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What is *Vallonia excentrica* (STERKI, 1893)? (*Gastropoda*: *Pulmonata*: *Vallonidae*)

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ABSTRACT. Based on detailed biometric data and field studies *Vallonia excentrica* (STERKI, 1893) is reduced to an ecological form of *V. pulchella* (O. F. MÜLLER, 1774).

Key words: Malacology, synonymy, ecological variation, *Gastropoda*, *Vallonia*.

INTRODUCTION

Vallonia excentrica (STERKI, 1893) (Fig.1) and *V.pulchella* (O. F. MÜLLER, 1774) (Fig.2) are Holarctic species of very wide original distribution, additionally introduced in nearly all other parts of the world. In Europe they are very common, avoiding only higher mountain altitudes. In Scandinavia *V. pulchella* reaches 71° N, *V. excentrica* 60° N (KERNEY & al. 1983). They live in open habitats, mainly meadows, sparse shrubbery, gardens, balks, lawns, clearings etc., *V. excentrica* prefering habitats of somewhat lower humidity.

V. excentrica was described by STERKI (1893) based on shell structure and mouthparts (jaw and radula). Most characters regarded by that author as diagnostic were estimated by other workers as having little or no value (STEENBERG 1917, WAGNER 1935, HUBENDICK 1950, 1952, SPARKS 1953, ZILCH 1969, ANT 1963, GIUSTI and MANGANELLI 1985). The structure of jaw and radula is most often omitted from the descriptions. Besides the basic paper by STERKI (1893), descriptions of jaw and radula in both species were given only by BOWELL (1915), WATSON (1920) and STEENBERG (1917); GIUSTI and MANGANELLI (1985) described those structures in *V. pulchella*. According to those papers the radular formula is the same in both forms (9-4-1-4-9), only the number of transverse rows being different (table 1):

Table 1:

excentrica	*pulchella*	author
81-84	65-70	STERKI (1893)
83	76	WATSON (1920)
76	70	STEENBERG (1917)

It should be remembered, however, that the character is much more variable than suggested by the literature data. This was stressed by HUBENDICK (1950) who considered the differences to be well within the range of intraspecific variation. Besides, the number of rows depends on the age of individual, as noted also by STERKI (1893) who provided the number of 60 rows for juvenile *V. pulchella*. It follows from STEENBERG's (1917) observations that the character is much variable in all the pupilloids (his *Pupillidae* s. l.).

The shell characters constitute a separate group. Variability ranges of some of them (size, number of whorls) overlap rather broadly. Such characters as "eccentricity" of the umbilicus and distension of the body whorl can be correctly identified only after examining large series of specimens. The only less ambiguous character which does not create interpretation difficulties is the structure of lip. A similar opinion was expressed by BERGER (1961).

