Comment on Psonis et al. (2015): ‘Evaluation of the taxonomy of *Helix cincta* (Muller, 1774) and *Helix nucula* (Mousson, 1854); insights using mitochondrial DNA sequence data’

Eike Neubert and Ondřej Korábek

aDepartment of Invertebrates, Naturhistorisches Museum der Burgergemeinde Bern, Bern, Switzerland; bDepartment of Ecology, Charles University in Prague, Prague 2, Czech Republic

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A recently published paper on some *Helix* species from the East Mediterranean basin is briefly reviewed. Parts of the results of the authors of that study are erroneous because they are based on a misinterpretation of some of the taxa involved. An analysis of the actually studied taxa is presented, and the essential consequences for nomenclature and phylogeny are discussed.

Keywords: Greece; North Africa; *Helix*; nomenclature; phylogeny

Introduction

As a matter of principle, phylogenetic research depends on excellent taxonomic knowledge; otherwise the results are hard to understand, misleading or simply wrong. In the past, several of these incidences occurred; a good example has been presented by Groenenberg et al. (2011). Quite recently, Psonis et al. (2015) investigated the phylogenetic relationships of several species of the genus *Helix* Linnaeus, 1758, focusing on southern Greece and the Aegean. We fully agree with the authors that the genus *Helix* is in serious need of taxonomic revision and that the taxa selected by the authors belong to a complicated group with uncertain relationships. Moreover, they published sequence data for the extremely rare species *H. valentini* Kobelt, 1891, and *H. godetiana* Kobelt, 1878. These aspects provide a valuable addition to our knowledge of helicoid diversity. However, the paper contains several taxonomic misconceptions, which may cause substantial confusion in the future. For this reason we herein clarify some errors in the study, and present some conclusions to disentangle the taxonomic situation.

Abbreviations used: GNM = Göteborg Natural History Museum; MHNG = Muséum d’histoire naturelle Geneve; SMF = Research Institute Senckenberg; ZMZ = Zoological Museum of the University of Zurich.

**Taxonomic note on Helix nucula**

Psonis et al. (2015) wrongly apply the name *Helix nucula* Mousson, 1854. This Latin binomial was published by two different authors for two different biological species.
of *Helix*. In their introduction, Psonis et al. state: ‘*Helix cincta* (Müller, 1774) and *Helix nucula* (Mousson 1854) are two dark-lipped species that are present mainly in the eastern Mediterranean region’. Consultation of the type material of *Helix figulina* var. *nucula* Mousson, 1854 in Mousson’s collection in Zurich reveals that he was talking about a white-lipped *Helix* species, which is closely related to the Greek *Helix figulina* Rossmässler, 1839. To unambiguously clarify this problem, the species considered by Psonis et al. will briefly be treated.

*Helix nucula* Mousson, 1854

(Figure 1A)

*Helix figulina* var. *nucula* Mousson, 1854, Mittheilungen der naturforschenden Gesellschaft in Zürich, 3 (8): 367, 372–373 [Smyrna (Bellardi); = Izmir] [non *Helix nucula* sensu L. Pfeiffer, 1859].

Type specimens: syntypes ZMZ 506381, ZMZ 506394.

This name was introduced by Mousson for a white-lipped species from Turkey. The species is also known from a number of Aegean Islands, particularly from the Dodekanissos, and is widespread along the southern coast of Turkey, where it is usually recorded under the name of *H. figulina*. This taxon was originally described in the genus *Helix* and thus the taxon authority should be cited without brackets.

In 1859, Louis Pfeiffer used the same name, *H. nucula*, for a *Helix* species from Egypt that he had received under this name from Ludwig Parreyss, an Austrian shell dealer, as shown by the wording ‘Parreyss in sched.’ in his text. Pfeiffer was aware of Mousson’s *nucula* from 1854 as he listed it in his synonymy, but regarded Parreyss (the ‘name supplier’) as the author of the name. As in many cases, Pfeiffer ‘re-described’ the species, which until today has been mistaken by subsequent researchers as the valid description for *Helix nucula*, and thus contributed to the present chaos. Unfortunately, the specimens from Egypt were dark-lipped, as can be seen from Pfeiffer’s text: ‘perist. fuscum, marginibus callo nigro-castaneo intrane junctis’, and thus represent a species different from *H. nucula* Mousson, 1854. So far, no original specimens of *H. nucula* sensu Pfeiffer, 1859 could be traced in the major European museums which are known to hold Pfeiffer specimens.

