



# Systematics, Phylogeny and Biology of the Neogastropoda

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## FOREWARD

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The idea of gathering a number of persons dealing with the Neogastropoda under several distinct (though interconnected) perspectives, arose during the final meeting of the 2<sup>nd</sup> International Workshop on Malacology, centred on the opisthobranchs (Cervera & Cattaneo Vietti, 2000). The observation that a significant increase of knowledge had been accumulated during the last years on this group by several teams around the world (e.g.: BALL *et al.*, 1997, 1997a; HARASEWYCH *et al.*, 1997; KANTOR & TAYLOR, 1991; TAYLOR, KANTOR & SYSOEV, 1993), suggested to take the occasion to trace the state of the art and to draw the possible future development.

Six invited lectures, and seventeen communications/posters covered three main fields, providing high level reviews and original scientific results on three main topics:

1. The phylogenetic hypotheses on the origin and radiation of the Neogastropoda.
2. The biology of the neogastropods.
3. The systematics of the several subgroups in the Neogastropoda.

Thirteen papers have been finally accepted for the publication in the present proceedings volume.

### 1. The phylogenetic hypotheses on the origin and radiation of the Neogastropoda with data from morphology, DNA, paleontology, development and ecology

Yuri I. Kantor summarised the existing hypotheses on neogastropod radiation and showed the possible sequence of morphological transformations of their digestive system. He suggests that the differing opinions on the neogastropod evolution (e.g.: KANTOR, 1996; AMAUDRUT, 1898; PONDER, 1974; GOLIKOV & STAROBOGATOV, 1988; PONDER & LINDBERG, 1997; RIEDEL, 2000) are likely the result of high rate of homoplasy within the neogastropods, since a large number of lineages rapidly proliferated during the Cretaceous (HARASEWYCH *et al.*, 1997). The result is a lot of differences in the opinions on the position of most families, as well as in the treatment of characters and character states. With relatively few morphological novelties recognizable, a cladistic analysis of the neogastropod lineages is often unsatisfactory, or poorly resolved (eg. KANTOR, 1996). The lack of clear autapomorphies hampers in some cases to recognize as monophyletic taxa, groups of species characterised by combination of non-exclusive characters (as in the case of the : SMITH, 1998 vs. KANTOR, 1991). In these cases the availability of a molecular dataset often helps, providing a molecular

framework within which the evolution of the morphological characters can be analysed. The rapid adaptive radiation of the neogastropods is probably best affordable by the sequences of genes like the cytochrome *c* oxidase I gene (HARASEWYCH *et al.*, 1997). The analysis of the evolution of the digestive system in the neogastropods supports their monophyly by several synapomorphies in the anterior foregut. Also the ontogenetic data give support to the neogastropod monophyly, as shown by Alex Ball with the similar developmental pattern of the foregut in *Conus anemone* and *Nucella lapillus*. Heterochrony associated to a considerable plasticity can give reason for the major differences in neogastropod adult morphology. The definition of the plesiomorphic state for some characters - the most primitive neogastropods have short proboscis, basal buccal mass, and the odontophoral and radular muscles pass through the nerve ring and join the columellar muscle - provide good indication for determining the potential sister groups of the Neogastropoda. According to Yuri I. Kantor, it should be searched for among the carnivorous groups of the Sorbeoconcha with underived foregut.

### 2. The biology of neogastropods, with special emphasis on the evolution of the conotoxins and their use in pharmacology

The five communications dealing with the biology of the neogastropods span a good deal of the taxonomic diversity: muricoideans, buccinoideans and conoideans are all treated.

The biology of cones is explored by Alan Kohn in the light of phylogeny to indicate how interpretation of the results differs in the absence of phylogenetic information. The group originated probably around the Lower Eocene and radiated first in the Middle Eocene. In the Cainozoic times of rapid radiation were punctuated by periods of reduced diversity, in a fashion similar to that of other invertebrates, addressing to extrinsic evolutionary factors. Kohn shows how ecological data may have a strong phylogenetic signal, with species within clades identified by molecular studies, using similar substrate and prey types. An analysis of the evolutionary pathway for the radula of cones has been presented by Rolán & Raybaudi, who propose the identification of the plesiomorphic vs. apomorphic state in radular character states. The mechanism of envenomation by cones has been explained by Detomal Espiritu *et al.* who have reviewed the present knowledge and the expanding application of cone snail venom components in medicine. They have furthermore addressed a very promising issue: the degree to



which the envenomation strategy may be shared by other venomous gastropod groups.

Helena Fortunato uses a comparative dataset on the reproduction and larval development of the *Strombina*-group and related gastropods to test the use of the larval shell for inference of development in fossil species. Having such comparative fossil-Recent studies available for more groups would provide sounding basis for the use of biometric data of the larval shells in fossils to infer developmental strategies.

Three further communications show how little we know about the biology of the neogastropods. Tan & Oh reported on the feeding habits of *Chicoreus capucinus*, a common predator in Indo-Pacific mangroves. Despite its large size and common occurrence, its biology and feeding habits are poorly known, when compared to rapanine counterparts. Solustri *et al.* described the biometrics of *Nassarius mutabilis*, a very common and commercially important Mediterranean gastropod. Hergueta *et al.* reported on the taxonomy, ecology and biology of *Chauvetia mamillata*, that is reported as feeding on egg capsules of other gastropods.

### 3. The systematics of several subgroups in the Neogastropoda with data from morphology, DNA, paleontology, development and ecology

M.G. Harasewych & Yuri I. Kantor described for the first time in detail the external morphology and anatomy of several species of the commercially important genus *Babylonia*. Among

other characters, the radula of all species differs markedly from that of any buccinoidean. Anatomy and DNA (partial sequences of CO-I) showed that *Babylonia* has close affinities to Volutidae and Olividae. The family Babyloniidae Kuroda, Habe and Oyama, 1971 is thus restored.

Guido Pastorino revised the systematics and phylogeny of the genus *Trophon* from Patagonia and Antarctica, based on the examination of over 1,000 specimens, in more than 600 lots. Four questions are addressed: how many valid *Trophon* species live in Patagonia and Antarctica? What is their range? How many lineages are represented? Do they form a monophyletic unit? It is suggested that the Patagonian species group and the Antarctic species group heretofore considered to be in the same genus, are probably polyphyletic.

Alexandra Richter & Ángel A. Luque provided a very up-to-date compilation of the current knowledge about feeding, anatomy, sexual strategy, parental care and protoconch of the coralliophilid gastropod. They show the results of a preliminary cladistic analysis on 25 characters relative to the anatomy, reproductive biology and larval development. This analysis separates Coralliophilidae and Muricidae into two independent monophyletic clades, and divide the coralliophilids into a primitive clade and a more derived one, a result that contrasts recent molecular analyses (Oliverio & Mariottini, 2001). The need for a deepening in the study of the anatomy and biology of coralliophilids is stressed, in particular in the reproductive system and reproductive strategy.



Raphitominae are morphologically the most diverse subfamily of conoideans. The great variation in the foregut anatomy results in three main feeding modalities: 1) the normal toxoglossan feeding with the radular tooth at the tip of the proboscis used to sting and inject the venom; 2) the use of the venom apparatus without the use of the radula; 3) prey capture without radula and venom, possibly by suction. A phylogenetic analysis suggests that Raphitominae have close affinities with Coninae and Mangeliinae.

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