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BITHYNIA TROSCHELII (PAASCH, 1842), A GIANT OF UNKNOWN ORIGIN?

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ABSTRACT: *Bithynia troschelii* (Paasch, 1842) and *B. leachii* (Sheppard, 1823) from 3 and 4 German localities, respectively, were studied by means of cellulose acetate gel allozyme electrophoresis, to compare 23 enzyme systems represented by 34 loci. In none of the loci a fixed difference was found between the two taxa. *B. troschelii* is much bigger than *B. leachii*; it also differs from the latter in the flagellum/penis length ratio. *B. troschelii* is rarer and its range narrower than that of *B. leachii*, in which it is contained. The results suggest a very close relationship between the taxa, but due to the striking size difference, representatives of one taxon could hardly mate with those of the other, so their reproductive isolation should be efficient. Thus *B. troschelii* is most probably a distinct species separated from *B. leachii* very recently, probably by saltational speciation.

KEY WORDS: snails, *Bithynia troschelii*, allozyme electrophoresis, speciation

INTRODUCTION

Bithynia troschelii (Paasch, 1842) occurs in the northern part of Central Europe: from the eastern part of North Germany, through North Poland, to Lithuania and Belorus (EHRMANN 1933, JAECKEL 1969, GLÖER 2002a). In some parts of its range it is rare or very rare: in Poland it occurs at a few localities (FALNIOWSKI 1989). Its shell resembles a typical *B. leachii* (Sheppard, 1823), but is much bigger (Fig. 1). However, a more careful examination of the shells of *B. troschelii* will show some differences: compared to the former species the whorls are less convex, the suture is shallower and may be different in shape, the operculum has a faintly marked angle, of which there is no trace in *B. leachii*. *B. troschelii* shows a number of distinct characters in the sculpture and inner structure of the shell (FALNIOWSKI 1990). The two differ also from each other in the proportion of flagellum length to penis length. This proportion is the only anatomical difference (except size) between *B. leachii* and *B. tentaculata* (FALNIOWSKI 1990) and its value in *B. troschelii* is between the values in the former two species. There are also differences in penis habitus (Fig. 2) between *B. leachii* and *B. troschelii*.

The status of *B. trpschelii* remains enigmatic. It is regarded as a form of *B. leachii*, its geographic race (in the subspecies sense) (GLÖER 2002a), or a distinct species. The latter is supported by the mentioned set of more or less distinct character states of *B. troschelii*, the general scarcity and weakness of interspecific differ-

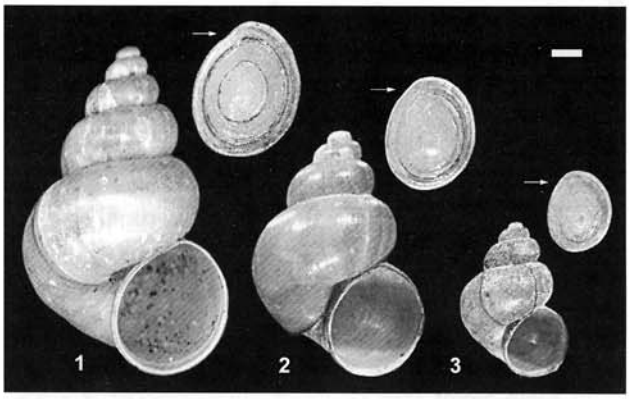

Fig. 1. Shells of the Central European *Bithynia* species: 1 – *B. troschelii* (Lankower See, Mecklenburg–Vorpommern), 2 – *B. troschelii* (Reitbrooker Sammelgraben, Hamburg), 3 – *B. leachii* (Suedensee, Schleswig-Holstein). Bar equals 1 mm

