



A revised check-list of the land and freshwater Mollusca (Gastropoda and Bivalvia) of mainland Portugal

Un listado revisado de moluscos terrestres y de agua dulce (Gastropoda y Bivalvia) de Portugal continental

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ABSTRACT

A list is presented of the species of land and freshwater Mollusca (snails, slugs and freshwater mussels) of mainland Portugal. Brackish-water Hydrobiidae and coastal pulmonates such as Ellobiidae are included, but taxa known only as fossils are not considered. A list of taxa reported from Portugal in the recent literature, for which all records appear to be erroneous or unsubstantiated is also given.

We attempt to fully update taxonomy and nomenclature from critical appraisal of the literature and give noteworthy new distributional data, as follows: all reports of the genus *Theodoxus* from Portugal are attributed to *T. baeticus* (Lamarck, 1822); *Pyramidula pusilla* Gittenberger & Bank, 1996 is treated as a junior subjective synonym of *P. umbilicata* (Montagu, 1803); *Balea heydeni* Maltzan, 1881 is maintained as valid against *B. sarsii* L. Pfeiffer, 1847, which is treated as a *nomen dubium*; *Aegopinella epipedostoma* (Fagot, 1879) is reported new to Portugal and NW Spain; *Hatumia* Arrébola *et al.*, 1962 is treated as a junior objective synonym of *Gasullia* Ortiz de Zárate López, 1962, and *Oestophora gasulli* Ortiz de Zárate Rocandio & Ortiz de Zárate López, 1961 is returned to the genus *Gasullia*; *Helix lusitanica* Linnaeus, 1767 is declared a "nomen oblitum" and *H. lusitanica* L. Pfeiffer, 1841 a "nomen protectum" to maintain current usage (as *Oestophora lusitanica* (L. Pfeiffer, 1841)).

A total of 195 species is accepted as having been reliably recorded in mainland Portugal, a few of which can only be tentatively identified at present. The total includes 134 terrestrial species, 50 freshwater species, 2 aquatic species more or less restricted to brackish-water and 9 strictly coastal species that are not aquatic. Among the terrestrial species, 10 (7.5%) are regarded as aliens; among freshwater species 8 (16%) are regarded as aliens. Mainland Portugal has 22 (16.4%) of the terrestrial mollusc species endemic and 7 (14%, all Hydrobiidae) of the freshwater species endemic. Taxa presumed to be locally extinct comprise one terrestrial (*Succinella oblonga* (Draparnaud, 1801)) and at least two freshwater species (*Bathyomphalus contortus* (Linnaeus, 1758) and *Bulinus truncatus* (Audouin, 1827)), none of which were endemics.

RESUMO

É apresentada uma lista das espécies de moluscos terrestres e de água doce (caracóis, lesmas e ameijoas de água doce) de Portugal continental. Hydrobiidae de água salobra e pulmonados costeiros como os Ellobiidae estão incluídos, mas os taxa conhecidos apenas como fósseis não são considerados. Uma lista de espécies relatadas para Portugal em literatura recente, para a qual todos os registos parecem ser erróneos ou infundados é também dada. Tentamos atualizar completamente a taxonomia e a nomenclatura por meio de uma ava-

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liação crítica da literatura, e dar novos dados distributivos relevantes, como segue: todos os relatos do género *Theodoxus* de Portugal são atribuídos a *T. baeticus* (Lamarck, 1822); *Pyramidula pusilla* Gittenberger & Bank, 1996 é tratado como um sinónimo júnior subjetivo de *P. umbilicata* (Montagu, 1803); *Balea heydeni* Maltzan, 1881 é mantido válido contra *B. sarsii* L. Pfeiffer, 1847, que é tratado com um *nomen dubium*; *Aegopinella epipedostoma* (Fagot, 1879) é reportado novo em Portugal e no Noroeste de Espanha; *Hatumia Arrébola et al.*, 1962 é tratado como um sinónimo júnior de *Gasullia* Ortiz de Zárate López, 1962, e *Oestophora gasulli* Ortiz de Zárate Rocandio e Ortiz de Zárate López, 1961 é devolvido ao género *Gasullia*; *Helix lusitanica* Linnaeus, 1767 é declarado como sendo um “nomen oblitum” e *H. lusitanica* L. Pfeiffer, 1841 como um “nomen protectum” para manter o uso atual (como *Oestophora lusitanica* (L. Pfeiffer, 1841)).

