vas deferens	15.0	39.5	14.4	12.3	19.0	21.7	12.5
6.Bursa teloris	9.0	9.8	5.3	5.8	7.8	7.4	4.8
7.G. pheromongena 1.	**27.3**	**23.0**	**11.6**	**18.0**	**30.5**	**27.0**	**11.9**
8.G. pheromongena 2.	**26.0**	**23.0**	**11.7**	**17.3**	**31.1**	**26.2**	**10.9**
9.Scapus	8.6	13.9	7.0	8.6	19.8	19.5	5.9
10.Pedunculus	23.9	20.6	5.3	4.4	21.8	18.5	–
11.Bursa copulatrix	1.4/1.4	3.0/3.0	–	2.7/2.4	3.7/2.4	2.0/1.9	–
12.Diverticulum	43.0	36.6	10.4	14.0	41.8	33.7	12.3
13.Glandula albuminea	20.0	14.8	6.0	7.0	21.0	8.1	5.6
Diverticulum/Gland. ph.	**1.57**	**1.59**	**0.88**	**0.77**	**1.34**	**1.25**	**1.03**
Pedunculus/Glandula ph.	**0.87**	**0.90**	**0.45**	**0.24**	**0.67**	**0.68**	–

Table IV. My measurements (in mm) and main characteristics refer to *Drobacia maeotica* genital system. Drawings are origonated from different authors.

Based on comparison of data of the tables we can draw the following conclusions:

1. Arithmetic mean values of Glandula pheromongena measurements are at *D. banatica* 7,6 to 31,6 mm, at *D. maeotica* 11,6 to 31,1 mm.
2. Arithmetic mean values of Diverticulum/ G.pheromongena measurements are at *D. banatica* 0,94 to 3,0, at *D. maeotica* 0.77 to 1,59.
3. Pedunculus/G.pheromongena quotients change at *D. banatica* 0,65 to 2,19 and at *D. maeotica* 0,24 to 0,9.

Consequently three main caracteristic numerical values notably overlap each other. Not it any shape or form I don’t adopt LUPU (1966) and GROSSU (1983) classificaton according to unique anatomy. In their case Glandula pheromongena numerical values have really relevant difference! Two bifurcationless Glandula pheromongena measurements at *D.banatica* 7,6 to 10,6 mm, at *D. maeotica* 23,0 to 26,0 mm.

4. Some data and idea on the biophysics (A) and biochemistry (B) of the genera Drobacia

A. After the Chernobyl catastrophe SZENTESI & DOMOKOS, 1998 investigated Sr-90 isotope activity on the shells of *Helicigona (Drobacia) banatica*. They measured β-activity originated Sr-90 isotope on the shell collected different period, and they compared those with β-activity on the shells of *Unio crassus* gleaned on the surrounding reach. The showed activity of landsnail *Drobacia banatica* in 1980 the doubled (6 years before the Chernobyl catastrophe: 27,3 Bq/kg), but in 1995 is the fivefold (9 years after the Chernobyl catastrophe: 56,0 Bq/kg) of the measurements of *Unio crassus*. The β-activity of *Unio crassus* shells is constant practically (12 illetve 11 Bq/kg).

B. DEGENS & LOVE, 1965 showed on the basis of the amino acid spectrum of fossil planorbids clades associated with change of the amino acid spektrum to be integrated with change of the ecological factors. In our opinion ecological changes bring about a changes in secondary structure and linkage of the shell protein, appeared in polymorphism.

FLORKIN, 1969 has detected with amino acid analyse, chemo taxonomical problems of fossils to be solved only in knowledge of sequences of amino-acids in proteins (See molecular taxonomy!)

Later GROSSU & TESSIO, 1975 by the help of electrophorese with biochemical aims demonstrated difference between *Helicigona (Drobacia) banatica*, *Helicigona (Drobacia) maeotica* and *Helicigona (Arianta) arbustorum* species. Considering that on the occasion of electrophorese colloidal protein come in the course of preparation are separated, differences ─ according to DEGENS & LOVE, 1965, FLORKIN, 1969 ─ are connected with polymorphism, are not with taxonomical variance. Accordingly *Helicigona (Drobacia) maeotica* only a retrograde *Helicigona (Drobacia) banatica* or *Helicigona (Drobacia) banatica* f. minor (KIMAKOWICZ, 1890), if it is agreeable to be named f. *maeotica*.

5. Conclusions

In the course of shell morphological and anatomical investigation came to light that recent *Drobacia banatica* and recent *Drobacia maeotica* do not regard as two independent species, merely the last-named ecotype/variant of the *Drobacia banatica*, which to be developed relatively in extreme circumstances (area border, fluctuation ereas). Lower limit of tolerance resulted by warmer and more arid climate in the Praecarpathicum, whereas upper limit of tolarance resulted by cooler and more rainy weather in Carpathicum. In the Munţii Apuseni optimum of abiotic ecological factors of the *Drobacia banatica* between 300 and 500 m ASL are following: mean temperature in July 16─20 ºC, annual precipitation 800─1200 m.

Naturally *banatica─maeotica* dilemma to consider that as final means molecular taxonomy.

