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On a remarkable dimorphism of the apices in many groups of sympatric, closely related marine gastropod species

A. VERDUIN

Rijksmuseum van Natuurlijke Historie, Leiden

The intention of this paper is to draw attention to an interesting phenomenon in marine gastropods, of which the importance has not yet been as widely appreciated as, in my opinion, it should be. I came across the phenomenon for the first time when studying ten recent species of the subgenus *Turboella* Gray, 1847, of the genus *Rissoa* Desmarest, 1814 (Verduin, 1976a). Eight of these species have similar apical dimensions of about 0.09/0.15 mm, though otherwise they differ conchologically. The first of these measurements is the diameter of the nucleus, the second one that of the first half whorl (fig. 1). The two remaining species, however, are conchologically so similar to two of the eight species mentioned, that the representatives can often only be separated reliably from their sibling partners by the distinctly larger apical dimensions being about 0.14/0.24 mm. There are strong indications that, of each pair of these sibling species, the partner with the larger apical dimensions lacks a swimming larval phase, in contrast to that with the smaller ones. The sibling species are sympatric in large parts of their range.

In complete agreement with the above are Rehfeldt's (1968) findings that in the Roskildefjord in Denmark two types of *Rissoa membranacea* (J. Adams, 1800) with very similar shells must be distinguished, which, however, also show the differences in apical dimensions and larval phase discussed above. Both forms, which apparently must be considered separate species, also occur in England and Bretagne, France, but the one with the coarse apex seems to be absent in the Mediterranean.

Examination of 19 European species of the genus *Gibbula* Risso, 1826, revealed that in all of these the apices measure between 0.08/0.17 and 0.10/0.21 mm. Obviously,

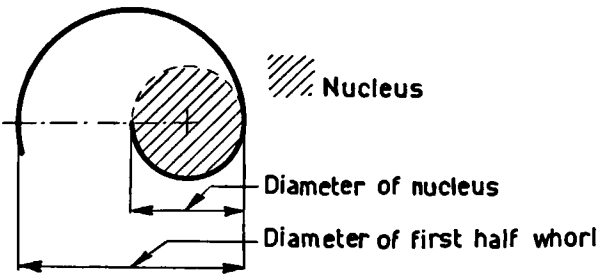

Fig. 1. Nucleus and first half whorl.

closely related species have generally a strong tendency to have similar apical dimensions. That this might even be true for closely related genera, might be concluded from the fact that I found much the same apical dimensions in two European species of the genus *Monodonta* Lamarck, 1801, three do. of the genus *Clanculus* Montfort, 1810, and three of the genus *Cantharidus* Montfort, 1810, which genera are closely related to the genus *Gibbula*. This once more stresses the point that the occurrence of apical dimorphism among the species of one genus must be looked upon as a remarkable phenomenon.

In order to find out whether the phenomenon is restricted to the genus *Rissoa* only, I examined a few pairs of closely related, sympatric species of which only one partner was found by Richter & Thorson (1975) in the plankton of the Golfo di Napoli. In this way, it proved to be not at all difficult to find a few more cases of apical dimorphism:

Turritella communis Risso, 1826, ... 0.12/0.19 mm
Turritella mediterranea[1] Monterosato, 1890, ... 0.19/0.30 mm

Cerithium vulgatum Bruguière, 1792, ... 0.09/0.15 mm
Cerithium rupestre Risso, 1826, ... 0.14/0.23 mm

Bittium latreillii (Payraudeau, 1826) ..... 0.08/0.12 mm
Bittium lacteum (Philippi, 1836) ..... 0.16/0.27 mm

The species of each of the pairs mentioned show a great conchological similarity. Juvenile specimens of *T. communis* and *T. mediterranea* are so alike that it is often difficult or impossible to tell them apart if the tips are damaged. The same applies to

1 From a paper by Mars, 1973, I infer that the taxonomy of recent and fossil European forms of the genus *Turritella* Lamarck, 1799, has not yet been firmly established. As the correct nomenclature of recent European *Turritella* depends largely on that of the fossil ones, and as the latter are outside the field covered by me, I feel that under the circumstances the name "*mediterranea*" denotes best the form under discussion. It has been figured and described well by Geronimo (1974 : 11).

juvenile specimens of *C. vulgatum* and *C. rupestre*. The similarity between juvenile specimens of *B. latreillii* and *B. lacteum* is discussed elsewhere (Verduin, 1976b).

Though it is closely related to the genus *Rissoa*, the genus *Alvania* Risso, 1826, shows a somewhat different picture. Indeed, also among European species of *Alvania* pairs of sympatric, nearly homeomorph species with different apical dimensions do exist, such as *A. cancellata* (Da Costa, 1778) and *A. hirta* (Monterosato, 1884), or *A. punctura* (Montagu, 1803) and *A. parvula* (Jeffreys, 1884). But the great majority of the European species of the genus cannot be arranged in such pairs. Yet, as can be seen in fig. 2, it seems that their apical dimensions can be arranged into two groups, which, moreover, connect well with the two sets of apical dimensions found in the genus *Rissoa*. However,