Acredita-se que um total de 195 espécies tenha sido registado de forma fiável em Portugal continental, algumas das quais apenas podem ser tentativamente identificadas no presente. O total inclui 134 espécies terrestres, 50 espécies de água doce, 2 espécies aquáticas mais ou menos restritas a águas salobras e 9 espécies estritamente costeiras que não são aquáticas. Entre as espécies terrestres, 10 (7,5%) são consideradas alienígenas; entre espécies de água doce 8 (16%) são também consideradas alienígenas. Portugal continental tem 22 (16,4%) das espécies de moluscos terrestres endémicos e 7 (14%, todos Hydrobiidae) das espécies de água doce são também endémicas. Taxa supostamente extintos localmente compreendem uma espécie terrestre (*Succinella oblonga* (Draparnaud, 1801)) e pelo menos duas espécies de água doce (*Bathymorphalus contortus* (Linnaeus, 1758) e *Bulinus truncatus* (Audouin, 1827)), nenhuma das quais era endémica.

RESUMEN

Se presenta un listado de las especies de moluscos terrestres y de agua dulce (caracoles, babosas y almejas de agua dulce) de Portugal continental. Los Hydrobiidae de agua salobre y pulmonados costeros como Ellobiidae están incluidos, pero los taxones conocidos solo como fósiles no se consideran. Se proporciona también un listado de los taxones citados en Portugal en la literatura reciente, para los cuales todos los registros parecen ser erróneos o sin fundamento. Intentamos actualizar completamente la taxonomía y la nomenclatura a partir de la evaluación crítica de la literatura y aportar nuevos datos notables de distribución, como sigue: todas las citas del género *Theodoxus* en Portugal se asignan a *T. baeticus* (Lamarck, 1822); *Pyramidula pusilla* Gittenberger & Bank, 1996 se considera como un sinónimo junior subjetivo de *P. umbilicata* (Montagu, 1803); *Balea heydeni* Maltzan, 1881 se mantiene como nombre válido frente a *B. sarsii* L. Pfeiffer, 1847, que se considera un *nomen dubium*; *Aegopinella epipedostoma* (Fagot, 1879) se cita por primera vez en Portugal y NO España; *Hatumia Arrébola et al.*, 1962 se considera un sinónimo junior objetivo de *Gasullia* Ortiz de Zárate López, 1962, y *Oestophora gasulli* Ortiz de Zárate Rocandio & Ortiz de Zárate López, 1961 se vuelve a incluir en el género *Gasullia*; *Helix lusitanica* Linnaeus, 1767 se declara un “nomen oblitum” y *H. lusitanica* L. Pfeiffer, 1841 un “nomen protectum” para mantener el uso actual (como *Oestophora lusitanica* (L. Pfeiffer, 1841)). Se acepta un total de 195 especies registradas de manera confiable en Portugal continental, algunas de las cuales solo tienen de momento una identificación provisional. El total incluye 134 especies terrestres, 50 especies de agua dulce, 2 especies acuáticas más o menos restringidas a aguas salobres y 9 especies estrictamente costeras que no son acuáticas. Entre las especies terrestres, 10 (7,5%) se consideran como no nativas; entre las especies de agua dulce 8 (16%) se consideran como no nativas. En la parte continental de Portugal, 22 (16,4%) de las especies de moluscos terrestres son endémicas así como 7 (14%, todas son Hydrobiidae) de las especies de agua dulce. Los taxones que se presumen estar localmente extintos comprenden una especie terrestre (*Succinella oblonga* (Draparnaud, 1801)) y al menos dos especies de agua dulce (*Bathymorphalus contortus* (Linnaeus, 1758) y *Bulinus truncatus* (Audouin, 1827)), ninguna de las cuales era endémica.

