

A NEOTYPE FOR *HELIX CINCTA* MÜLLER, 1774 (GASTROPODA, PULMONATA, HELICIDAE)

FOLCO GIUSTI¹, VIVIANA FIORENTINO², GIUSEPPE MANGANELI¹

¹Dipartimento di Scienze Fisiche, della Terra e dell' Ambiente, Università di Siena, Via Mattioli 4, 53100 Siena, Italy

²School of Biological Sciences, Queen's University Belfast, 97 Lisburn Road, Belfast BT9 7BL, Northern Ireland

Abstract As currently conceived, *Helix cincta* Müller, 1774, is widespread in the north-east Mediterranean from Italy to the Middle East. Recent phylogenetic research shows that it is not monophyletic and raises the question of which of its clades includes the true species of Müller. Unfortunately the type material no longer exists, the original description is defective and no precise type locality is available. To definitively clarify its identity, a neotype is designated according to Rossmässler's interpretation that it was mainly an Italian species.

Key words *Helix cincta*, type material, nomenclature, taxonomy, geographic distribution

NEOTYPE DESIGNATION

Müller (1774: 58) described *Helix cincta* without any geographical indication, based on material in Spengler's museum. In the first half of the nineteenth century, the species was mentioned again by a number of authors and first depicted by Férussac (1819), Michaud (1831) and Rossmässler (1837, 1839). Férussac (1821: 29) reported *Helix cincta* from some sites along the northern sector of the eastern Mediterranean, from north-eastern Italy to northern Lebanon (Reggio, Parme, Montfalcon près Trieste, île de Zante, île de Chypre, Costantinopoli, Gemleck, Lataquie, Tripoli de Syrie) and was the first to illustrate it (Férussac, 1819: Pl. 20 fig. 7, Pl. 24 fig. 1). Michaud (1831: 17–18, Pl. 14 fig. 2) quoted it from Tonnere (Yovonne). Finally Rossmässler (1839: 10) wrote that his figures (Rossmässler, 1837: Pl. 21 fig. 287; Rossmässler, 1839: Pl. 44 figs 583–584) constituted the *Formentypus* of this widespread species and that northern Italy could be considered its *eigentliche Vaterland*.

In the subsequent literature, authors referred to *Helix cincta* according to Rossmässler's (1839) interpretation, regarding it as a species occurring in north-eastern Italy, nearby Balkan countries and sometimes southern France (see for example Pfeiffer, 1846, 1847–48 as *Helix grisea*; Pilsbry, 1889; Westerlund, 1876–78).

Matters appear to change towards the end of the century when Westerlund (1889: 458) and then Kobelt (1903: 104–105) and Hesse (1920: 190) again included specimens from eastern Mediterranean

countries in *H. cincta*. This approach has since been adopted, see for example Neubert (2014: 88) who stated that the species is widespread from Italy to Lebanon in two separate sectors, one extending from Lombardy (Italy) to northern Dalmatia, the other from islands in the eastern Aegean Sea to south-western Turkey, Cyprus, the Hatay area of Turkey, Syria and probably northern Lebanon.

Recent molecular phylogenetic studies (Psonis *et al.*, 2014; Korábek *et al.*, 2014, 2015; Fiorentino *et al.*, submitted) revealed that *H. cincta*, as currently conceived, is not monophyletic, raising the problem of which clade matches Müller's species.

Müller's description ("*Helix testa imperforata, subglobosa, alba, fasciis labroque rubis*") is insufficient to clarify the identity of the species and can be adapted to more than one of the many different *Helix* species from the eastern Mediterranean. Type material no longer exists. Spengler's collections were merged with those of the Natural History Museum of Denmark (Zoology) (Copenhagen, Denmark) and type material of Müller's species could not be located (Tom Schiøtte pers. comm. 12.03.2014). In this situation only a neotype designation can clarify its identity.

The species was first known from the illustrations of Férussac (1819e), Michaud (1831) and Rossmässler (1837, 1839). Of these three authors, Rossmässler claimed that his illustrated specimens constituted the *Formentypus* of this species and that *Oberitalien* should be considered its *eigentliche Vaterland*. A century later Hesse (1920: 190–192, Pl. 655 figs 16–22) first described its



Figure 1 Shell of the neotype of *Helix cincta*: Italy, Arquà Terme, crossroad of Via Costa and Via degli Ulivi (municipality of Arquà Petrarca, province of Padua), 32TQR1316, I. Niero leg. 10.06.2010.