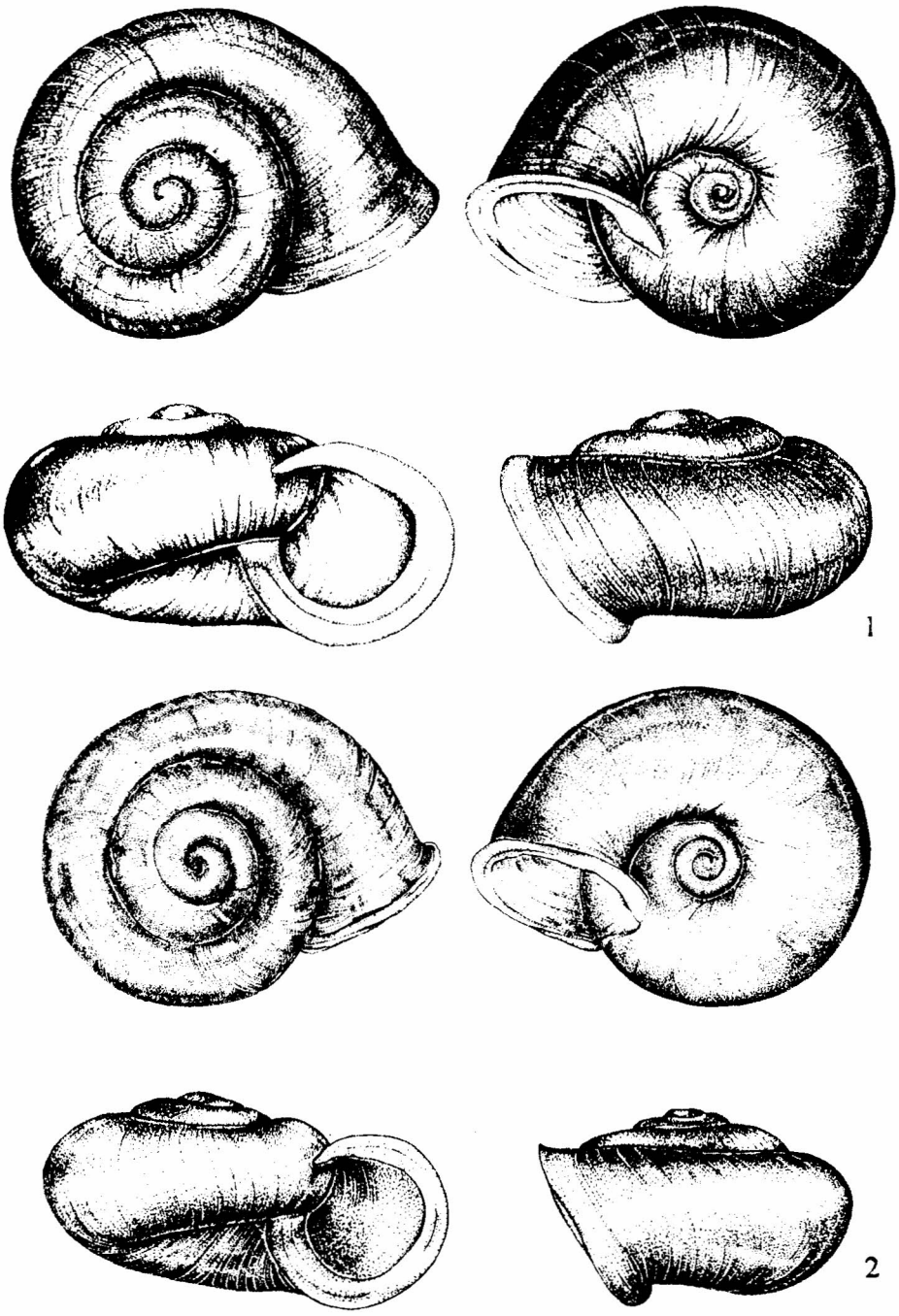
Till now no taxonomical study of the reproductive system has been done. This results from the difficulties in interpreting much simplified internal organs and the high (over 80%) proportion of aphallic individuals in all the populations (STEENBERG 1917, WATSON 1920, SHILEYKO 1984, BARKER 1986).

VALLONIA PROBLEM IN LITERATURE

The common occurrence of the two species makes it necessary for authors of faunistic papers to express an opinion (indirectly) on the taxonomic status of *V. excentrica*. Basically, three opinions can be distinguished.

1. *V. pulchella pulchella* (O. F. MÜLLER, 1774) and *V. pulchella excentrica* (STERKI, 1893) are subspecies.
2. *V. excentrica* (STERKI, 1893) is a good species.
3. *V. excentrica* is a form of *V. pulchella*.

