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# On the validity of some Iberian species of *Theodoxus* (Gastropoda: Neritidae)

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In the newest published paper about *Theodoxus* Monfort, 1810 of Spain from Martínez-Ortí & Osca (2023), the authors state that *Theodoxus baeticus* (Lamarck, 1822) is a *nomen dubium*, and *Theodoxus mixta* (Westerlund, 1892) is a valid species, different from *Theodoxus fluviatilis* (Linnaeus, 1758). In addition, they conclude that the operculum of *Theodoxus* is not a sufficient feature for species identification.

Martínez-Ortí & Osca (2023: p.13) wrote: "Glöer (2018, 2019) pointed out that the operculum of *T. fluviatilis* presents a reduced or non-existent pseudo-apophysis". The fact is, however, that Glöer (2019: p. 42) wrote: "The callus is thin and a pseudo-apophysis is missing." The authors (p.13) continued: "However, we found opercula from Swedish and Spanish specimens of *T. fluviatilis*, which allows us to verify that the variability in length towards the edge of the operculum of the pseudo-apophysis (Figs 48, 51–52, 54–58, 60–61), and that can be confused with those of *T. meridionalis* (Figs 24, 28–29, 38, 40–42, 44–46) and *T. mixta* (Fig. 72). Therefore, we consider that the operculum is neither determinant nor sufficient to identify *T. fluviatilis*". However, their pictures show: a) in #48, no pseudo-apophysis, only a callus along the border; b) #51-52: no pseudo-apophysis, but a callus along the border; c) #54-58 and #60-61: no pseudo-apophysis. That means that the authors misinterpreted the opercula characters they depicted, and so their conclusion cannot be considered as valid.

Martínez-Ortí & Osca (2023: p.11) believe that *Neritina baetica* is a *nomen dubium* because it "has an uncertain taxonomic status, as its taxonomic validity cannot currently be determined." And these authors continued: "It would be necessary to know the molecular sequence of one syntype, something that we currently believe is very unlikely. According to Glöer (2018), soft parts of the other syntype (lectotype according to Sands *et al.*, 2020), was (*sic*) processed in a solution of KOH to remove the operculum, preventing the only possibility of knowing its molecular sequence." The fact is that Glöer never had *T. baeticus* in his hand, and he wrote under Acknowledgements section: "I like to thank Emmanuel Tardy (Muséum d'Histoire Naturelle Geneva) for the photos of the opercula of the syntypes of *Theodoxus baeticus*". Glöer (2018: p. 114) extracted an operculum from one specimen of a large sample of *T. meridionalis*.

However, later, Martínez–Ortí & Osca (2023: p.11) indicated that the Sevillian population "initially assigned to *T. baeticus* corresponded genetically to *T. fluviatilis*, and for this reason they were inclined to consider *T. baeticus* as a junior synonym of *T. fluviatilis*. In addition, they considered that the morphology of the operculum was not discriminating within this genus due to the variability of the size of the pseudo-apophysis (Figs 53–57, 59–60)"; but none of the depicted opercula actually show a pseudo-apophysis, thus all the depicted specimens belong to *T. fluviatilis*. Thus, the *T. baeticus* used by Martínez–Ortí *et al.* (2023) was a misidentification, which explains the genetic results.

Martínez-Ortí & Osca (2023: p.11) continued: "… that can cause confusion, despite the fact that other authors such as Glöer & Pesic (2015) and Glöer (2018) considered it [the operculum] discriminatory." But when Sands *et al.* (2020) published their results on *Theodoxus* spp., no confusion could be found between *T. baeticus* and *T. fluviatilis*, since both are genetically well separated in the molecular genetic tree. This confirms that the operculum is indeed an important feature to discriminate *Theodoxus* species. In addition, the existing lectotype of *T. baeticus* is well defined (Glöer, 2018), and, unless misidentifications, it cannot be interpreted as *nomen dubium*.

*Theodoxus mixta* (Westerlund, 1892) is a species accepted as valid by Martínez-Ortí & Osca (2023: p.13, figs 72-73), which shows an operculum similar to *T. fluviatilis* (missing pseudo-apophysis). Thus, it can be concluded that *T. mixta* is a younger synonym of *T. fluviatilis*. In addition, in *T. fluviatilis* there is a sexual dimorphism (Glöer & Pešić, 2015) in the opercula, also visible in the opercula of syntypes of *T. mixta*: fig. 72 = male (curved rib shield); fig 73 = female (straight rib shield), both depicted by Martínez-Ortí & Osca (2023: p.12). Such a dimorphism is not known in any other *Theodoxus* species, and this further supports the fact that *T. mixta* and *T. fluviatilis* are conspecific.

## References

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