Table 1 Anatomical variability in the neotype (ARQ1) and other specimens from the type locality of *Helix cincta* (ARQ2-ARQ6). Nine anatomical variables were counted (LDG and RDG) or measured using a caliper (all the others; in mm): P length of penis, E length of epiphallus, F length of flagellum, BCD length of bursa copulatrix duct, DBCD length of distal part of bursa copulatrix duct, PBCD length of proximal part of bursa copulatrix duct, DBC length of diverticulum of bursa copulatrix duct, LDG number of branches of left digitiform glands group, RDG number of branches of right digitiform glands group. E and P are conceived according to Hesse (1908).

	P	E	F	BCD	PBCD	DDBCD	DBC	LDG	RDG
ARQ1	8.8	3.3	50.0	45.0	17.3	27.7	4.9	12	10
ARQ2	11.3	4.7	48.5	30.6	16.0	14.6	2.2	19	24
ARQ3	10.3	3.3	48.4	43.1	21.3	21.8	3.6	8	10
ARQ4	13.2	5.3	56.6	35.4	–	–	0.0	19	28
ARQ5	10.3	3.1	55.4	40.7	14.5	26.2	6.0	24	31
ARQ6	9.3	2.8	56.5	35.8	14.8	21.0	2.2	15	25
M ±SD	10.5±1.6	3.8±1.0	52.6±4.0	38.4±5.4	16.8±2.8	22.3±5.1	3.2±2.2	16.2±5.7	21.3±9.1

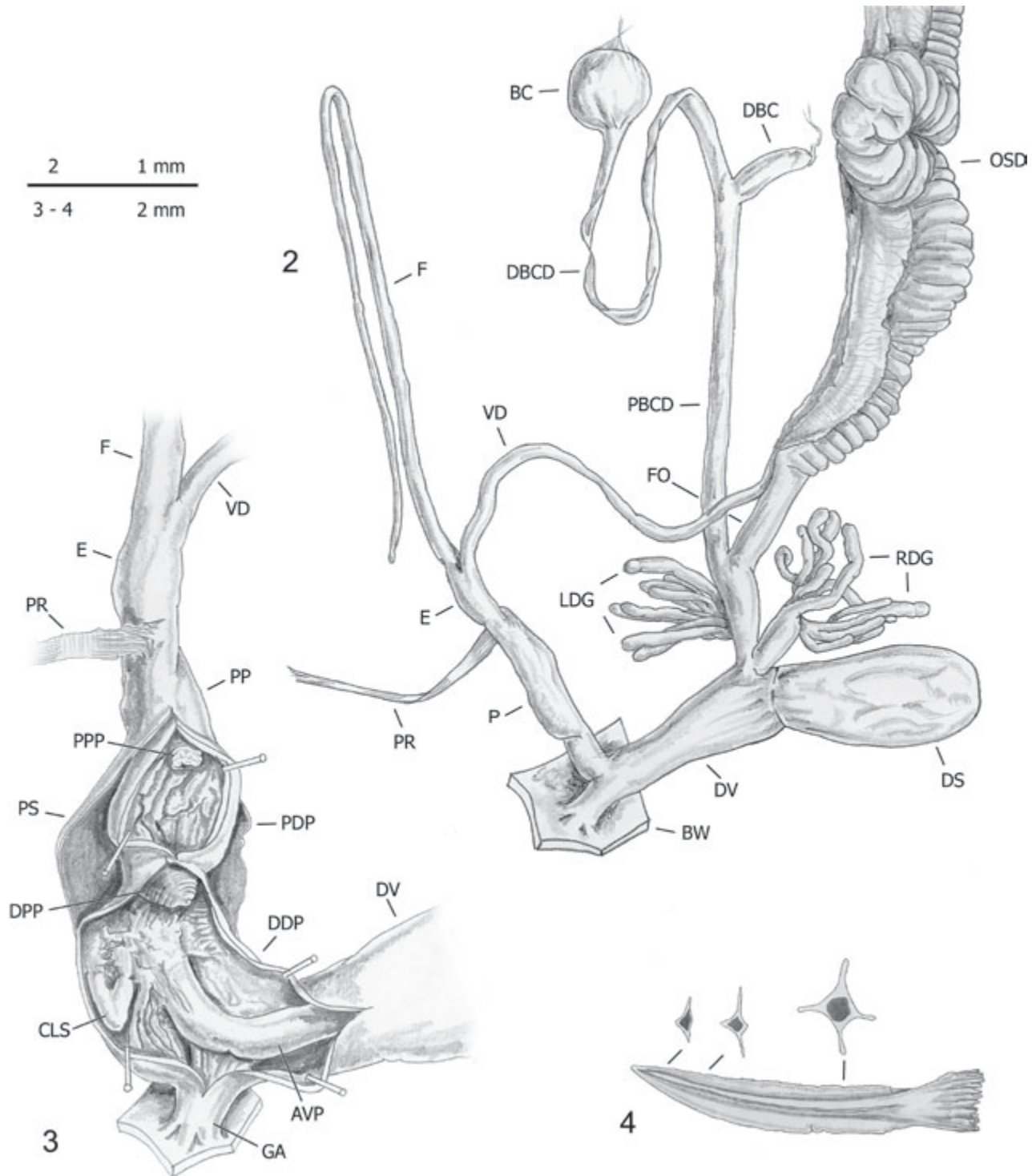
anatomy again based on specimens from north-eastern Italy (San Zeno di Montagna, Bassano and Görz [Gorizia]). We therefore select a specimen collected at Arquà Terme, crossroad of Via Costa and Via degli Ulivi (municipality of Arquà Petrarca, province of Padua, Venetum, north-eastern Italy) as the neotype.