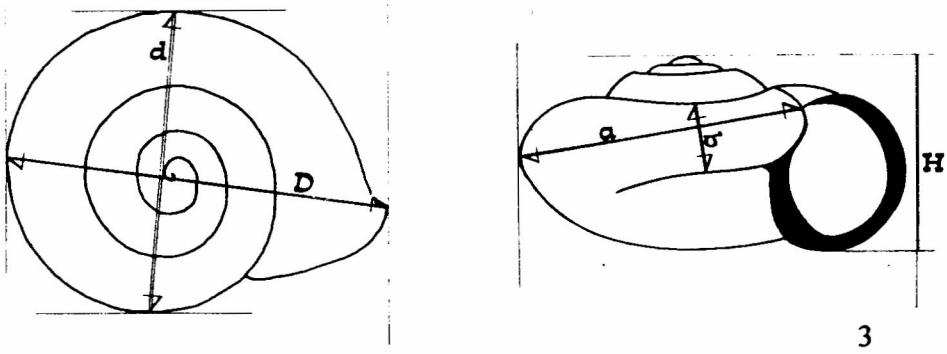
The first opinion results most probably from an attempt at finding a compromise. Such an approach is unacceptable since, as pointed by HUBEDICK (1952), the two forms often co-occur. It is symptomatic that such a position is taken by authors of faunistic papers (e.g. DAMJANOV and LIKHAREV 1975) who are essentially interested only in the presence/absence of a species in an area. The other two opinions on *Vallonia* divided their proponents into two camps.



1. *Vallonia excentrica*: specimen from Podlesice (Wyżyna Krakowsko-Częstochowska); 2. *Vallonia pulchella*: specimen from Morsko (Wyżyna Krakowsko-Częstochowska)

As mentioned by SPARKS (1953 and references contained therein), a large group of authors favours regarding *V. excentrica* as a form of *V. pulchella*, but most consider them to be distinct species. Though the "voting" criterion in favour vs. against does not appear to be decisive when evaluating taxonomic status, it makes it possible to estimate the situation.

An extreme, and hence discussed separately, position was taken by VARGA (1972) in his revision of Hungarian valloniids. He states that the eccentricity is within the



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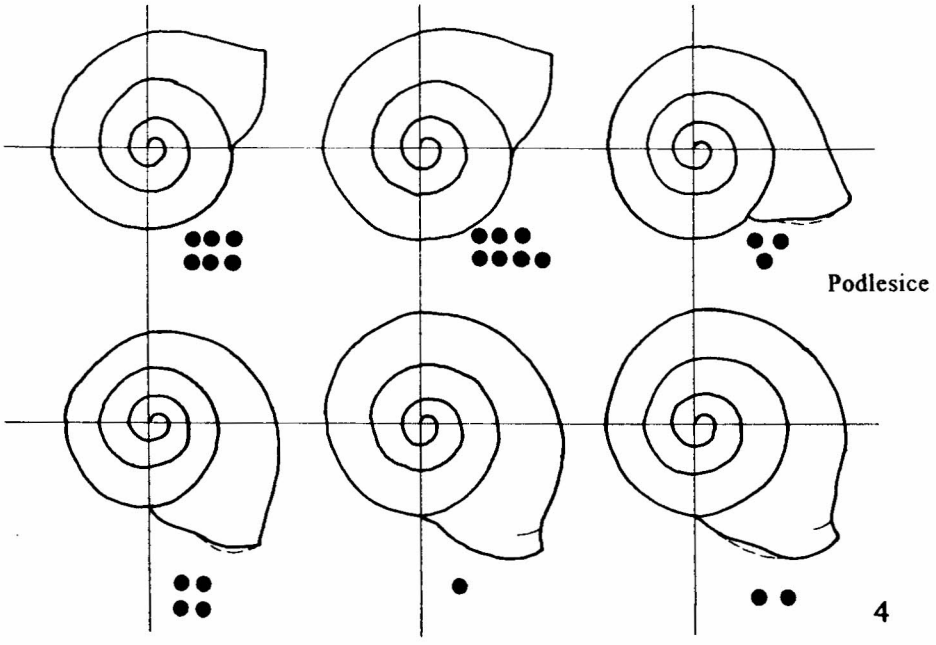

