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Taxonomic revision of *Neohoratia herreroi* Bech, 1993 (Gastropoda, Hydrobiidae)

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The type series of the hydrobiid taxon *Neohoratia herreroi* Bech, 1993, is composed of the holotype and 10 paratypes, deposited in "Museu de Ciències Naturals" of Barcelona, and three paratypes in the "Museu Valencià d'Història Natural" of Alginet (Valencia). The holotype shows that *N. herreroi* is a valid *Corrosella* species. *Corrosella hauffei* (Delicado & Ramos, 2012) should be considered a junior synonym of *Corrosella herreroi* (Bech, 1993). Two of the paratypes of *N. herreroi* are here reassigned to *Mercuria* spec. A map of the geographical distribution of this Iberian endemic species is presented.

Key words: *Neohoratia*, *Corrosella*, Hydrobiidae, synonymy, taxonomy, Spain.

INTRODUCTION

Gasull (1981) mentioned two species of the genus *Pseudamnicola* Paulucci, 1878, from several localities in the province of Castellón, identified by Dr. H. D. Boeters, viz. *Pseudamnicola astieri* (Dupuy, 1951) from the department of Var, SE France, and *P. conovula* (Frauenfeld, 1863) from Dalmatia (Croatia) and Corsica (France) (Falkner & Boeters, 2003). Boeters (1988)

assigned samples attributed to *P. conovula* by Gasull (1981) to *Mercuria* Boeters, 1971. Falkner et al. (2002) and Delicado & Ramos (2012) concluded that the Spanish *Pseudamnicola* species differs from the French one and that its incorrect identification is due to a misunderstanding between Gasull and Boeters.

Bech (1993) described two species of *Bythinella* Moquin-Tandon, 1856, viz. *B. brosi* and *B. gonzalezi*, and one of *Neohoratia* Schütt, 1961, viz. *N. herreroi*. The latter was dedicated to the Valencian botanist Dr. Juan José Herrero-Borgoñón Pérez, who collected the material 17-10-1985 in the cave of Sant Josep in La Vall d'Uixó (Castellón Province). Bank (2013) did consider neither *N. herreroi* nor other taxa described by Bech in 1993.

Delicado & Ramos (2012) studied *Corrosella astieri*, using molecular markers and morpho-anatomical characters of specimens of Castellón populations. They described *C. astieri* sensu Gasull (1981), as a new species, *Pseudamnicola (Corrosella) hauffei* Delicado & Ramos, 2012, with the "Fuente de los Nogales" in Benafer (province of Castellón) as its type locality. Additionally they indicate its presence in the Province of Valencia. This name was usually used later on (Delicado et al., 2012, 2013, 2015; Boeters et al., 2015). Subsequently, Delicado et al. (2015) considered *Corrosella* Boeters, 1970, a separate genus, not a subgenus of *Pseudamnicola* Paulucci, 1878.

		<i>Neohoratia herreroi</i> Bech, 1993														<i>C. hauffei</i> (Delicado & Ramos, 2012) (n=18)	
in mm	Holotype* (MZB 2009-2303)	Paratypes (MZB 2009-2303)										Paratypes (MVHN-03031 5SD01)			Holotype and paratypes (n=14)		
		1*	2*	3	4	5	6	7	8	9	10*	11	12*	13	min – – max	min – – max	
SL	2.3	2.9	2.1	1.95	3	2.2	2	1.75	2.05	2.25	2.35	2.15	2.55	2.2	1.75 – 2.27 – 3.0	2.17 – 2.50 – 2.85	
SW	1.6	1.95	1.47	1.45	1.95	1.55	1.475	1.3	1.5	1.75	1.65	1.4	1.6	1.5	1.3 – 1.59 – 1.95	1.44– 1.59 – 1.78	
AH	1.15	1.3	0.95	1	1.35	1	1.07	0.95	1.05	1.15	1.05	1	1.1	1.12	0.95 – 1.09 – 1,3	1.04– 1.20 – 1.36	
AL	1.25	1.4	1.05	1.05	1.4	1.05	1.05	0.95	1.1	1.3	1.15	1.05	1.2	1.2	0.95 – 1.22 – 1.4	1.11 – 1.26 – 1.41	
AW	0.9	1	0.75	1	1	0.8	0.8	0.975	1.1	0.95	0.8	0.65	0.85	0.8	0.65 – 0.88 – 1.1	0.78 – 0.89 – 1.11	
SL-LBW	0.6	0.85	0.55	0.4	1	0.55	0.5	0.45	0.4	0.9	0.65	0.6	0.8	0.6	0.4 – 0.63 – 1.0	0.49 – 0.69 – 1.0	