It should be stressed that *Helix nucula* sensu Pfeiffer, 1859 has been widely used since its ‘re-description’ (e.g. Kobelt 1904; Kaltenbach 1950; Zilch 1952) without recognising the nomenclatural situation.

**Which species were analysed?**

In the tree of Psonis et al. (2015), the name ‘*H. cincta*’ appears in three genetically distinct clusters, a fact that shows the authors follow another concept of this also black-lipped species. Thus, a clarification of the question – Which species has been investigated? – is urgently needed. Without having seen the specimens investigated, we only can use our own knowledge on the whole genus, which among others is based on the investigation of almost all type specimens available for names published in the group (Neubert 2014).
We here follow the sequence of the black-lipped group from left to right (Psonis et al. 2015, fig. 2). The first problem arises by application of the name *H. cincta* for the black-lipped species from Tunisia. No *Helix* specimens from Northern Africa have ever been placed in *H. cincta*. In their revision of the Tunisian continental malacofoauna, Letourneux and Bourguignat (1887) did not mention *Helix cincta* O.F. Müller, [1774], however, they list *H. melanostoma* (together with *H. nucula* and other taxa) as very abundant from the area. *Helix melanostoma* is a well-known species, and has been depicted in several identification guides (Kerney et al. 1983; Fechter and Falkner 1990; Welter-Schultes 2012; Neubert 2014). It differs from *H. cincta* markedly, by both shell shape and colour. Our own unpublished data show the sequences of Psonis et al. (2015) on *H. melanostoma* populations from Tunisia, thus fully confirming our expectations (Korabek et al. 2015). We here figure the syntype specimen of a synonym name of *Helix melanostoma* Draparnaud, [1801] from Tunisia (Figure 1B).

The next problem is the presence of two widely separate ‘*cincta*’ clades in the tree. Psonis et al. (2015) have suggested *H. cincta anatolica* Kobelt, [1891] (in green) to be ‘raised to species level’. This claim is flawed because of a misunderstanding of the taxonomy of *H. cincta*. Within this species, three subspecies used to be recognised (Knipper [1939]; Zilch 1960) found in (1) northern Adriatic coastlands (*H. cincta cincta* Müller, [1774]); (2) in Greece and the Aegean (*H. cincta ambigua = *H. cincta borealis* Mousson [1859]); (3) in Turkey (*H. cincta anatolica*, Figure 1C). Out of these, Psonis et al. have sampled the last two, while the nominotypical subspecies is not included in their dataset. Therefore, their data cannot provide any support for the separation of *H. cincta anatolica* from *H. cincta cincta*. Based on anatomical, shell morphological and genetic investigations of Italian as well as Turkish specimens, we consider *Helix (Pomatia) cincta* var. *anatolica* Kobelt, [1891] a junior synonym of *Helix cincta* Müller, [1774] (Neubert 2014; Korabek et al. 2015).

However, another aspect is much more interesting: the so-called ‘*Helix cincta*’ clade (Psonis et al. 2015, fig. 2, in red) comprises specimens originating from central Greece and western Crete, including a sample from Kerkyra Island, which is the type locality of *Helix ambigua* var. *borealis* Mousson, [1859]. These results clearly indicate that *H. cincta borealis* is a separate species. Actually, *H. borealis* has already been considered separate from *H. cincta* by E. Neubert, and his view has been followed by some projects (Fauna Europaea; International Union for Conservation of Nature [IUCN] Red List).

The central part of the Bayesian tree of Psonis et al. (2015) contains a cluster called ‘*Helix nucula*’ (in orange). It comprises specimens originating from localities in Crete, the island Anafi, the Cyclades and Libya. This result confirms that there is another black-lipped species living in the East Mediterranean basin besides *H. cinta* and *H. borealis*, corresponding to ‘*H. nucula*’ as understood by Kaltenbach ([1951]), and comprising also populations from the southern Aegean. Accepting the existence of such an East Mediterranean species, the next nomenclaturally available name has to be used for this taxon. This name would then be ‘*Helix pronuba*’ published in the original combination *Helix thiesseana* var. *pronuba* Westerlund & Blanc, [1879], which originates from ‘Crete, Messarà’.
Conclusions