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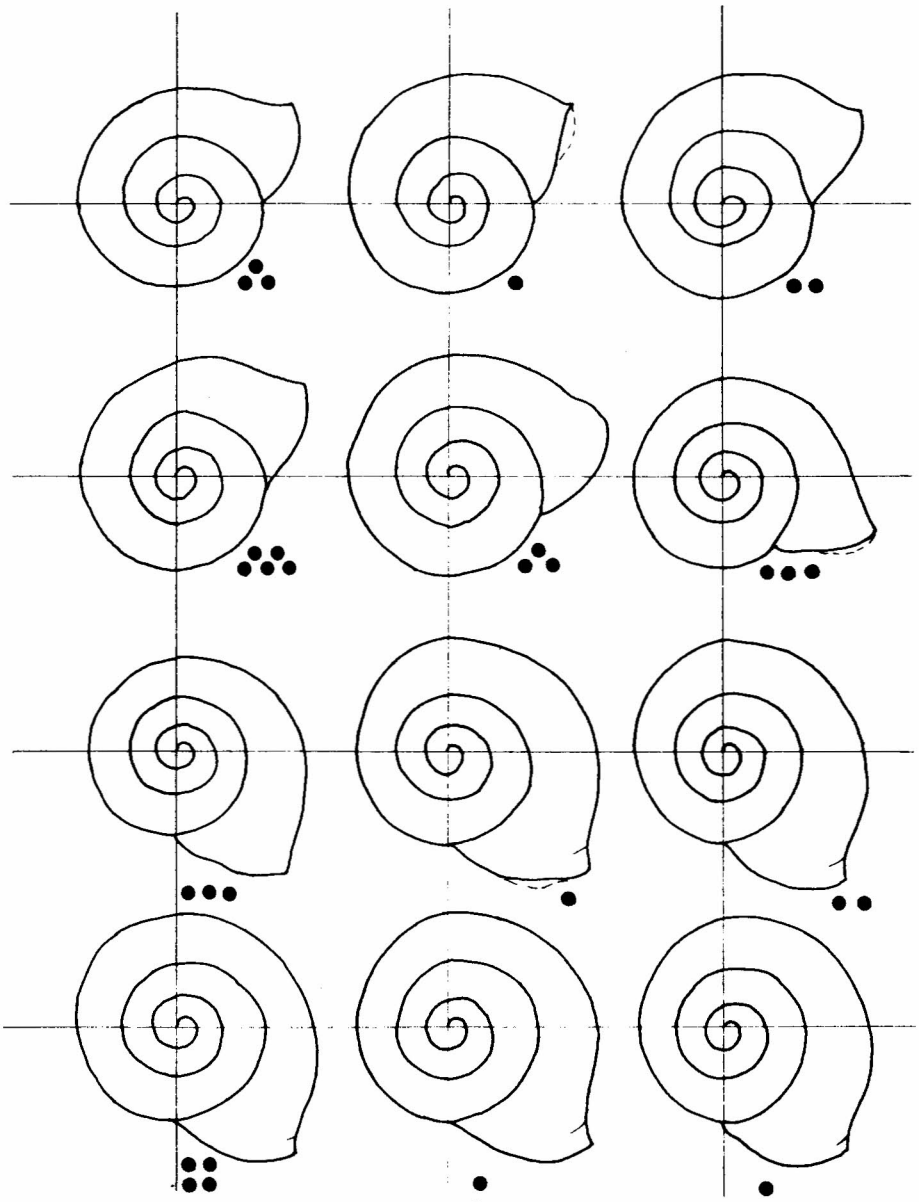
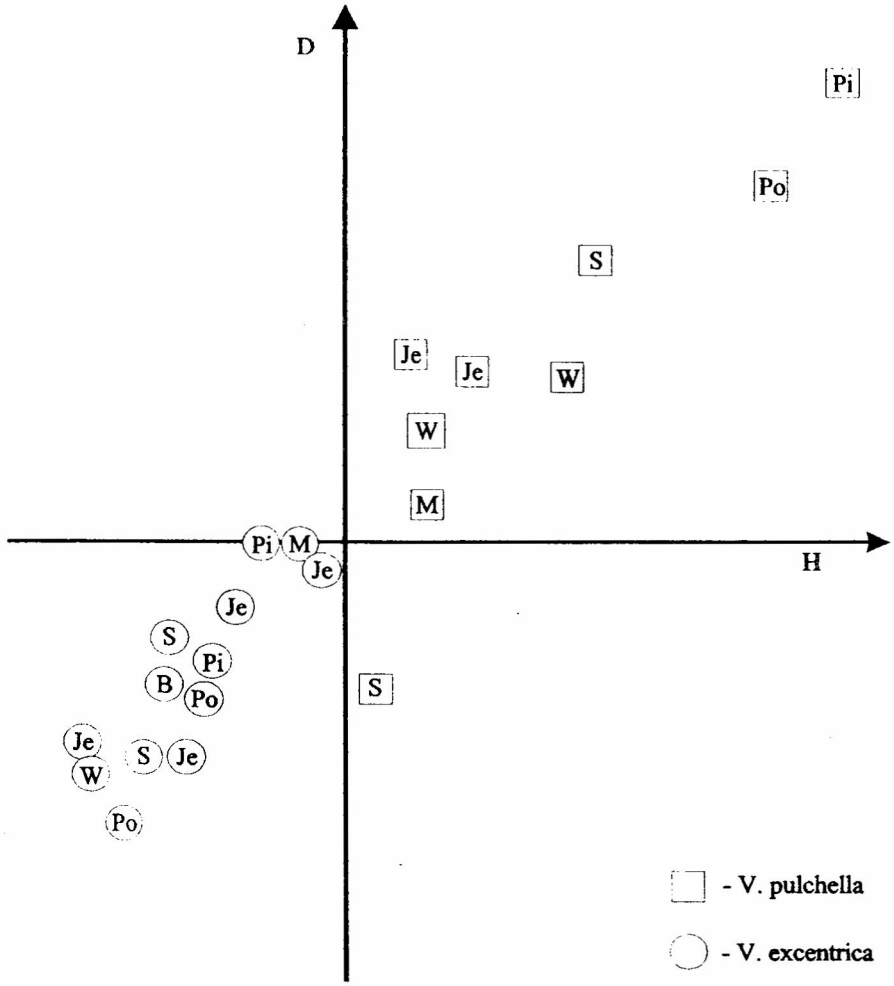
3. Main biometric properties of *Vallonia* shell; "a", "b" - parameters "flatness index" of MEIER-BROOK; "d", "D" - small & large shell breadth; "H" - shell height. 4. Variability of shells - populations from Podlesice & Morsko; black dots denote the number of individuals of each from (see also page 395)