The neotype is deposited in the malacological collection of the Museo di Storia Naturale dell'Università di Firenze, Sezione Zoologica La Specola (MZUF GC/48221). Its shell is illustrated in Fig. 1, its genital anatomy is depicted in Figs 2–4. Anatomical variability of the population from which it was selected is described in Tab. 1. Haplotypes (ARQ2-3-4–5) sequences of

COI and 16S of topotypes (specimens from the type locality) have been deposited in GenBank (accession numbers: COI KT806366-69; 16S: KT806370-73).

ACKNOWLEDGEMENTS

Tom Schiøtte, assistant curator in the Natural History Museum of Denmark (Zoology) (Copenhagen, Denmark), dedicated much time to unsuccessfully searching for Spengler/Müller's original material of *H. cincta*. Ivano Niero collected the specimen designated as neotype. Finally, Giovanni Cappelli took the photos of the neotype shell.



2	1 mm
3 - 4	2 mm

Figures 2–4 Genital anatomy of the neotype of *Helix cincta*: Italy, Arquà Terme, crossroad of Via Costa and Via degli Ulivi (municipality of Arquà Petrarca, province of Padua), 32TQR1316, I. Niero leg. 10.06.2010; distal genitalia (2); internal structure of the distal genitalia (3); dart (4). Key to acronyms (anatomical nomenclature is mainly according to Giusti et al., 1995; E and P are conceived according to Hesse, 1908): AVP atrial-vaginal pilaster, BC bursa copulatrix, BW body wall, CLS crest-like structure, DBC diverticulum of bursa copulatrix duct, DBCD distal part of bursa copulatrix duct, DDP distal part of distal penis, DPP distal penial papilla, DS dart sac, DV distal vagina, E epiphallus, F flagellum, FO free oviduct, GA genital atrium, LDG left digitiform glands group, OSD ovispermiduct, P penis, PBCD proximal part of bursa copulatrix duct, PDP proximal part of distal penis, PP proximal penis, PPP proximal penial papilla, PR penial retractor, PS penial sheath, RDG right digitiform glands group, VD vas deferens.