Molecular phylogenetics is an irreplaceable tool for taxonomists, but interpretation of the results must be based on clear taxonomic concepts corroborated by all available resources – that is, the primary reference, the subsequent taxonomic literature and the type specimens of the organisms of interest. Otherwise, molecular phylogenetics can cause confusion with detrimental consequences to follow-up studies (e.g. ecological and evolutionary). Probably, the authors followed the mainstream literature in the apparently wrong application of the names discussed above. In the course of his
taxonomic revision of the genus *Helix*, the first author noticed the problem of the 'nucula misidentification' already years ago, and consequently recognised *Helix nucula* Mousson, 1854 as a valid species (Neubert 2014). This information was disseminated to the community and shared with many colleagues. Thus, findings of *H. nucula* Mousson, 1854 have been reported from southwestern Turkey in two papers cited by Psonis et al. (2015), Neubert et al. (2000) and Örstan et al. (2005), both referring to the white-lipped species. Later, these results were used for the preparation of the European Red List of Non-marine Molluscs (Cuttelod et al. 2011). These results were criticised by Psonis et al.; however, this opinion reflects their misinterpretation of the taxonomic and nomenclatural problem as explained above. They have probably followed AnimalBase and Welter-Schultes (2012), where these two taxa are confused and their distribution data pooled together. Psonis et al. (2015) also used sequences of *H. pomatia* and *H. lucorum*, both downloaded from GenBank and both from unknown localities, and we urge against this practice, where a voucher specimen is not available.

The results of our analysis are: (1) the name *Helix nucula* Mousson, 1854 has to be applied to a white-lipped species; (2) *Helix nucula* sensu L. Pfeiffer, 1859 is a description without any nomenclatural meaning; (3) the species Psonis et al. (2015) referred to as ‘*H. cf. cincta*’ from Tunisia is in fact *H. melanostoma* Draparnaud, 1801; (4) the species Psonis et al. (2015) referred to as ‘*Helix cincta*’ from western Greece is *Helix borealis* Mousson, 1859; (5) the species Psonis et al. (2015) referred to as ‘*Helix cincta anatolica*’ is in fact *Helix cincta* Müller, 1774; (6) the species ‘*Helix nucula* L. Pfeiffer, 1859’ sensu auctores is a species in its own right, and has to be called *Helix pronuba* Westerlund & Blanc, 1879, because these authors published the first valid description.

In order to recognise the species involved, each taxon is here briefly diagnosed to prevent further misidentifications (copied from Neubert (2014); see also Figure 1A–L):  

*Helix (Pelasga) nucula* Mousson, 1854 (Figure 1A): shell small to moderately sized, thin, spherical, protoconch small, teleoconch with coarse axial riblets and surface granulation, aperture always white; flagellum as long as epiphallus + penis, long diverticulum surmounting bursa copulatrix in length.  

*Helix (Helix) pronuba* Westerlund & Blanc, 1879 (Figure 1D): shell small to very small, spherical, white or with up to five spirals, teleoconch with fine and densely spaced riblets and a prominent granulation, aperture deep chocolate brown. Morphology of genital organs unknown.  

*Helix (Helix) melanostoma* Draparnaud, 1801 (Figure 1B): shell of medium size, greyish to brilliant white, spherical, teleoconch sculptured by coarse ribs, labial callus and palatal area deep brown to chocolate-coloured; penis and epiphallus of same length, flagellum moderately long, glandulae mucosae much shorter than dart sac, pedunculus with a thick and short diverticulum.  

*Helix (Helix) cincta* O.F. Müller, 1774 (Figure 1C): shell of medium size, thick, protoconch small, spiral bands no. 1 to 3 usually fused, columellar side of aperture relatively straight, aperture reddish-brown coloured; flagellum extremely long, pedunculus stem long, usually without diverticulum.  

*Helix (Helix) borealis* Mousson, 1859 (Figure 1E): shell of medium size, thin, protoconch small, aperture very large, dark brown, palatal area with expanded dark brown colouration. Morphology of genital organs unknown.
The differences in shell morphology are sufficient to recognise the species: *H. nucula* has a white lip, and thus differs from all other species listed here. The shell of *H. pronuba* differs from the other dark-lipped species by the presence of heavy granulation of at least the body whorl. The differences between *H. cincta* and *H. borealis* are more peculiar: the first species has a heavy, rather small and globular shell with a rounded aperture and often-fused spiral colour bands, while in the latter species, the shell is thinner, larger, the aperture is more oblique, and the colour spiral bands are often reduced in intensity or even lacking.

**Disclosure statement**

No potential conflict of interest was reported by the author(s).

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