Table 1. Shell measurements of *C. herreroi*/*C. hauffei*. (Abbreviations: SL=height; SW=width; AL=longitude aperture; AH=width aperture; AW=height aperture; SL-LBW= shell length-length of body whorl) (*specimens figurate in this manuscript).

The author participates in the revision of the molluscan species described by Miquel Bech (Martínez-Ortí, Prieto & Uribe, 2018), using the original material in his collection. In the present article the validity of *Neohoratia herreroi* Bech, 1993, is dealt with.

MATERIAL AND METHODS

The “Miquel Bech” malacological collection is deposited in the “Museu de Ciències Naturals” of Barcelona (MCNB). It was donated by his widow, Mrs. Francisca Pipó in 2009. The type series of *Neohoratia herreroi* Bech, 1993, is originally formed by the holotype, with the code MZB 2009-2302, and 12 paratypes with the code MZB 2009-2303. Every paratype has been numbered and separated (tables 1, 2). Three paratypes were in the private collection of Dr. Juan José Herrero-Borgoñón Pérez and have been deposited recently in the “Museu Valencià d’Història Natural” of Alginet (Valencia) with the code: MVHN-030315SD01. All shells of the type series of *N. herreroi* were measured (Table 1). Some of these shells are figured (Figs 1-11, 14-16) and some are photographed with a digital camera and in the Scanning Electron Microscope Hitachi, S4100 and S4800, without gold-palladium metallic cover (Figs 10, 11, 16).

RESULTS

Bech (1993: fig. 4) figured the holotype of *N. herreroi* and Bech & González (1995: pl.1 fig. 2, pl. 2 fig. 2), figured the holotype and three paratypes. The specimens figured by Bech were collected alive and preserved dry for more than 30 years. The pictures were taken between 1985 and 1993. Throughout this time, some dry portions of soft parts of the bodies that were initially attached to the inside of the shell were separated. This loss has slightly modified the initial spots that appear

in the figures of M. Bech, as shown in the illustrations that are provided in this paper (Figs 1-4; 6, 7).