INTRODUCTION

This list provides a critical compilation of the species of land and freshwater Mollusca (snails, slugs and freshwater mussels) of Portugal. The region covered is all of mainland Portugal, including inshore islands such as the Berlengas but excluding the Azores and Madeiran Islands.

The need for an updated list has become apparent over the past decade. A previous checklist (MATOS, 2004) was superseded by the undated book published privately by MATOS [2014]. However, these works did not cover slugs or Bivalvia, and they included at least ten species for which the records from the region now appear to be incorrect or dubious. Furthermore, MATOS (2014: 258) is explicit in not taking account of literature from 2009 onwards, despite the numerous taxonomic revisions and descriptions of new species involved.

Fuller application of molecular techniques combined with traditional systematic methods is already starting to give a better understanding of species-level relationships in European land and freshwater molluscs, including those of Portugal. The present list therefore attempts to record the current state of knowledge of the fauna, remove erroneous and dubious records, and comment on taxonomic, nomenclatural and distributional problems that need to be addressed.

METHODS

The classification adopted here is based on the CLECOM lists for N. and W. Europe (BANK *ET AL.*, 2001; FALKNER, BANK & PROSCHWITZ, 2001; FALKNER, RIPKEN & FALKNER, 2002), with Portuguese taxa not covered by those works inserted. Numerous other modifications have been made from more recent literature, the differences from the CLECOM treatment being explained by notes or references to the literature.

Here, supra-generic classification follows BOUCHET *ET AL.* (2017) for gas-

tropods and BOUCHET *ET AL.* (2010) for bivalves. Those publications should be consulted for justification of changes from the treatment adopted for CLECOM. Families are listed alphabetically within superfamilies, genera alphabetically within families and in each genus species are listed alphabetically.

The use of subgenera and subspecies for all taxa that have been subdivided was inherent in the CLECOM lists. This sometimes resulted in cumbersome quadrinomial nomenclature [e.g. "*Trochulus (Trochulus) striolatus ablutens* (Locard, 1888)"] that implies a correspondingly detailed understanding of hierarchical relationships of taxa. Such detailed hierarchies are now often being refuted as more of the existing morphological analyses (or merely untested hypotheses) have been revised or tested by multi-locus molecular genetic studies. Here therefore, mention of subgenera is mainly restricted to a few notes at the end of the species accounts.

Subspecies have not been recognised within many species because of doubts about their evolutionary significance, usefulness, or both. Many of these doubts are already expressed in the literature. Nevertheless, subspecific nomenclature sometimes appears helpful in understanding Portuguese populations (e.g. for *Theba*; also for *Macrogastrea rolphii* following NORDSIECK, 2006).

Treatment of brackish-water and coastal taxa follows conventional practice in at least NW Europe of following partly habitat-related divisions, partly taxonomic divisions. This undoubtedly leads to a somewhat artificial and inconsistent arrangement, with almost all Pulmonata being covered, including all Ellobiidae (but not Siphonariidae). With the remaining gastropods, all Hydrobiidae and Assimineidae are included, whereas more strictly marine groups such as Littorinidae and Patellidae are completely excluded. All brackish-water Bivalvia are also excluded, despite the broad habitat overlap of some such as *Cerastoderma glaucum* (Bruguière, 1789)

with Hydrobiidae. Taxa known only as fossils are not considered.

Information on each of the species recognised is given in the sequence: valid name; author(s); year of publication. Notes to explain the treatment adopted here, correct published errors, etc., often follow. A list of taxa reported from mainland Portugal for which all records appear to be erroneous or unsubstantiated is also given at the end of the main systematic list.

Abbreviations:

agg.: aggregate (of two or more similar species)

CGAH: Collection of G.A. & D.T. Holyoak
CRM: Collection of Rui da Costa Mendes

fig., figs: figure, figures
hectad: 10-kilometre square of U.T.M.

grid
I.C.Z.N.: International Commission on Zoological Nomenclature

ims: 80% industrial methylated spirit

leg.: collected by

LSL: Linnean Society of London, U.K.