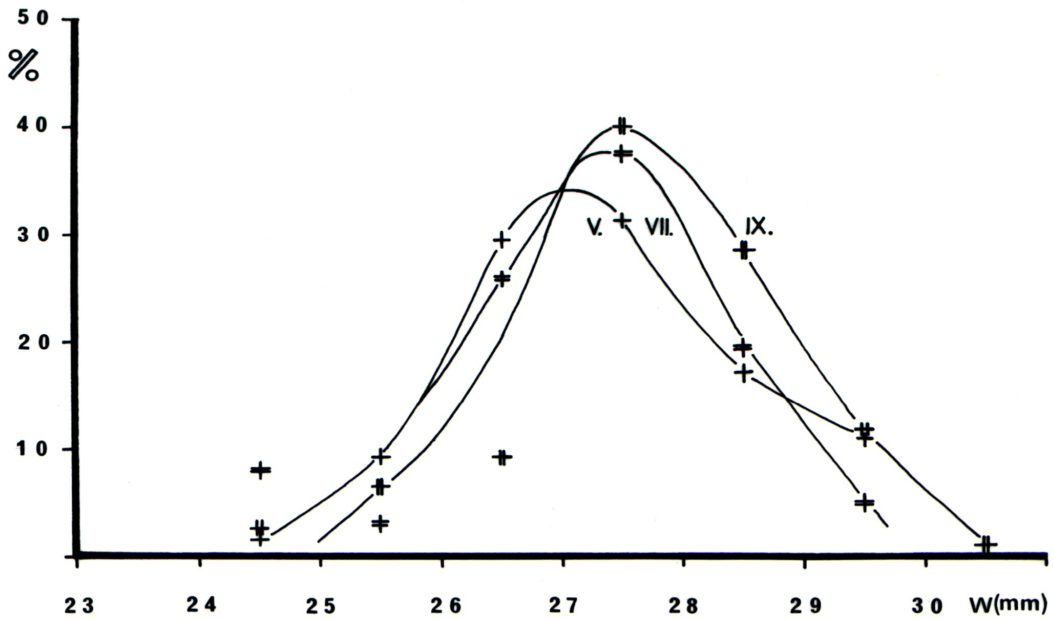

Fig.1. Seasonal changes of frequency of width in the Makó Landor Forest collected in 1991 (V. = May, VII. = July, IX. = September — DOMOKOS, 1992b).

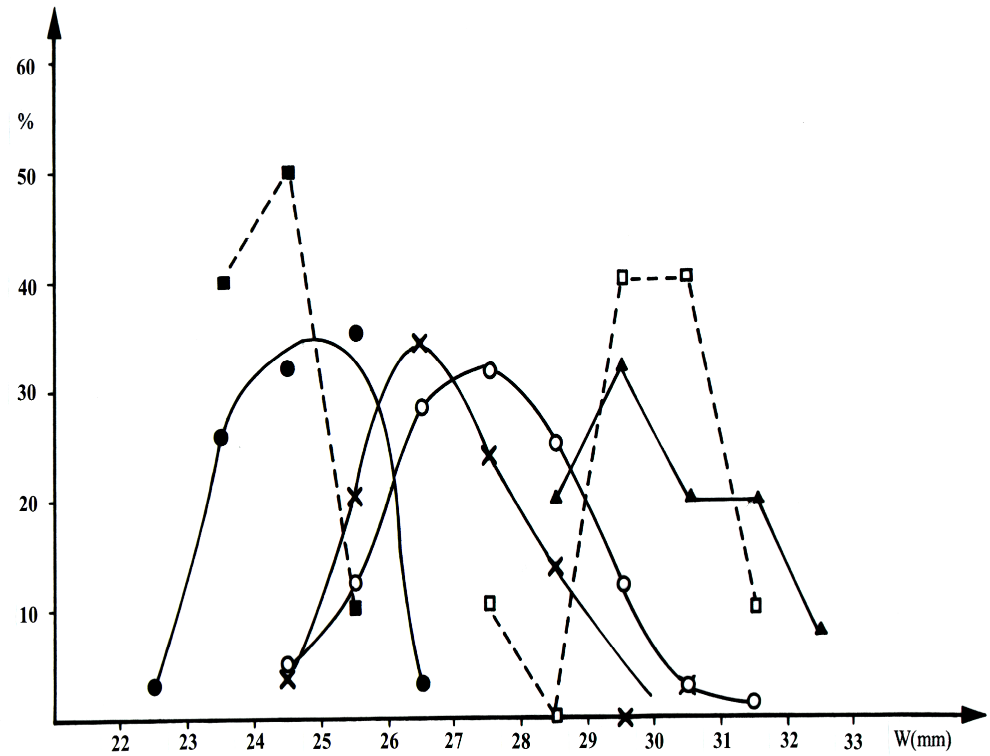

Fig. 2. Changes of width of *Drobacia banatica* in six Romanian biotopes.■ = Munţii Bihor, Stâna de Vale [*Drobacia maeotica* (LUPU, 1966)!], □ = Munţii Bucegi, Sinaia; Munţii Căpăţânii, Vaideeni-Hurezu (LUPU 1966); ● = Munţii Bihor, Cheile Someşului Cald (*Drobacia maeotica*!) , x = Munţii Padurea Craiului, Valea Iadului, ○ = Munţii Bihor, Cetăţile Ponorului, ▲ = Munţii Codru-Moma, Uileacu Beius (After Domokos).

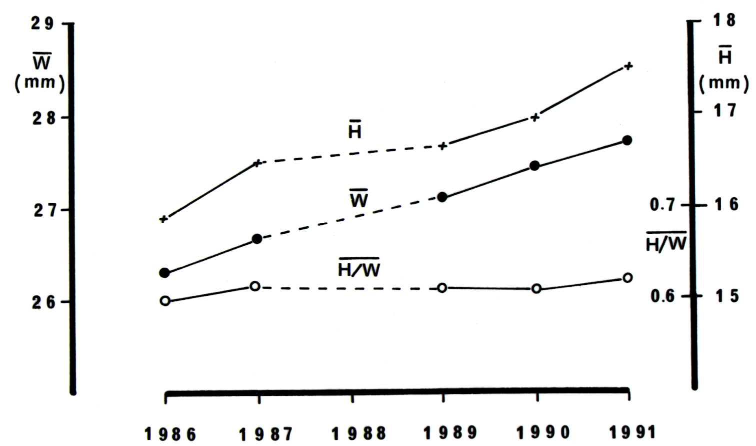

Fig. 3. Morphometrical properties of the *Drobacia banatica* individuals collected between 1986 and 1991 from the 14/A parcel (ash— oak—poplar) of the Landor Forest to be found in flood plain of the Maros River and in flood plain near Makó (DOMOKOS, 1992b).