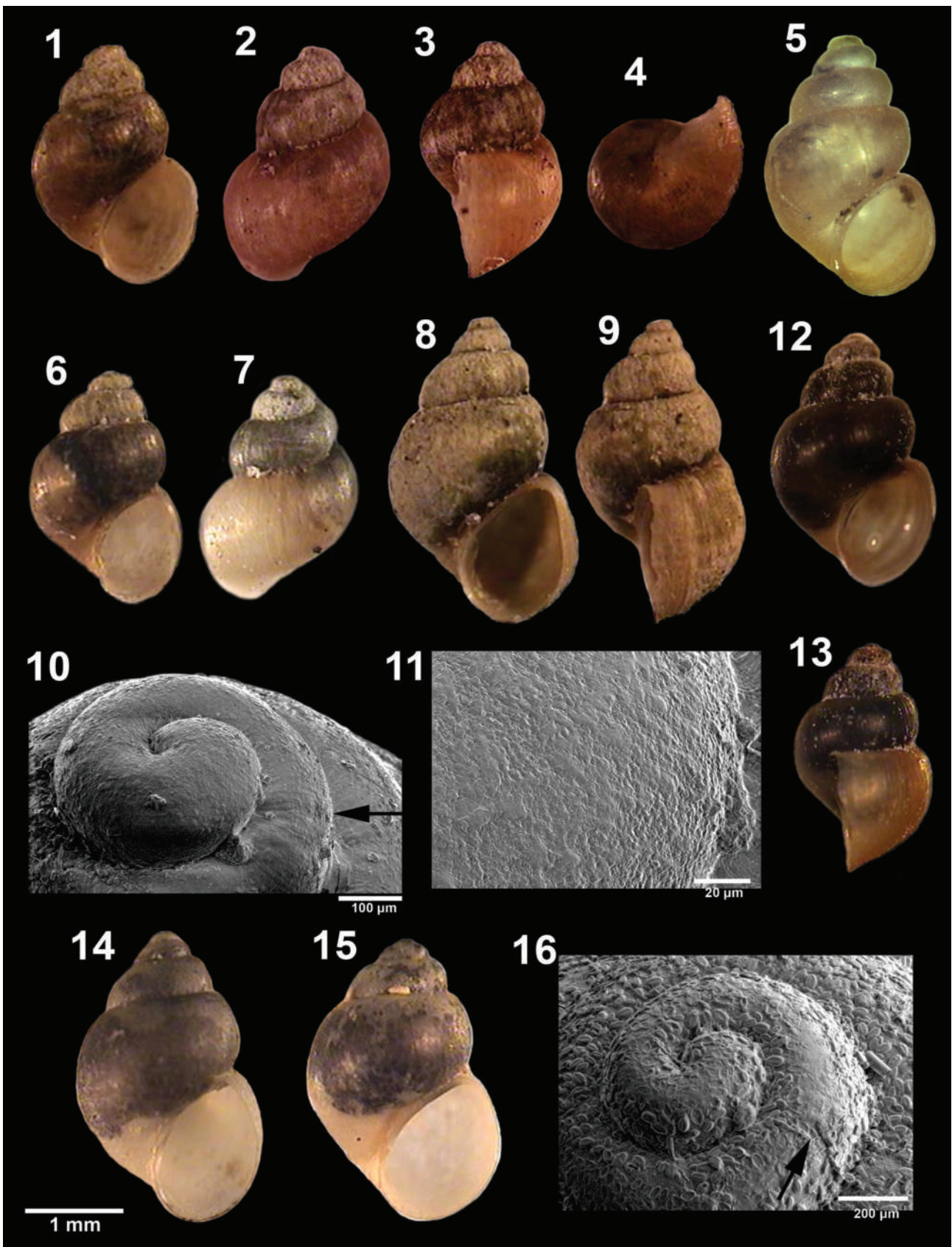
Two paratypes (MZB 2009-2303B) erroneously attributed by Bech to *N. herreroi*, (Figs 14, 15; Table 2) have been reassigned to the genus *Mercuria*.

The description provided by Bech (1993) for *N. herreroi* in general coincides with that of Delicado & Ramos (2012) for *Corrosella hauffei*. Bech (1993). Bech & González (1995) indicate for shells of *N. herreroi*: height 2.15 mm, diameter 1.40 mm, and apertural height 1.0 mm height. The data for *N. herreroi* are within the range of variability indicated by Delicado & Ramos (2012: table 2) for *C. hauffei* (Delicado & Ramos, 2012) (Figs 12, 13), although most of the measures are close to the lower limit of the range, because the majority of the specimens of the type series are younger specimens. The protoconch, the number of whorls, and the size and sculpture of the nucleus are in agreement with this conclusion.

The type locality of *N. herreroi* Bech, 1993, is within the range indicated for Delicado & Ramos (2012) for *C. hauffei*. “The Cova de Sant Josep” in La

(in mm)	spm. 1	spm. 2
SL	2.85	2.65
SW	1.8	1.9
AH	1.2	1.3
AL	1.45	1.5
AW	1	1
SL-LBW	0.6	0.55

Table 2. Shells measurements of specimens of *Mercuria* sp. assigned by Bech (1993) to *N. herreroi* and included in its type series (Abbreviations: SL=height; SW= width; AL=longitude aperture; AH=width aperture; AW=height aperture; SL-LBW=shell length-length of body whorl).