Morsko

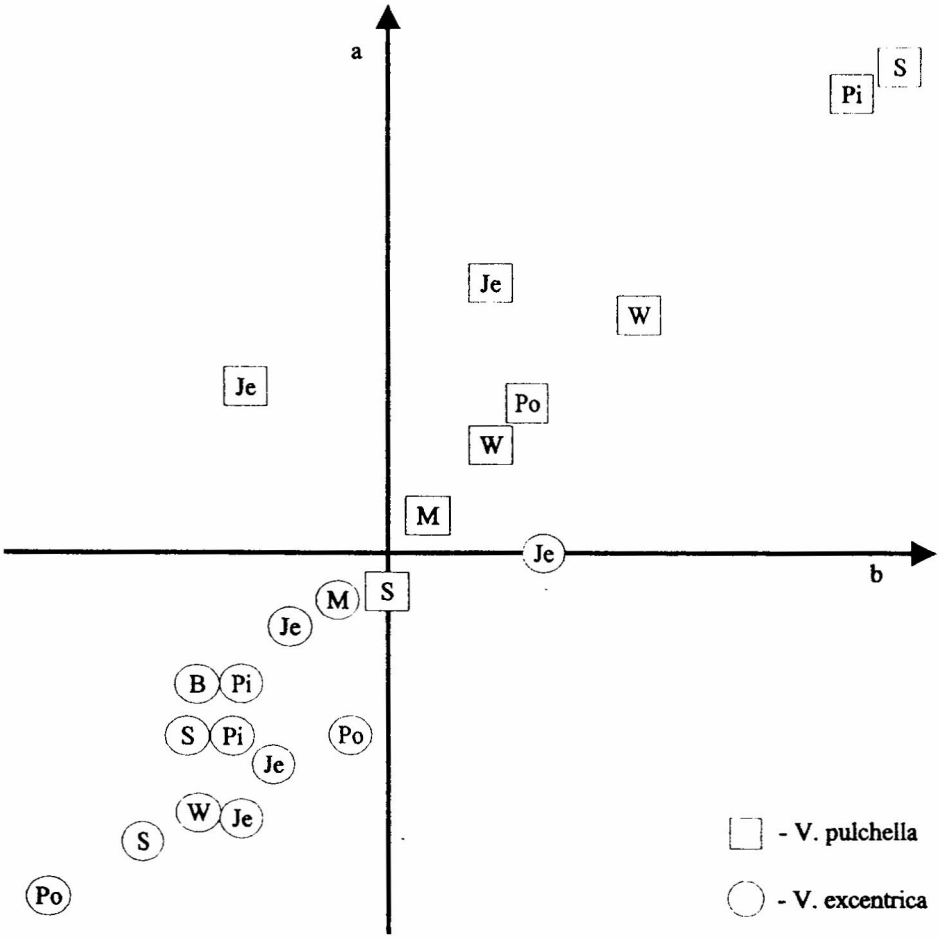
variability range of *Vallonia pulchella* and, consequently, omits it in his subsequent publications (1986a, b). Such an approach is not the most fortunate. Already superficial field observations in various habitats and examination of the collections reveal that the eccentricity character can not be ignored. It is of stratigraphic importance (SPARKS 1953) and serves as a measure of the xeric character of habitat. Besides, it is difficult to overlook the existence of purely eccentric populations. This does not imply a clear difference between the forms pulchella and excentrica. On the contrary, the awkward fact that in some populations there exists a slight but distinct proportion of specimens which are difficult to classify, is omitted by most authors (Fig. 4).



5. Natural indices (PERKAL's method) of studied populations - height/breadth ratio

MATERIAL AND METHODS

In order to estimate the taxonomic value of conchological characters, collections from several European localities were examined. Scandinavian samples (an extreme of variability range) and those from two xeric areas: a plateau near Jena (Germany) and Balkan Mountains - Stara Planina (former Yugoslavia) were regarded as the most important. At the same time I took samples in the field. I have examined specimens from the following collections:



5. Natural indices (PERKAL's method) of studied populations - "flatnes index"

1. Museum and Institute of Zoology, Polish Academy of Sciences, Warsaw;
2. Museum of Natural History, Wrocław University;
3. Naturhistorisches Museum Wien;
4. Naturhistoriska Museet, Göteborg;
5. Naturhistoriska Riksmuseet, Stockholm;
6. Staatlische Museum für Naturkunde, Görlitz.

Shells were identified according to STERKI's (1893) criteria, and then measured (Fig.3). The results were subject to a preliminary statistical analysis. For each sample mean, standard deviation and variability coefficient were calculated. The peristom measurements are omitted from the figure, since comparison of the variability coefficients in particular samples with the coefficient calculated for the total material ("Vip") revealed that the range of interpopulation variability was lower than that of intrapopulation variability. For example, for the peristom height Vip = 3.9%, whereas in particular populations it ranges from 4.0 to 4.7%. Besides, measurements of "a" and "b" parameters ("flatness index" of MEIER-BROOK 1988) were used (Fig 3).

In order to make data and samples comparable, the so called natural indices according to PERKAL (1958) were calculated. The results are illustrated in Figs 5-6.