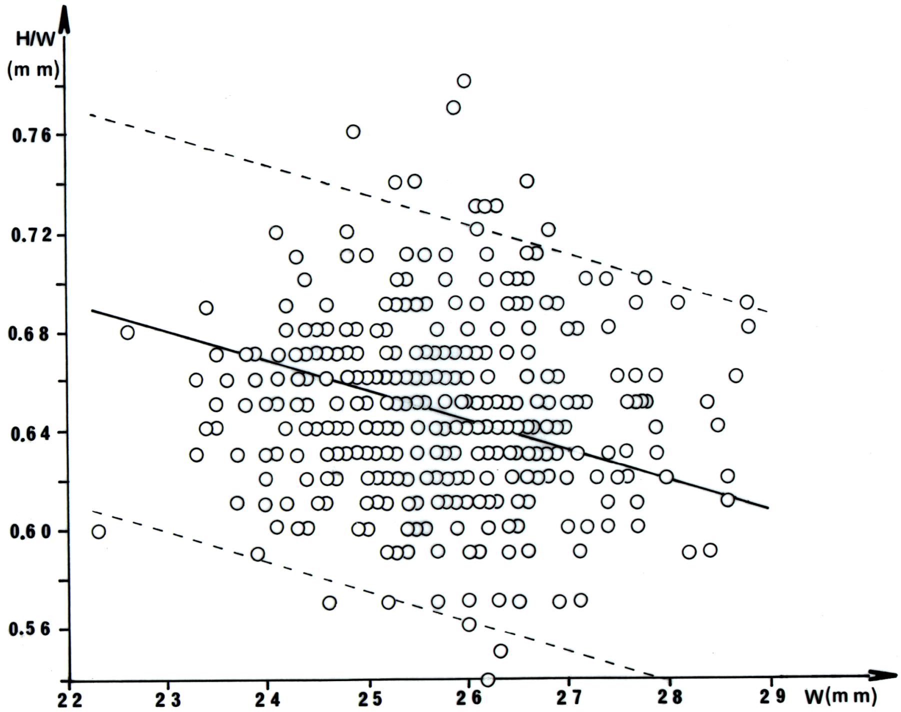

Fig. 4. Elongation (H/W) as a function of shell width (W) for 445 individuals of *Drobacia banatica* collected between 1993 and 1995 in the Sitka Forest (Gyula-Gyulavári settlement) (DOMOKOS, 2001).

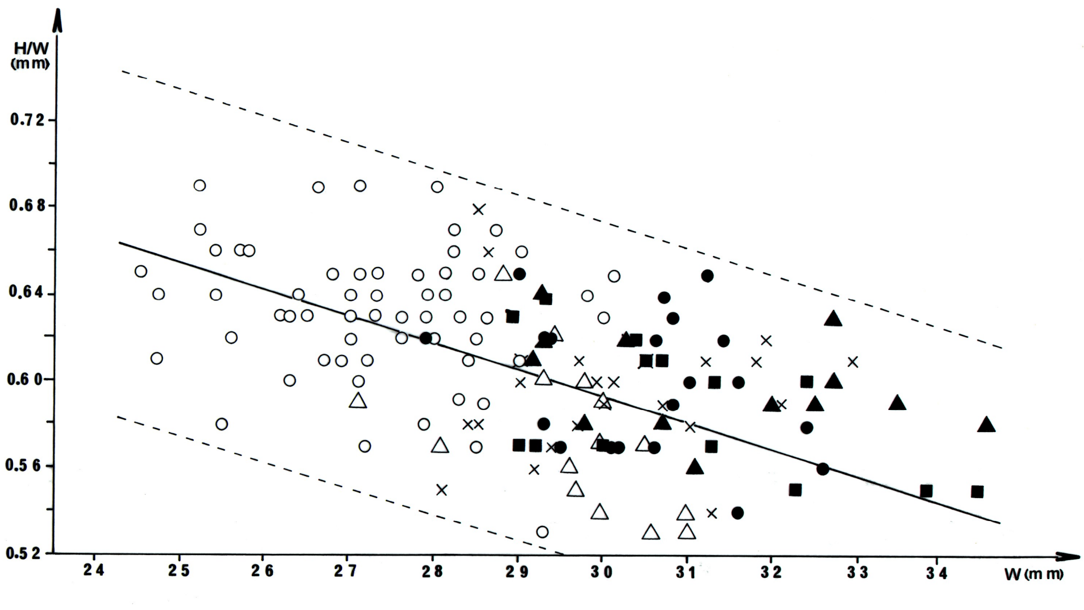

Fig. 5. Elongation (H/W) as a function of shell width (W) of *Drobacia banatica* for the different collection site sin the catchment basin of the Körösök rivers between 1982 and 1990. ○ = Munţii Bihor, Pietroasa, Cetăţile Ponorului, ▲= Munţii Codru-Moma, Moneasa, ● = Munţii Pădurea Craiului, Lunca Sprie, x = Munţii Codru-Moma, Uileacu Beius, ■ = Munţii Codru-Moma, Borz, Δ = Oradea, Episcipiei Resort (DOMOKOS, 2001).

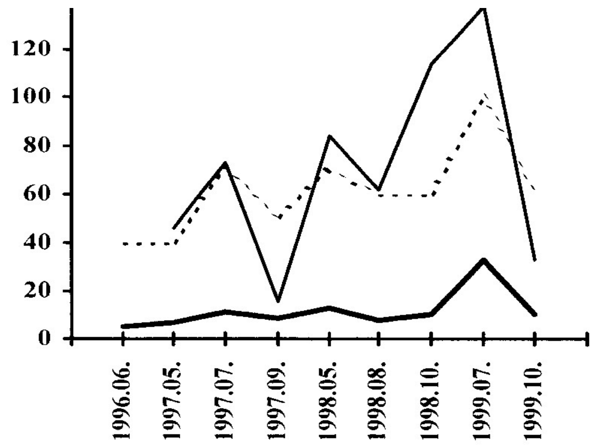

Fig.6. Monthly changes of the precipitation (mm, thinner line), constancy (%, pecked line) and frequency (1/6 abundancy, thicker line) of *Drobacia banatica* in the Csigás Forest (Hungarian Lowland, Dénesmajor settlement) between 1996 and 1999 The periods are different, disproportionate! (BÁBA & DOMOKOS, 2002).