Figs 1-16. Some Spanish hydrobiids. 1-4, Holotype of *Corrosella herreroi* (Bech, 1993) (MZB 2009-2303). "Cova de Sant Josep" (Vall d'Uixó, Castellón). 5, Paratype nº2 (MVHN-030315SD01). 6-7, Paratype nº2 (MZB 2009-2303). 8-9, Paratype nº1 (MZB 2009-2303). 10-11, Protoconch and microsculpture of the paratype nº10 (MZB 2009-2303). 12-13, Topotype of *C. hauffei*. Nogales spring, Benafer (Castellón). 14-15, Foreclosed nº1 and nº2 specimens of *Mercuria* sp. of the type series of *C. herreroi* (MZB 2009-2303B). 16, Protoconch of specimen nº2 of *Mercuria* sp. (MZB 2009-2303B).

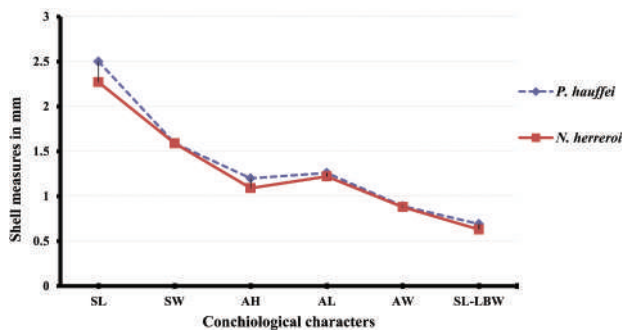


Fig. 17. Comparative measures graphic of the shells of *N. herreroi* and *C. hauffei*.

Vall d' Uixó for *N. herreroi* and the "Fuente de los Nogales" in Benafer (UTM: 30SYK0723) for *C. hauffei*, are both in the province of Castellón (Fig. 16).

Bech (1993) and Bech & González (1995) indicate that the presence of the shells of *P. herreroi* in the underground river of the "Cova de Sant Josep" could be attributed to the transfer from nearby springs. However, the sample collected by Dr. Herrero-Borgoñón from among the sandy sediment contains mainly live-collected individuals, with opercula and dried body parts still inside the shells.

The cave has changed during the past decades. It is visited by thousands of tourists every month, travelling in boats along the underground river. The water conditions have changed markedly. There has been a rise of temperature and numerous submerged halogen spotlights are present now to illuminate the tourist tour. In the "Font Nova" of Benifaió in the province of Valencia *C. herreroi* must be considered extinct.

CONCLUSIONS

The conchological characters of both *Neohoratia herreroi* and *Corrosella hauffei* indicate that they are conspecific. As a consequence, *Neohoratia herreroi* Bech, 1993, is a senior synonym of *Pseudamnicola* (*Corrosella*) *hauffei* Delicado & Ramos, 2012. While accepting *Corrosella* Boeters, 1970, as a separate genus (Delicado et al., 2015), the species in question should be called *Corrosella herreroi* (Bech, 1993).

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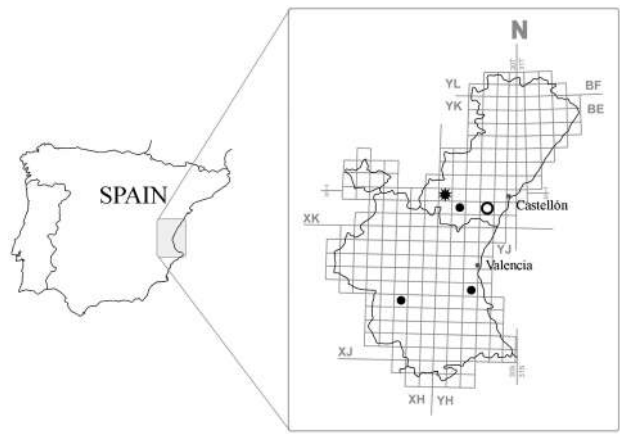


Fig. 18. Geographical distribution map of *Corrosella herreroi* (Bech, 1993) (circle: Locus typicus of *C. herreroi*; star: Locus typicus of *C. hauffei*; black points: others localities of *C. herreroi*).

rero-Borgoñón Pérez for data about the sample, and the donation of the paratypes he owned and donated to the "Museu Valencià d'Història Natural" of Alginet (Valencia). We also thank the staff at the "Secció de Microscòpia Electrònica" of the S.C.S.I.E., Universitat de València for their help using the SEM Hitachi S4100 and S4800.

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