MHNG: Muséum d'Histoire Naturelle, Ville de Genève, Switzerland

NHMB: Museum für Naturkunde, Berlin, Germany

NHMO: Natural History Museum, University of Oslo, Norway

NHMUK: Natural History Museum, London, U.K.

NMR: Natuurhistorisch Museum, Rotterdam, The Netherlands

NMW.Z: National Museum of Wales, Cardiff, U.K.

NR: Naturhistoriska Riksmuseet, Stockholm, Sweden

p., pp.: page, pages

pl., pls: plate, plates

Prov.: Province (in Spain)

RAMM: Royal Albert Memorial Museum, Exeter, U.K.

RMNH: National Museum of Natural History (Naturalis), Leiden, The Netherlands

s. l.: *sensu lato* (in the wide sense)

SMF: Forschungsinstitut Senckenburg, Germany

s. s.: *sensu stricto* (in the narrow sense)

sp., spp.: species (singular), species (plural)

ssp., sspp.: subspecies (singular), subspecies (plural)

syn.: synonym (or synonyms)

TL: type locality

UM.PDL: Université de Montpellier, France

U.T.M.: Universal Transverse Mercator map grid

UUZM: Uppsala University Zoological Museum, Uppsala, Sweden

var., vars: variety, varieties

** : Species endemic in mainland Portugal

* : Species endemic in Iberian Peninsula

(**) : Subspecies endemic in mainland Portugal

‡ : Present in Portugal only as alien.

SYSTEMATIC LIST OF SPECIES RECORDED IN MAINLAND PORTUGAL

Phylum MOLLUSCA

Class GASTROPODA

Family NERITIDAE

Theodoxus baeticus (Lamarck, 1822)

Previously reported as *Theodoxus fluviatilis* (Linnaeus, 1758), with some distinctive local populations treated as synonyms (*Neritina violacea*, *N. inquinata*, *N. guadianensis*, *N. elongatula*, all named by MORELET, 1845). BUNJE & LINDBERG (2007) showed that *Theodoxus* from Greece, Sicily, Tunisia and Spain form a single clade. A subsequent molecular-phylogenetic study published as yet only as an abstract (MARTÍNEZ-ORTÍ *ET AL.*, 2015) found that this clade (which they placed as *T. meridionalis* (Philippi, 1836)) is widespread in Iberia, whereas *T. fluviatilis* occurs only in the north. ALBA *ET AL.* (2016) reported *T. cf. meridionalis* from Prov. Tarragona, Spain as being morphologically similar to Sicilian topotypes and distinct from *T. fluviatilis* present elsewhere in Catalonia.

GLÖER (2018) reexamined syntypes of *Neritina baetica* Lamarck, 1822 (LAMARCK, 1822: 188; TL Andalusia, Spain) from MHNG and found that they resembled syntypes of *Nerita meridionalis* Philippi, 1836 from NHMB in possessing a diagonal pseudo-apophysis (peg) on

the inside of the operculum (GLÖER, 2018: 135, figs 5 and 6), a feature lacking in *T. fluviatilis* (GLÖER, 2018: 135, figs 2-4). He therefore regarded *N. meridionalis* as a junior syn. of *N. baetica*, since they also have similar shells and molecular data show they belong to the same clade. WELTER-SCHULTES (2012: 26) regarded *Theodoxus baeticus* as endemic in S. and SE. Spain, including Mallorca.

Our recent study of opercula and shells from Portuguese *Theodoxus* populations (CGAH, CRM) based on Gloër's criteria did not reveal any *T. fluviatilis*, whereas *T. baeticus* occurred in springs or their outlet streams in seven hectads from Coimbra (Beira Litoral) southwards to Alcobertas and Alcanena (Ribatejo) (29SND06, ND08, ND26, NE24, NE32, 29TNE43, NE44) and in one hectad in Baixo Alentejo in the tidal but freshwater part of the R. Guadiana ca 1 km W. of Pomarão (29SPB25).

Family ACICULIDAE

***Platyla lusitanica* (D. Holyoak & Seddon, 1985)

Fresh shells were refound at the TL in 2001 (CGAH).