OBSERVATIONS

The preliminary analysis of biometrical data demonstrates distinctly that the values of the studied characters have continuous distributions where *V. excentrica* always ocupies lower parts of variability ranges, but can not be unambiguously separated on this basis (Fig. 5-6.). This is an evidence that the forms are difficult to separate biometrically.

Field studies reveal that the value of the museum materials for the analysis of intrapopulation variation in *Vallonia* is low. This results partly from their bionomics. BARKER (1986) stresses that *V. excentrica* in pastures in New Zealand is very unevenly distributed. This is confirmed by the observations in Polish habitats. It is plainly manifest in xeric meadows of the Wyżyna Krakowsko-Częstochowska and epilithic grasslands and meadows of the Pieniny Mts where populations often occupy an area of a radius not exceeding 10 cm. Considering this distribution most museum materials (especially including subfossil specimens) comprise specimens from several local populations and preclude the possibility of distinguishing between ecophenotypic forms. Only ground cover samples treated separately make it possible to study such a variation. Such an approach makes it possible to trace the dependence between the proportion of the two forms and the habitat humidity and calcium content. Because the data are incomplete they can be treated as preliminary only. Figure 4 represents the distribution of shell variation in two populations from comparatively close localities in the Wyżyna Krakowsko-Częstochowska. These are epilithic grasslands from the vicinity of Morsko and Podlesice with a community of crevice plants of *Potentillon caulescentis* BR.-BL., but differing slightly in the humidity and insolation.

The locality in Morsko is situated on a soil-filled deep rock crevice c. 30x20 cm, shaded by shrubs. The site in Podlesice on the mountain Apteka is smaller (15x25 cm), totally unshaded and situated in a shallow rock concavity with little soil. It is obvious that the site in Morsko creates more favourable humidity conditions.

Based on those data it can be conjectured that *V. excentrica* is a "starvation" form of *V. pulchella*. This changes basically the way of interpreting the taxon/habitat dependence: *V. excentrica* occurs in dry habitats not because it is a xerophile, but because it can only exist there in this form.

Some data on the life history of *V. pulchella* seem to confirm such a point of view. The species needs 82-162 days to form peristom (which also implies sexual maturity). The data come from the laboratory culture where the temperature and humidity conditions were constant. Even under such favourable conditions the mortality of juveniles reached 75%, and the insufficient humidity was decisive. Individuals which have already formed more than 3/4 of the first definitive whorl are less sensitive to dessication. Such snails could survive dry periods of a few days or even weeks in inactive state. During that time there was obviously a break in shell growth (ISKRZYŃSKA 1986).

Field observations (Barker 1985) indicate that eggs appear mainly in the spring and fall, though laboratory data show no seasonal peaks of reproductive activity (WHITNEY 1938, ISKRZYŃSKA 1986). Unfavourable humidity conditions (e.g. in xeric habitats) may result in a considerable delay in sexual maturation. In consequence, shell growth termination may be accelerated because of the necessity to lay eggs before the cold season. Hence the form excentrica has a slightly different peristom and fewer whorls.

Another factor affecting the shape and "massiveness" of shell is calcium content in the substratum. Shell is one of the storage places for calcium reserves, though such reserves are the last to be mobilized (FOURNIÉ, CHÉTAIL, 1984). Following completion of the peristom *Vallonia* thickens its shell from within, and during calcium deficiency it can "bite off" the inner shell margin (ISKRZYŃSKA 1986). In xeric habitats with calcareous substratum calcium is readily available and taken up with food, while its excess in organism is relieved among others by depositing it in the shell. Hence snails from such localities have distinctly thicker and less translucent shells.

Certainly the hypothesis presented above needs verification. It seems that a laboratory culture of "pure lines" of *Vallonia* (i.e. originating from single individuals) under different humidity, temperature and calcium availability conditions might be decisive.

I think it safer to regard *V. excentrica* as a form of *V. pulchella* unless contrary evidence becomes available.

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