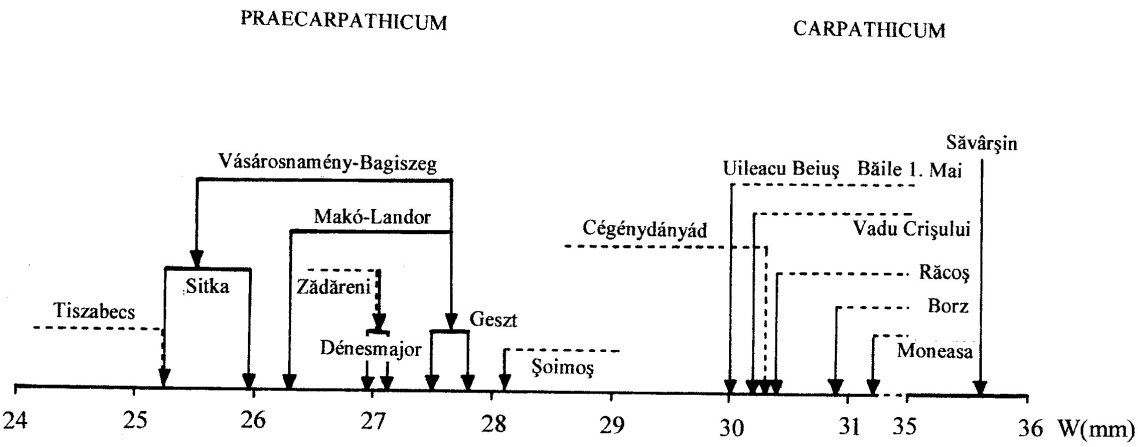

Fig.7. The average width and extreme width of biotopes, biotope groups in Hungarian Lowland (Praecarpathicum) and Apuseni Mountains (Carpathicum, Románia). (DOMOKOS & DELI, 2006/7).

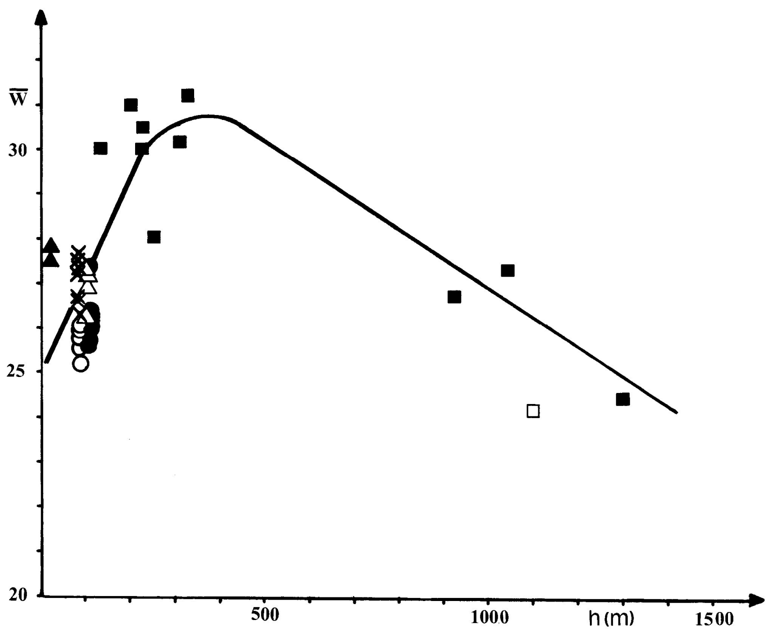

Fig.8. Mean shell width (mm) of the *Helicigona (Drobacia) banatica* as a function of Adriatic see-level (m ASL): —■— Munţii Apuseni, —▲— Geszt, —x— Makó,— Δ— Dénesmajori Csigás-erdő, —●— Vásárosnamény-Bagiszeg, —○— Gyulavári, Sitka, —□— Lupu's mean shell width of *Helicigona (Drobacia) maeotica* (LUPU, 1966).

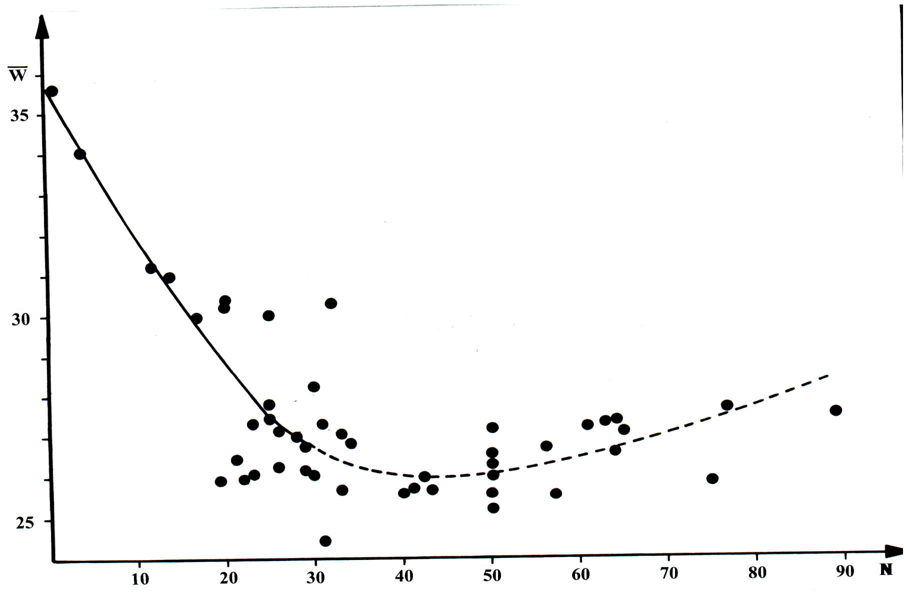

Fig.9. Mean width (W over —) as a function of number of *Drobacia banatica* samples (N) for 50 Hungarian and Romanian biotopes.

