
Anatomy of accessory rhynchodeal organs of *Vepracula vepratrica* and *Tritonoturris subbrissoides*: new types of foregut morphology in Raphitominae (Conoidea)

A. E. FEDOSOV

A.N. Severtzov Institute of Ecology and Evolution, Russian Academy of Sciences, Leninsky prospect 33, Moscow, 119071, RUSSIA

ABSTRACT. Anatomy of anterior part of digestive system in two representatives of the subfamily Raphitominae, *Vepracula vepratrica* and *Tritonoturris subbrissoides* has been studied. *V. vepratrica* possesses full set of foregut organs while the foregut of *T. subbrissoides* is highly reduced — radula, venom apparatus, proboscis and salivary glands are absent. In both species there is an additional foregut organ, lacking in other studied representatives of Raphitominae but having analogues in representatives of other groups of Conoidea. The foregut morphology of *V. vepratrica* and *T. subbrissoides*, apparently representing new types of foregut organization for Raphitominae is described, and the possible functioning of these organs is discussed in comparison to analogous structures found in other conoideans.

Origin of special foregut complex, consisting of highly modified radula and venom apparatus and underlying the unique feeding mechanism of Conoidea, was a crucial step in evolution of the group. It allowed their rapid radiation, unusual diversity and doubtless evolutionary success [Taylor et al., 1993]. High effectiveness of this mechanism, consisting in usage of separate radular teeth held at the tip of the proboscis for stabbing and envenomation of the prey, allowed *Conus* to become one of the most species-rich genera among invertebrates. Moreover, mollusks of this genus are a rare example of invertebrates having developed fish-hunting [Duda, Palundi, 2003]. Nevertheless, in representatives of some groups of Conoidea the foregut complex providing this effective feeding mechanism, undergoes significant transformations.

In some evolutionary advanced lineages of Conoidea a clear tendency to the reduction or complete loss of radula has been noticed [Taylor et al., 1993, Oliverio, 1995; Kantor, Taylor, 2002]. Usually the loss of radula is accompanied by a reduction of proboscis, venom apparatus and, sometimes, salivary gland, i.e. the other foregut organs employed in the classical conoidean mode of feeding.

The opposite tendency of foregut transformation is the origin of specialised accessory organs, usually constituting outgrowths of rhynchodaeum. Formation of these organs has been observed in mollusks possessing a full set of foregut organs as well as in mollusks demonstrating full loss of foregut complex [Taylor, 1990].

Loss of radula in representatives of Turridae is an extraordinary event and in both known cases a complete reduction of foregut organs is accompanied by appearance of special rhynchodeal structures. These organs are pyriform gland of *Zemacies excelsa* [Medinskaya, Sysoev, 2003] and distinct tongue-shape muscular outgrowth in some species of *Horraiclavus* [Fedosov, Kantor, in press]. These organs have developed in representatives of two subfamilies, Zemaciinae and Crassispirinae, independently.

Some representatives of the family Terebridae also possess a special rhynchodeal organ [Taylor, Miller, 1990]. The presence of this organ, named APS (accessory proboscis structure), does not correlate with the state of reduction of other foregut organs. It sporadically appears in both radulate and radula-less terebrids.

Family Conidae, particularly the subfamily Raphitominae, is characterized by unusually high diversity of foregut morphology exceeding that in other groups of Conoidea [Kantor, Taylor, 2002]. Raphitominae include most of described radula-less representatives of Conoidea [Kantor, Sysoev, 1989; Kantor, Taylor, 2002, our unpublished data]. Despite this great morphological diversity, additional foregut structures have never been found in representatives of Raphitominae, as well as in other Conidae.

While studying anatomy of anterior part of digestive system in representatives of the subfamily Raphitominae, two new types of the foregut which include different rhynchodeal outgrowths, were found in *Vepracula vepratrica* Hedley, 1903 and *Tritonoturris subbrissoides* Hervier, 1897. They are described below together with the discussion of possible functioning of these organs.