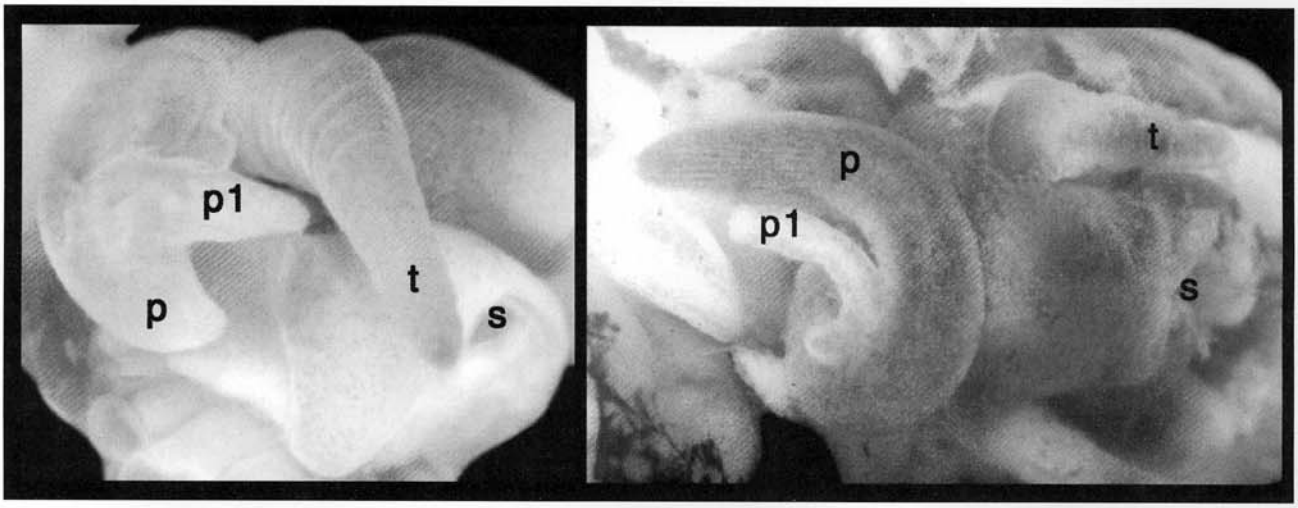

Fig. 2. Heads and verges of *Bithynia*: left: *B. leachii*, right: *B. troschelii* (p = penis arm containing vas deferens, p1 = penis arm containing flagellum, t = tentacle, s = snout)

ences in the bithyniids in question (PONDER 2003). The subspecies concept does not agree with the fact that the ranges of the two taxa are not distinct: the range of *B. troschelii* is a part of the range of *B. leachii*, and within the range of *B. troschelii* both species can be found. The taxa usually do not occur in sympatry, but in some localities they do. Then the differences between the two taxa are somewhat less pronounced, and some intermediate specimens, possibly hybrids, occur (GLÖER 2002b). It must also be stressed that the reproductive organs in *B. troschelii* are normally developed (FALNIOWSKI 1990), thus this is not a case of gigantism caused by larval trematodes, as observed in many prosobranch species (FRETTER & GRAHAM 1962).