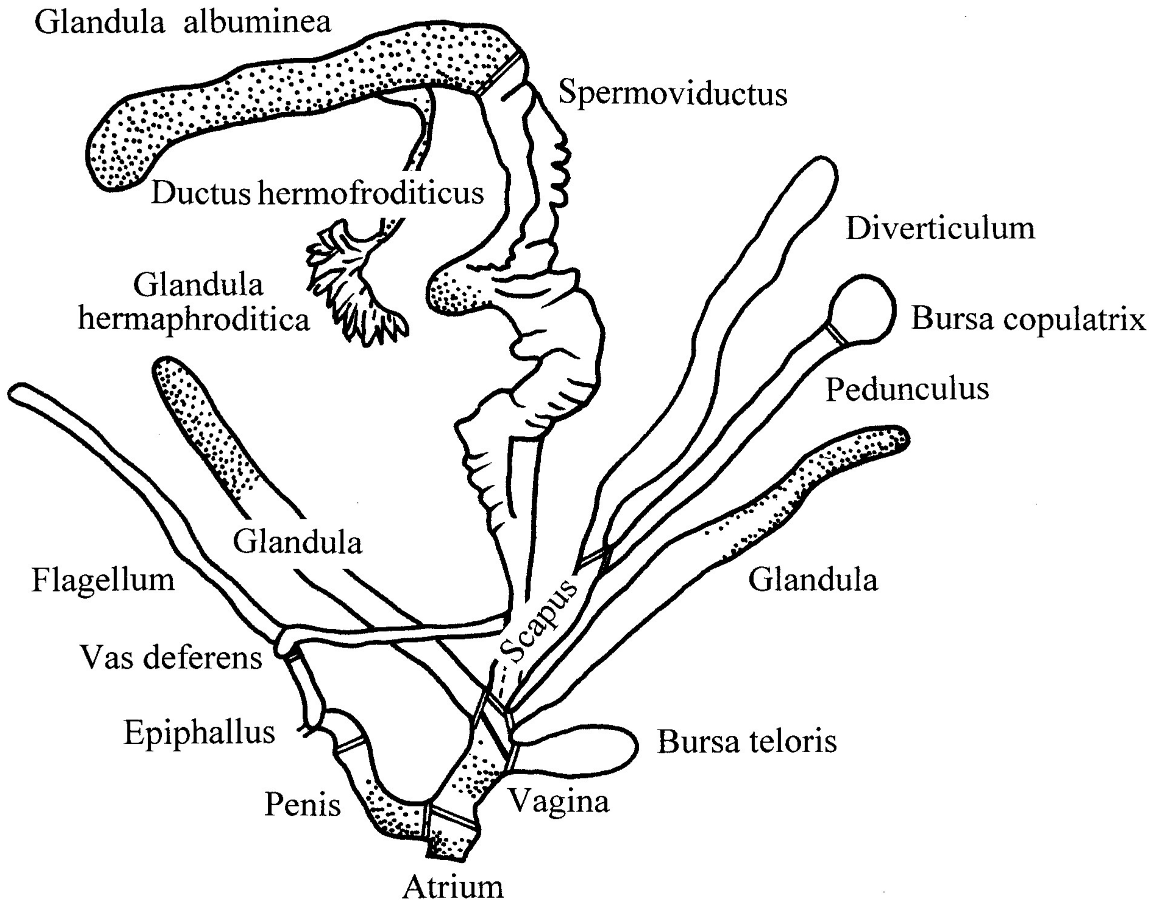

Fig. 10. Two-dimensional genital system drawing of the genera *Drobacia* Brusina 1904 based on Subai's drawing. Limits respectively pigmentations of parcels of the genital system marked with double lines respectively with dotting. (Glandula = Glandula mucosa or to be more precise Glandula pheromongena).