Family POMATIIDAE

Pomatias elegans (O.F. Müller, 1774)

‡*Tudorella sulcata* (Draparnaud, 1805)

Known in Portugal only near Lagoa de Alvor in SW. Algarve, where first reported from this locality by NOBRE (1941: 223) and presumably introduced. CADEVALL & OROZCO (2016: 125) correctly treated the Algarve snails as *T. sulcata*, with a shell photo resembling that in MATOS (2014: 35, fig. 16) and our recently collected specimens. They differ from shells of the few populations in S. Spain (assigned to *T. mauretanicus* (Pallary, 1898)) in having more swollen whorls with stronger spiral ribs. The shells figured as *T. mauretanicus* by WELTER-SCHULTES (2012: 105) from "Algarve, Alvor near Portimão" are thus referable to *T. sulcata* (see above), but his generalised range map for *T. mauretanicus*

shows both the Algarve and S. Spain (although the few localities there are represented by extensive shading).

The taxonomy of *Tudorella* is controversial, and we follow MARTÍNEZ-ORTÍ *ET AL.* (2008) in recognising three species (the other being *T. ferruginea* (Lamarck, 1822) of the Islas Baleares), although all of them could easily be regarded as three well defined subspecies of *T. sulcata*. A paper by PFENNINGER *ET AL.* (2009) claimed six to eight species on the basis of molecular data, some of them cryptic morphologically, or almost so. The ANIMALBASE website (cf. WELTER-SCHULTES, 2012: 105) did not accept this increased number because it does not conform to the biological species concept applied there.

As reaffirmed by BANK (2011: 14), the year of publication of *Cyclostoma sulcatum* Draparnaud was 1805, not 1801 as given by MATOS (2014: 24, 34).

Family ASSIMINEIDAE

Assiminea glaubrechti Aartsen, 2008

Reported new to Portugal, living on intertidal mud under reed-swamp fringing brackish lagoon, SW. of Aveiro, Beira Litoral by HOLYOAK & HOLYOAK (2013). The species is known elsewhere only from N. Spain and the type-locality in S. France (Bayonne) (AARTSEN, 2008: 175).

Family BITHYNIIDAE

Bithynia tentaculata (Linnaeus, 1758)

Family HYDROBIIDAE

***Belgrandia alcoaensis* C.R. Boettger, 1963

Known only from spring at source of the Alcoa River near village of Chiqueda de Cima, 2 km E. of Alcobaca, Estremadura, where still present in 2012. See ROLÁN & OLIVEIRA (2009) and OLIVEIRA & ROLÁN (2010) for illustrations and distributional data.

***Belgrandia alvaroi* G. Holyoak, D. Holyoak & da Costa Mendes, 2017

Described in HOLYOAK *G.A.*, HOLYOAK & MENDES (2017: 73-77);

known only from one small spring near Alpedriz, Alcobaça, Estremadura.

***Belgrandia heussi* C.R. Boettger, 1963

C. Portugal, where known only from S. part of Beira Litoral and northern edges of Estremadura and Ribatejo. See ROLÁN & OLIVEIRA (2009) and OLIVEIRA & ROLÁN (2010) for illustrations and distributional data.

***Belgrandia jordaoui* G. Holyoak, D. Holyoak & da Costa Mendes, 2017

Described in HOLYOAK G.A., HOLYOAK & MENDES (2017: 75-78); known only from one small spring near Alpedriz, Alcobaça, Estremadura.

***Belgrandia lusitanica* (Paladilhe, 1867)

Known from two springs in Beira Litoral: at and near Fonte das Lágrimas, Quinta das Lágrimas, near Coimbra, and Quinta do Brulho, Verride, concelho de Montemor-o-Velho. See ROLÁN & OLIVEIRA (2009) and OLIVEIRA & ROLÁN (2010) for illustrations and distributional data.

***Belgrandia silviae* Rolán & Oliveira, 2009

Described by ROLÁN & OLIVEIRA (2009: 84, figs. 13-25, 70-73), from the spring of Alcabideque (3 km E. of Condeixa-a-Nova), Beira Litoral. HOLYOAK G.A., HOLYOAK & MENDES (2017: 78-79) reported a second locality 4 km away in a spring at Arrifana (Condeixa-a-Nova, Beira Litoral).