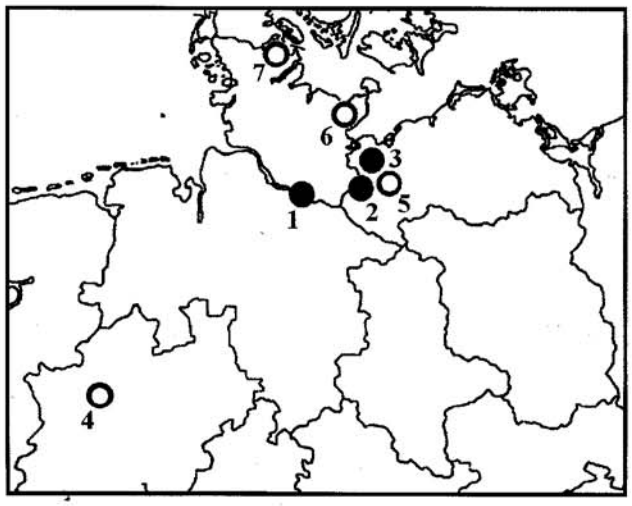

Fig. 3. Map of the studied localities: open circle – *Bithynia leachii*, solid circle – *B. troschelii*: 1 – Reitbrooker Sammelgraben (Hamburg) (sympatric typical *B. leachii*, typical *B. troschelii* and intermediate-shelled specimens), 2 – Lankower See (Mecklenburg–Vorpommern), 3 – lake in Klein Siems (Mecklenburg–Vorpommern), 4 – NSG Bevernsee bei Rünthe (Nordrhein–Westfalen), 5 – Graben bei Crivitz (Mecklenburg–Vorpommern), 6 – Klostergraben in Cismar (Schleswig-Holstein), 7 – Suedensee (Schleswig-Holstein)

MATERIAL AND METHODS

In the summer of 2003, specimens of *B. troschelii* were collected at three localities in the central part of northern Germany (Fig. 3). At locality 1 intermediates of *B. troschelii* and *B. leachii*, together with typical specimens of the two taxa were found, while at localities 2 and 3 there were only typical *B. troschelii*. *B. leachii* was also collected from localities 4–7. Allozyme electrophoresis on cellulose acetate gels was run according to the protocols of RICHARDSON et al (1986). There is no general rule how profound the differences in allozymes must be to confirm a species distinctness, thus together with *B. leachii* and *B. troschelii* specimens of *B. tentaculata* from a couple of localities were assayed at the same gels. We were applying the strategy of searching for fixed differences, that is, for loci fixed on different alleles in different taxa (RICHARDSON et al. 1986). For each taxon at each locality not less than five specimens were assayed, for 23 enzyme systems, represented by 34 loci (the list available upon request from the senior author).

RESULTS AND DISCUSSION

We found fixed differences between *B. leachii* and *B. tentaculata* in six (20.5% of all studied) enzyme systems (MURPHY et al. 1996), coded by seven loci: glucose-6-phosphate isomerase (EC 5.3.1.9; *Gpi*), hydroxybutyrate dehydrogenase (EC 1.1.1.30; *Hbdh*), isocitrate dehydrogenase (EC 1.1.1.42; *Idh-2*), malate dehydrogenase (EC 1.1.1.37; *Mdh*), malate dehydrogenase ($NADP^+$) (EC 1.1.1.40; *Mdhp*), and phosphoglucomutase (EC 5.4.2.2; *Pgm-1, Pgm-2*).

At the same time, at any locus we did not find a constant difference between *B. leachii* and *B. troschelii*. Also the presumed hybrid specimens from locality 1 were allozymatically identical with both *B. leachii* and *B. troschelii*.

The above results confirm the molecular identity of *B. troschelii* and *B. leachii*. This means that the taxa are either one species or two species that are almost indistinct allozymically. The latter is known in gastropods (DAVIS 1994). As in other studies like that, one can also suppose that the assayed loci were not representative. *B. troschelii* may be a giant *B. leachii* and the observed differences in the proportions of the soft parts may be a result of allometric growth, while the differences in shell structure and sculpture are perhaps due to some environmental factors. In any case, *B. troschelii* is certainly not a giant caused by parasites: the reproductive organs in the taxon are usually normally developed and with no trace of larval trematodes. On the other hand, given the striking size differences, the disjoint ranges (shell height: 4–6 mm in *B. leachii* and 8–12 mm in *B. troschelii*) copulation between the two taxa seems hardly possible, so their reproductive isolation must be efficient. Thus *B. troschelii* is most probably a distinct species separated from *B. leachii* very recently, probably by saltational speciation. It must be noted, however, that at some localities the size ranges of the representatives of the two taxa nearly overlap. This means that the supposed isolating mechanism may fail, in which case (rare) hybrids between these very close species will appear.

ACKNOWLEDGMENTS

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