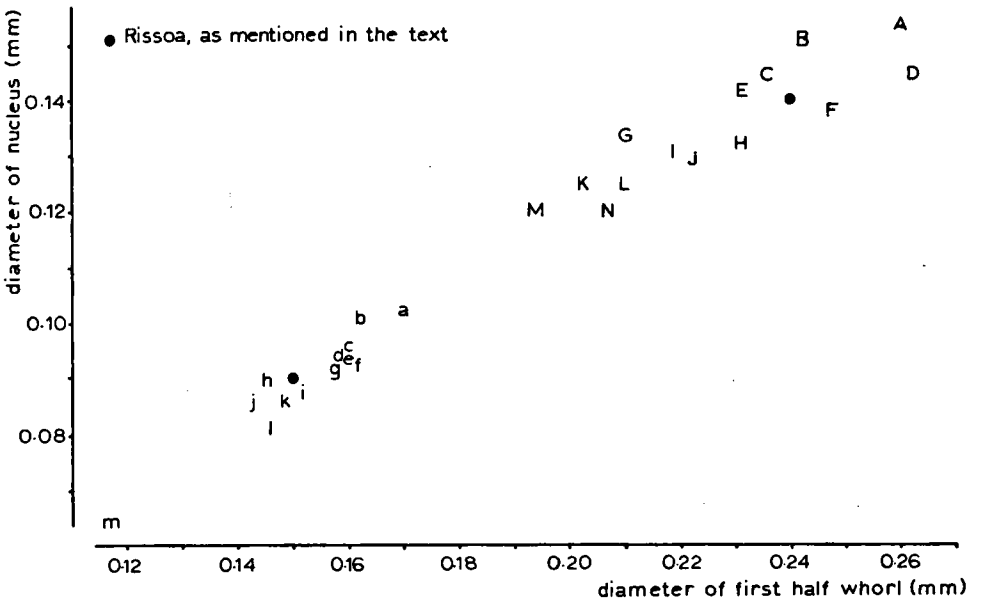

Fig. 2. Apical dimensions of a number of European species of the genus *Alvania* Risso, 1826, see fig. 1. A: *A. subareolata* Monterosato, 1869; B: *A. aspera* (Philippi, 1844); C: *A. lineata* Risso, 1826; D: *A. weinkauffi* Schwartz, 1868; E: *A. lanciae* (Calcara, 1845); F: *A. fischeri* (Jeffreys, 1884); G: *A. hirta* (Monterosato, 1884); H: *A. dictyophora* (Philippi, 1844); I: *A. subcrenulata* Schwartz, 1869; J: *A. spinosa* (Montersato, 1890); K: *A. vermaasi* Van Aartsen, 1975; L: *A. parvula* (Jeffreys, 1884); M: *A. scabra* (Philippi, 1884); N: *A. pagodula* (Bucquoy, Dautzenberg & Dollfus, 1884).

a: *A. rudis* (Philippi, 1844); b: *A. reticulata* (Montagu, 1803); c: *A. costata* (Adams, 1797); d: *A. testae* (Aradas & Maggiore, 1843); e: *A. cimicoides* (Forbes, 1844); f: *A. zetlandica* (Montagu, 1811); g: *A. lactea* (Michaud, 1830); h: *A. calathus* (Forbes & Hanley, 1853); i: *A. carinata* (Da Costa, 1778); j: *A. tenera* (Philippi, 1844); k: *A. cancellata* (Da Costa, 1778); l: *A. geryonia* (Chiereghini, 1870); m: *A. punctura* (Montagu, 1803).

it must be remarked that most species of the genus *Alvania* show a considerable variability of the apical dimensions, and that, because of the small numbers of shells involved, fig. 2 must be considered tentative. The measurements given in fig. 2 are mean values, calculated from 3-18 specimens of each species, derived from 1-6 localities per species. The apical dimensions of two species even have not been incorporated in fig. 2, because they did not seem to be of much value here. Those of *A. montagui* (Payraudeau, 1826) showed a too large geographic variation, i.e. between 0.10/0.18 and 0.14/0.22 mm. Those of *A. cimex* (Linnaeus, 1767) seem to vary considerably with time; two specimens from Benidorm, E. Spain, collected in May 1959, measure about 0.14/0.21 mm, four other specimens from the same locality, collected in May 1966, measure about 0.10/0.16 mm!

When we discussed the phenomenon of apical dimorphism, Dr. J.J. van Aartsen drew my attention to the fact that it had already been mentioned by A.W.B. Powell (1942: 26), who wrote in his paper on the recent and fossil Turridae of New Zealand: "A certain number of genera appear to occur in parallel series, being alike in adult shell features and evidently of common origin, but by their respective protoconchs they are separable into polygyrate and paucispiral series." and "In general, a conical polygyrate protoconch indicates a free swimming larva, and such types are likely to have a wide geographic range as well as a considerable time range..... A blunt paucispiral protoconch, on the other hand, is characteristic of most of the locally distributed types, in which there is no efficient swimming stage, and in such the distribution cannot be wide..... When once the radical embryonic change from a sedentary to a free swimming larva takes place, both types appear to develop independently..... Polygyrate series usually outlive paucispiral series." Powell's observations are in exellent agreement with my own experience (cf. *Rissoa munda* and *R. marginata* in Verduin, 1976a, and *Bittium lacteum* in Verduin, 1976b) that of a pair of closely related, sympatric species, the one with a blunt, paucispiral protoconch (or coarse apex for short) often has a remarkable propensity to display marked geographic variation. Because the local forms probably differ genetically, they are to be considered subspecies (Mayr, 1964: 106).

For the remainder, little seems to be known about apical dimorphism; nothing about the cytological implications, nor whether or not the change from sedentary to free swimming larva (or the other way round) is a gradual one, nor whether or not it is reversible or whether it is restricted to Prosobranchia only.

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