**Alzoniella rolani* (Boeters, 1986)

Belgrandiella rolani Boeters, 1986 is transferred to *Alzoniella* following ARCONADA, ROLÁN & BOETERS (2007).

Hydrobia glyca (Servain, 1880)

BOETERS (1988: 192) regarded *Paludestrina glyca* Servain, 1880 as a synonym of *Hydrobia minoricensis* (Paladilhe, 1875) (TL Menorca, Islas Baleares). However, WILKE ET AL. (2000) demonstrated that the populations of *Hydrobia* s. s. ranging from Brittany to SW. Spain and N. Morocco [*H. glyca*] are genetically distinct from those in both N. Europe (*H.*

neglecta Muus, 1963) and the Mediterranean (*H. minoricensis* (Paladilhe, 1875)).

Hydrobia joessei AARTSEN, MENCHORST & GITTENBERGER, 1984 (p. 13, fig. 51) was treated as a synonym by WILKE ET AL. (2000). Its paratypes include specimens from Lagos in RMNH (BOETERS, 1988: 191).

H. glyca probably includes most or all of the records treated by MATOS (2014: 40-43) as *Hydrobia acuta* (Draparnaud, 1805) and *H. joessei*. It may also have contributed to the records she mapped as *Hydrobia ventrosa* (Montagu, 1803), a species likely to occur in Portugal but needing confirmation (see account of *Ecrobia ventrosa* (Montagu, 1803) under "Unconfirmed or erroneous reports" heading below).

The I.C.Z.N. (2003) agreed to a request by GIUSTI, MANGANELLI & BODON (1998) to resolve several nomenclatural problems involving *Hydrobia* s. s. and *Obrovia* Radoman, 1974 (the latter genus was recognised by GIUSTI & PEZZOLI, 1985: 123, 131). FALKNER ET AL. (2002: note 35) and GARGOMINY (2011: 347, note 38) considered the consequences of the I.C.Z.N. (2003) Opinion, which included adoption of the generic name *Hydrobia* in preference to *Obrovia* for *H. glyca*.

***Mercuria tachoensis* (Frauenfeld, 1865)

Mercuria edmundi Boeters, 1986 was described from the W. Algarve (BOETERS, 1986: 126, figs 4-7, pl. 18a, fig. 2; 1988) as a new species differing from *M. tachoensis* only on the basis of larger shell size, presence of a large rounded bulge on the penial appendage and shorter penis relative to the appendage. MATOS (2014: 45-47) also treated it as a different species from *M. tachoensis*, and gave additional localities, but she reversed the shell size characters used to define them. HOLYOAK D.T., HOLYOAK & MENDES (2017) inferred from a new study of shell and penis characters that the type material of *M. edmundi* was of *M. tachoensis* approaching sexual maturity, with shells approaching full size, so the name should be regarded as a taxonomic synonym of the latter.

Peringia ulvae (Pennant, 1777)

‡*Potamopyrgus antipodarum* (J.E. Gray, 1843)

Authorship given as J.A. Gray in MATOS (2014: 38) is incorrect; J.E. Gray is correct on her p. 24.

Family TRUNCATELLIDAE

Truncatella subcylindrica (Linnaeus, 1767)

Family VALVATIDAE

Valvata piscinalis (O.F. Müller, 1774)

Apparently now rare, with two recent records, both from Beira Litoral: 2008, 2 alive from pool in disused fish hatchery, S. edge of Praia de Mira (29TNE17), in CGAH; 2009, deep ditch in R.N. do Paúl de Arzila (29TNE34). Also as old dead shells, 2010, in dredged sediment on bank of ditch, ca 1 km SW. of Alfarelos (29TNE24).

Family LYMNAEIDAE

Galba truncatula (O.F. Müller, 1774)

‡*Pseudosuccinea columella* (Say, 1817)

Recorded new to mainland Portugal from two localities in Beira Litoral (OLIVEIRA, HOLYOAK & HOLYOAK, 2010: 41). A brief earlier report of its occurrence in Portugal by SIMÕES (2005) did not state whether the record was from mainland Portugal, Madeira or the Azores.