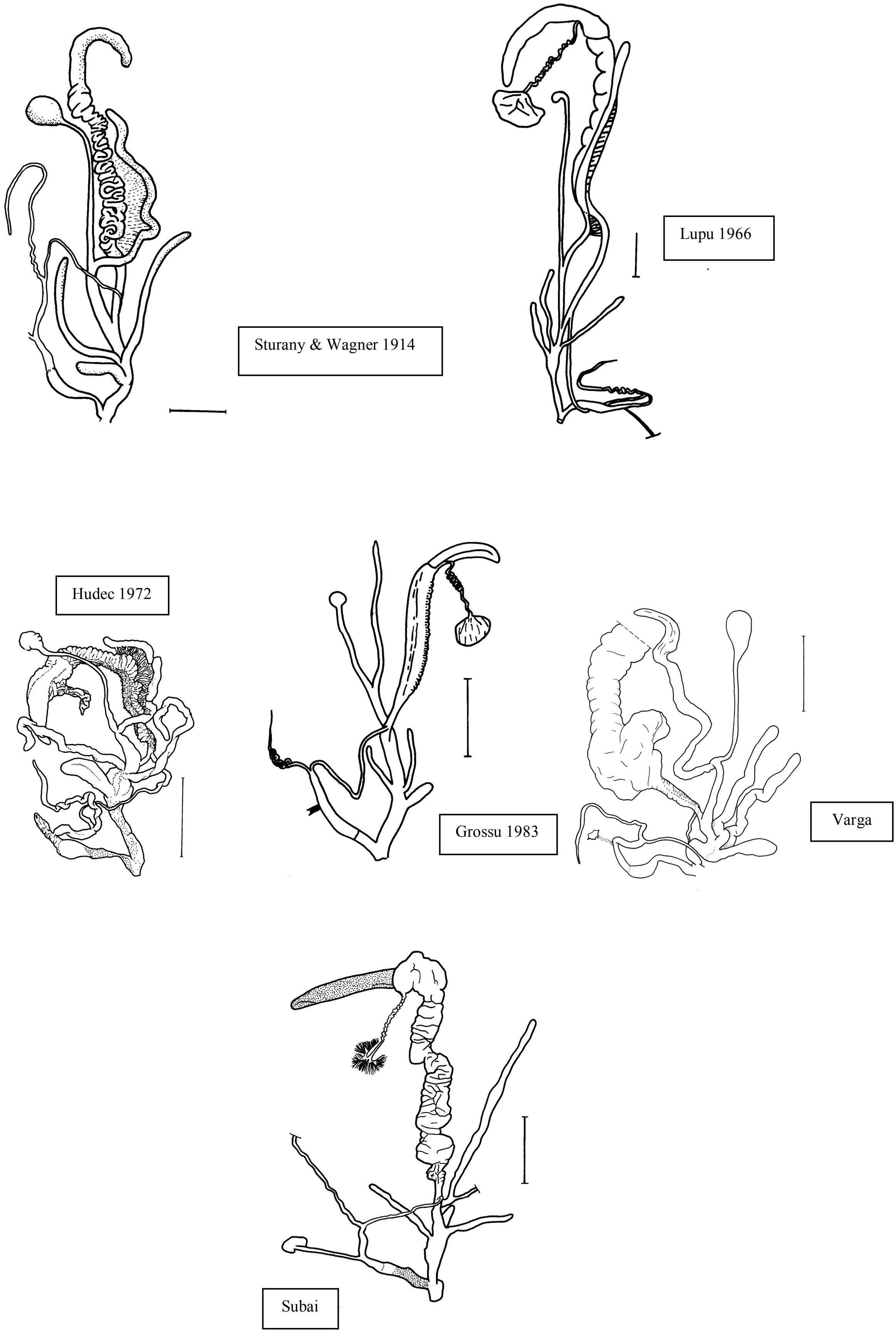

Fig.11. Genital system drawings of *Drobacia banatica* species from different authors (Scale bar = 1mm).

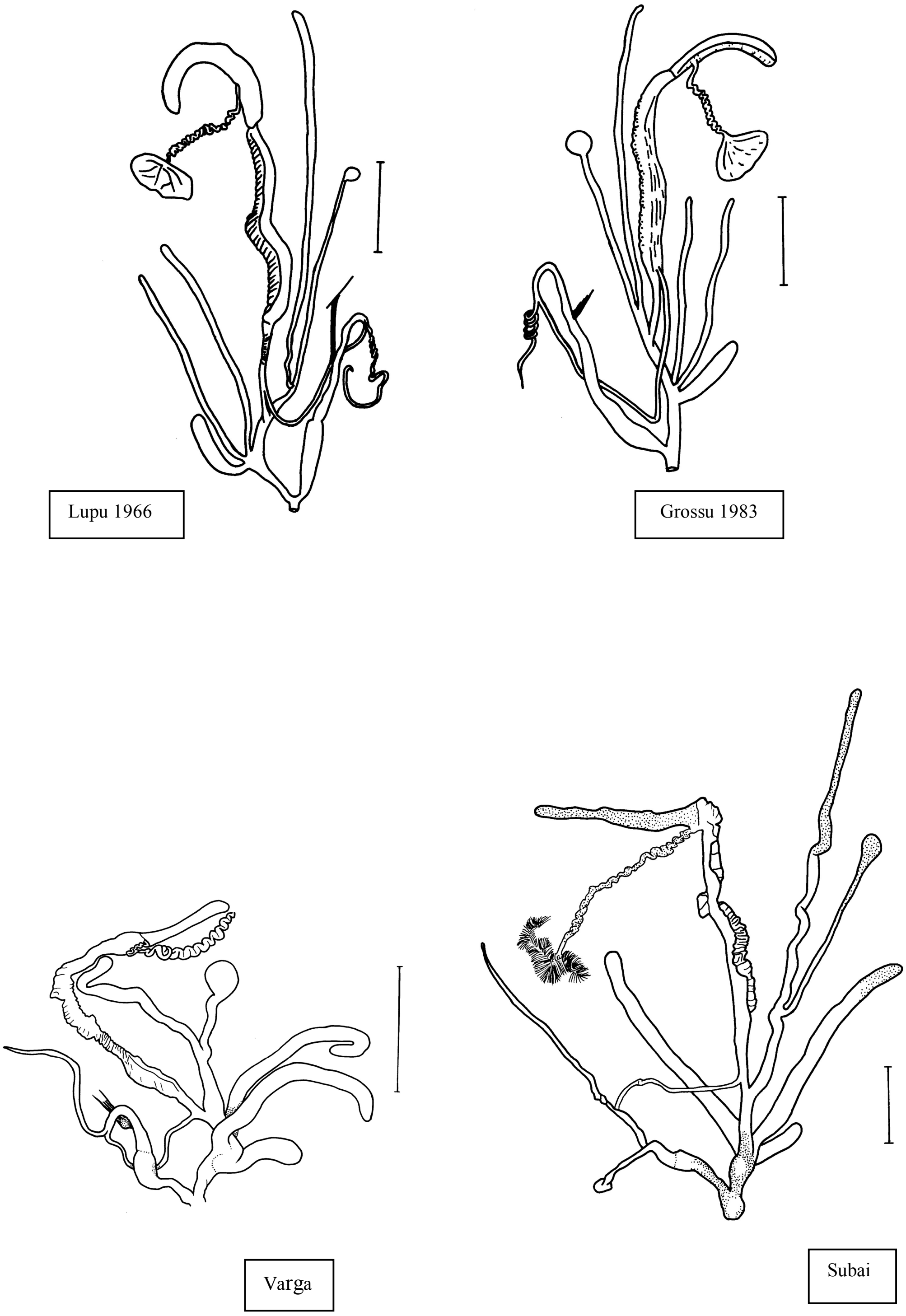

Fig.12. Genital system drawing of the *Drobacia maeotica* species from different authors.

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References

BÁBA, K. & DOMOKOS, T. (1992): The occurrence and ecology of *Chilostoma banaticum* (Rossmässler) in Hungary. — Abstract 11th International Malacological Congress. 383—385. Siena.

BÁBA, K. & DOMOKOS, T. (2002): Seasonal malacological investigation on the willow forest fauna (Csigás-erdő) on the active flood plain of the Fekete-Körös river near Dénesmajor. — Nachrichtenblatt. der Ersten Vorelberger Malakologischen Gesellschaft, **10:** 31–42. Rankweil.

BÁBA, K. & KOVÁCS, GY. (1975): Adatok a Király-hágó környéke, a révi szurdokvölgy és a Tordai hasadék Mollusca-faunájához (Román Szocialista Köztársaság). — Soosiana, **3:** 27–34. Baja.