REFERENCES

- FÉRUSAC AEJPF, D'AUDEBARD DE 1819 Histoire naturelle générale et particulière des Mollusques terrestres et fluviatiles. Livraison 5: 73–96, Pls. 14, 18, 20, 22, 24, 25. Paris.
- FÉRUSAC AEJPF, D'AUDEBARD DE 1821 Tableaux systématiques des animaux Mollusques classés en familles naturelles, dans lesquels on a établi la concordance de tous les systèmes; suivis d'un prodrome général pour tous les Mollusques terrestres ou fluviatiles vivants ou fossiles. Livraison 10: 25–48 pp. [Quarto ed.]. Paris.
- FIORENTINO V, MANGANELLI G, GIUSTI F & KETMAIER V, submitted. Recent adaptation and relic survivors: the phylogeography of the land snail genus *Helix* (Mollusca, Gastropoda) South to North Europe. *Molecular Phylogenetics and Evolution*.
- GIUSTI F, MANGANELLI G & SCHEMBRI PJ 1995 The non-marine molluscs of the Maltese Islands. *Monografie Museo Regionale di Scienze Naturali* 15: 1–607. Torino.
- HESSE P 1908 Kritische Fragmente, IV. *Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft* 40: 131–141.
- HESSE P 1920 In Rossmässler EA, Iconographie der Land- & Süßwasser-Mollusken, mit vorzüglicher Berücksichtigung der europäischen noch nicht abgebildeten Arten. Neue Folge. 23 (5–6): 153–262 [5], Pls: 651–660. Berlin und Wiesbaden.
- KOBELT W 1903 Gattung *Helix* (L.) s.str. In Systematisches Conchylien-Cabinet von Martini und Chemnitz. Lieferung 485: 89–120, Pls: 318–322. Nürnberg.
- KORÁBEK O, JUŘIČKOVÁ L & PETRUSEK A 2014 Resurrecting *Helix straminea*, a forgotten escargot with trans-Adriatic distribution: first insights into the genetic variation within the genus *Helix* (Gastropoda: Pulmonata). *Zoological Journal of the Linnaean Society* 171: 72–91.
- KORÁBEK O, PETRUSEK A, NEUBERT E & JUŘIČKOVÁ L 2015 Molecular phylogeny of the genus *Helix* (Pulmonata: Helicidae). *Zoologica Scripta*, 44 (3): 263–280.
- MICHAUD AL[G] 1831 Complément de l'Histoire naturelle des mollusques terrestres et fluviatiles de France, de J.P.R. Draparnaud. xvi, 116 pp., Pls. 14–16, 12 pp. Verdun.
- MÜLLER OF 1774 Vermium terrestrium et fluviatilium, seu animalium infusoriorum, helminthicorum, et testaceorum, non marinorum, succincta historia. Volumen alterum. xxxvi, 214, 2, 8 pp. Havniae et Lipsiae.
- NEUBERT E 2014 Revision of *Helix* Linnaeus, 1758 in its east Mediterranean distribution area, with a note on *Helix godetiana* Kobelt, 1878 (Gastropoda, Pulmonata, Helicidae). *Contributions to Natural History* 26: 1–200.
- PFEIFFER L 1846 Die Schnirkelschnecken (Gattung *Helix*). In Systematisches Conchylien-Cabinet von Martini und Chemnitz. Lieferung 58: 1 (12) [(1)]: v–xv, 49–56, Pls. 6, 9–11, 13–14. Nürnberg.
- PFEIFFER L 1847–48 Monographia Heliceorum viventium sistens descriptiones systematicas et criticas omnium huius familiae generum et specierum hodie cognitarum. 1: i–xxxii +160 pp. (1847), 161–484 (1848) pp. Lipsiae.
- PILSBRY HA 1889 Manual of conchology, structural and systematical, with the illustrations of the species. Pulmonata. Second series, 4 (16): 199–300. Philadelphia.
- PSONIS N, VARDINOYANNIS K, MYLONAS M & POULAKAKIS N 2014 Evaluation of the taxonomy of *Helix cincta* (Muller, 1774) and *Helix nucula* (Mousson, 1854); insights using mitochondrial DNA sequence data. *Journal of Natural History* 49: 383–392.
- ROSSMÄSSLER EA 1837 Iconographie der Land- und Süßwasser-Mollusken, mit vorzüglicher Berücksichtigung der europäischen noch nicht abgebildeten Arten. 1 (5–6): 1–2, 1–70, Pls: 21–30. Dresden und Leipzig.
- ROSSMÄSSLER EA 1839 Iconographie der Land- und Süßwasser-Mollusken, mit vorzüglicher Berücksichtigung der europäischen noch nicht abgebildeten Arten. 2 (3–4) [9–10]: i–iv, 1–46, Pls: 41–50. Dresden.
- WESTERLUND CA 1876–78 Fauna europea molluscorum extramarinorum. Prodromus. Sistens descriptiones systematicas et criticas omnium generum et specierum horum animalium in Europa viventium et hodie cognitarum. 1: 1–160 pp. (1876); 2: 161–320 pp. (1878). Lundae.
- WESTERLUND CA 1889 Fauna der in der paläarktischen Region (Europa, Kaukasien, Sibirien, Turan, Persien, Kurdistan, Armenien, Mesopotamien, Kleinasien, Syrien, Arabien, Egypten, Tripolis, Tunesien, Algerien und Marocco) lebenden Binnenconchylien. Vol. 2. Genus *Helix*. 473, 31 pp. Berlin.