BIELZ, E. A. (1863): Fauna der Land- und Süsswasser-Mollusken Siebenbürgens. Ed. I**:** 64–65. Hermannstadt.

BIELZ, E. A. (1867): Fauna Land- und Süsswasser-Mollusken Siebenbürgens. Ed. II: 68—69. Hermannstadt.

CLAUSS, E. (1979): Eine Population von *Helicigona (Drobacia) banatica* (Rossmässler, 1838) in Quedlinburg.— Malak. Abh. Staatl. Mus. Tierk. Drezden, **6 (6):** 85—87. Drezda.

CLESSIN, S. (1887): Die Mollusken-Fauna Mitteleuropas II. Die Molluskenfauna Österreich-Ungarns un der Schweiz. p.140. Nürnberg.

DEGENS, E. T. & LOVE, S. (1965): Comparative studies of amino acids in shell structures of *Gyraulus trochiformis*, shells from the Tertiary of Steinheim. — Germany, Nature. **205:** 876—878.

DELI, T. (1997): A Praecarpathicum fejlődése az Alföldön a terresztris Mollusca fauna biogeografiai és paleobiográfai elemzése alapján. — Szakdolgozat, Manuscriptum, 1–42. Debrecen.

DELI, T. & FARKAS, R. (2006): A bánáti csiga (*Drobacia banatica* Rossmässler, 1838) legújabb hazai lelőhelyei a Szamos mentén. — Natura Bekesiensis, **8:** 19–28. Békéscsaba.

DOMOKOS, T. (1986): Faunatörténeti megjegyzés a *Helicigona banatica* (Rossmässler) faj Fekete-Körös menti fosszilis előfordulásával kapcsolatban. — Környezet és Természetvédelmi Évkönyv, Békéscsaba, **7:** 189—1994.

DOMOKOS, T. (1987): A klíma hatása a *Helicigona banatica* csigafaj házának alaki jellemzőire egyik alföldi előfordulása helyén. — Alföldi Tanulmányok, **11:** 45—60. Békéscsaba.

DOMOKOS, T. (1992a): Javaslat a Sitkai-erdő egy részének védetté nyilvánítására (A *Hygromia kovacsi* és a *Helicigona banatica* együttes előfordulása).— Malakológiai Tájékoztató, **11:** 55–56. Gyöngyös.

DOMOKOS, T. (1992b): A klíma hatása a *Helicigona banatica* csigafaj házának morfológiájára Makó-Landori-erdőben, — Folia Historico-naturalia Musei Matraensis, **17:** 189–198. Gyöngyös.

DOMOKOS, T. (1994): Javaslat a Fekete-Körös egyik hullámtéri füzesének védetté nyilvánítására (A *Helicigonaa banatica* és a *Vitrea crystallina* előfordulása). — Malakológiai Tájékoztató, **13:** 57–59. Gyöngyös.

DOMOKOS, T. (1995): A Gastropodák létállapotáról, a létállapotok osztályozása a fenomenológia szintjén.— Malakológiai Tájékoztató, **14:** 79–82. Gyöngyös.

DOMOKOS, T. (2001): Data on the shellmorphology of the *Chilostoma banatica* E. A. Rossmässler,1838) and its climate dependence in the Sitka Forest (Békés County, Gyulavári) (Mollusca, Gastropoda). — Adatok a *Chilostoma banatica* (E. A. Rossmässler,1838) Sitkai-erdőből (Békés-megye, Gyulavári) gyűjtött egyedeinek héjmorfológiájához és annak klímafüggéséhez (Mollusca, Gastropoda).— Soosiana, **29:** 11–26. Nagykovácsi.

DOMOKOS, T. & RÉPÁSI, J-né (2001): Adalék a hullámtéri *Chilostoma banatica* (Rossmässler) héjmorfológiájához, állatföldrajzi és ökológiai viszonyaihoz a Praecarpathicum magyarországi szakaszáról. — Malakológiai Tájékoztató, **19:** 59—66. Gyöngyös

DOMOKOS, T. , VÁNCSA, K. & SÁRKÁNY-KISS, E. (2002): Malacofaunistical study of the flood-plain the Mureş river in the Zam region. — Tiscia monograph series, **6:** 63—70. Szolnok—Szeged—Tg. Mureş.

DOMOKOS, T. , LENNERT, J. & RÉPÁSI, J-né (2003): A Fekete-Körös völgy magyar szakaszának szárazföldi malakofaunája II. (Három füzes malakológiai vizsgálata.) — A Békés Megyei Múzeumok Közleményei, **24–25:** 41—73. Békéscsaba.

DOMOKOS,T., FINTHA, I. & GASKÓ, B. (2005): On the Hungarian occurrences of *Drobacia banatica* (Rossmässler) — A *Drobacia banatica* (Rossmässler (bánáti csiga) magyarországi előfordulásáról — Soosiana, **33:** 23—35. Nagykovácsi..

DOMOKOS, T. & DELI, T.(2006/7): New data (Geszt, Cégénydányád) and thoughts (Şoimoş) on the Hungarian encounters of the *Drobacia/Helicigona banatica* (Rossmässler, 1838) — Újabb adatok (Geszt, Cégénydányád) és gondolatok (Şoimoş) a *Drobacia/Helicigona banatica* (Rossmässler, 1838), bánáti szalagoscsiga magyarországi előfordulásához.— Soosiana, **34–35:** 59—66.Nagykovácsi.

DOMOKOS, T. (2007): A puhatestűek védelmi helyzetének változása hazánkban, különös tekintettel az elmúlt közel negyedévszázadra (1702—) 1979—2005 (Vázlatos kronológia). Changes in Protection of Molluscs in Hungary berween 1979 and 2005.— Malakológiai Tájékoztató, **25:** 33–56.

FINTHA, I., SÜMEGI, P. & SZILÁGYI, G. (1993): A new biotope of *Chilostoma banaticum* (Rossmässler, 1838) in Hungary and its nature conservational aspects. — Malakológiai Tájékoztató, **12:** 29–33. Gyöngyös.

FLORKIN, M (1969): Fossil shell „conchiolin" and other preserved biopolimers. – in: EGLINTON, G. & MURPHY, M.T. (Eds.): Organic Geochemistry, Springer-Verlag, 498—519. Berlin.

GEYER, D. (1927): Unsere Land- und Süsswasser-Mollusken. 227. Stuttgart.

GROSSU (1983): Gastropoda Romaniae. **4:** 487—490. Bucureşti.

GROSSU, A. V. & TESSIO, C.(1975): Systematic studies on some species of the genus *Helicigona* (Pulmonata: Helicidae). — Malacological Review, **8:** 111–113. Ann Arbor.

HOFFMANN, R. (2008) : Ex verbis

HUDEC, V. (1972): Bemerkungen zur Anatomie einiger Schneckenarten (Gastropoda) aus Rumänien. — Polska Akademia Nauk. Institut Zoologiczny Annales Zooligici, **29 (10):** 338—340. Warsawa.

KERNEY, M. P. CAMERUN, R. A. D. & JUNGBLUTH, J. H. (1983): Die Landschnecken Nord- und Mitteleuropas. 278–279., 362. Hamburg and Berlin.

KIMAKOWICZ, M. (1890): Beitrag zur Molluskenfauna Siebenbürgens II. Nachtrag. — Verhandlungen und Mitteilungen des Siebenbürgisches Conchylien Vereins für Naturwissenschaften zu Hermannstadt. **40:** 186. Hermannstadt.

KREJCI, K. & WENZ, W. (1926): Jungtertiäre Landschneken aus Südrumänien Neues Jahrbuch für Mineralogie, Geologie und Paläontologie.**55:** 60–61. Stuttgart.

LENGYEL, G. D. & PÁLL-GERGELY, B. (2010): Notes on the landsnail (Gastropoda) and harvestman (Opiliones) fauna of Bihor and Vlădeasa mountains, Romania. — Studii şi Cumunicări, Seria Ştiinţele Naturii, **10—11:** 91—111. Satu Mare.

LUPU, D. (1966): Un fossile vivant de la faune de la Roumanie: *Chilostoma (Drobacia) maeotica* Wenz (Gastropoda-Pulmonata). — Travaux du Muséum d'Histoire Naturelle" Grigore Antipa", **6:** 31—37. Bucureşti.

PFEIFFER, L. (1846): Die Schnirkelschnecken nebst den zunächst verwansten Gattungen. II. — In: Martini & Chemnitz: Systematisches Conchylien.-Cabinet. (1) **12 (2):** 81—82. Nürnberg.

PFLEGER, V. (1984): Schnecken und Muscheln Europas. 148. Stuttgart.

ROSSMÄSSLER, E. A. (1838): Iconographie der Land- & Süßwasser-Mollusken mit vorzüglicher Berücksichtigung der europäischen noch nicht abgebildeten Arten. **2 (1/2):** 14. Dresden und Leipzig.

SÓLYMOS, P., CZENTYE, I. & TUTKOVICS, B. (2006-2007): Microscale distributions of landsnails in a homogenous alder stand – Szárazföldi csigák mikro-léptékű eloszlási viszonyai egy homogén égeres állományban.— Soosiana, **34–35:** 39–43.

SOÓS, L. (1943): A Kárpát-medence Mollusca-faunája. — In Magyarország természetrajza, I. Állattani rész. MTA. 389—390. Budapest.

SOÓS, L. (1955—1959): Puhatestűek. — Mollusca. In: SZÉKESSY V.: Magyarország Állat-világa.— Fauna Hungariae, Akadémia Kiadó, **19 (3):** 145–146. Budapest.

STURANY, R. & WAGNER, A. J. (1914): Über schalentragende Landmollusken aus Albanien und Nachbargebeiten. — Denkschriften Mathematische-Naturwissenschaftliche Klasse der Kaiselichen Akademie der Wissenschaften in Wien, **91:**19–138. Wien.

SZABÓ, A. & FINTHA, I. (1999): The third and most significant record of *Chilostoma banaticum* (Rossmässler, 1838) / = *Helicigona banatica* / in Hungary (Tiszabecs, floodplain of River Tisa) ─ Tiscia monograph series, **4:** 479–480. Szeged.

SZENTESI, GY. & DOMOKOS, T. (1998): A Sr-90 izotóp aktivitásának vizsgálata *Helicigona banatica* (Gastropoda) és *Unio crassus* (Bivalvia) mészvázakon. ─ Csernobil utóhatásának indikálása.─ Állattani Közlemények, **83:** 83–86. Budapest.

TRYON, G. W. (1888): Manual of Chonhology, **4 (2):** 97. Philadelphia.

VARGA, Z. (1970): Extension, isolation, micro-evolution.─ Acta Biologica Debrecina, **7–8:**193–209.

VARGA, Z. (1971): A szétterjedési centrumok és a szétterjedési folyamat jelentősége a földrajzi izoláció kialakulása és a mikroevolúció szempontjából. ─ Állattani Közlemények, **58 (1-4):** 142–149.

VARGA, Z. (1975): Geographische Isolation und Subspezialization bei den Hochgebirgslepidopteren der Balkanhalbinsel.─ Acta Entomologica Jugoslavica, **11 (1–2):** 5–40.

WELTER-SCHULTES, F. W. (2012): European non-marine molluscs, a guid for species identification. A1─A3, 1─679, Q1─Q78. Göttingen (Planet Poster Editions).

WESTERLUND, C. A. (1889): Fauna der in der paläarctischen Region (Europa, Kaukasien, Siberien, Turan, Persien, Kurdistan, Armenien, Mesopotamien, Kleinasien, Syrien, Arabien, Egypten, Tripolis, Tunesien, Algerien und Marocco) lebenden Binnenconchylien, **2:** 116─117. Berlin.

www.animalbase.uni-goettingen.de/.../
www.faunaeur.org (4-2008)
www.malacologukraine.narod.ru/check-l.
www. Red book of Ukraine Animals. Part 1. 298.(issuu.com/…)
www.mail.menr.gov.ua/bubl/...redbook.ph