Radix cf. *auricularia* (Linnaeus, 1758)

Some specimens from Portugal clearly show the shell characters traditionally regarded as characteristic of *R. auricularia* (e.g. MATOS, 2014: 61, fig. 37). Nevertheless, PFENNINGER *ET AL.* (2006) demonstrated from a study combining molecular and conchological data that shell form alone is inadequate for reliably delimiting and recognising species in European *Radix*. SCHNIEBS *ET AL.* (2011) showed that specimens mainly from Germany can be identified to species delimited from molecular data using a combination of characters from

the shell, external body coloration and distal genital anatomy. Nevertheless, the combined molecular and morphological study by SCHNIEBS *ET AL.* (2011) revealed that some populations of *R. balthica* have shells virtually indistinguishable from those of *R. auricularia*, so confirmation of all Portuguese records is needed using additional characters.

Radix cf. *balthica* (Linnaeus, 1758)

The molecular study by PFENNINGER *ET AL.* (2006) apparently implied that *R. balthica* s. s. may not occur in the Iberian Peninsula. However, SCHNIEBS *ET AL.* (2011: 657) accepted that the species occurs in Spain and N. Africa, so the impression from shell characters that Portuguese records of the genus belong mainly or entirely with this species may be correct. Nonetheless, the combined molecular and morphological study by SCHNIEBS *ET AL.* (2011) revealed that some populations of *R. balthica* have shells virtually indistinguishable from those of *R. auricularia* and other congeners occurring in Germany, so confirmation of all Portuguese records is needed using additional characters.

FROGLEY & PREECE (2007: 283) sought to retain the name *Buccinum peregrum* O.F. Müller, 1774 for this species (or species-complex), since this name “is listed as a conserved name by the I.C.Z.N.”. However, KADOLSKY (2012: 73) correctly pointed out that its placement on the Official List of Specific Names in Zoology in Opinion 336 (1953) does not protect the name from the principle of priority (I.C.Z.N. Article 80.6.4) when it is regarded as a junior synonym of *Helix balthica* Linnaeus, 1758.

VINARSKI (2017) reexamined the arguments and evidence for replacement of the name *Buccinum peregrum* O.F. Müller, 1774 by CLECOM, making a clear case that it is a *nomen dubium*. Nevertheless VINARSKI (2017: 147) advocated that for “the sake of the stability and continuity of zoological nomenclature it is most desirable to retain the common name *Radix peregra* ... since the facts do not contradict its traditional interpretation (= *R. peregra sensu*

Ehrmann). Anyway, the binomen *R. labiata* (Rossmässler, 1835) cannot be used as a replacement name for *R. peregra* since its type series is represented by shells belonging to a quite different species”.

In our view, if usage of *R. peregra* is restored on the basis of Vinarski's suggestions, the taxonomic data on whether it is correctly treated as a different species from *R. balthica* (Linnaeus, 1758) (syn. *R. ovata* (Draparnaud, 1805)) would also merit critical reassessment.

Stagnicola palustris (O. F. Müller, 1774)

Since the detailed studies by JACKIEWICZ (1993) it has been widely accepted (e.g. GLÖER, 2002) that there are at least four other European species allied to *Stagnicola palustris* which can often be difficult to separate on shell characters alone. OLIVEIRA & MARTÍNEZ-ORTÍ (2007) confirmed the first Portuguese records from study of the genital anatomy as *S. palustris* s. s. from Douro Litoral. A population discovered in 2016 by RM further south near Lagoa de Óbidos (Estremadura) has recently been confirmed anatomically by us as the same taxon.

Family PHYSIDAE

‡*Physa acuta* Draparnaud, 1805

ANDERSON (2003: 7) provided strong arguments that this species is an alien in Europe, of N. American origin. *P. acuta* has been separated from *Physa* in the genus *Physella* Haldeman, 1843 [year taken from WELTER-SCHULTES & AUDIBERT, 2013: 11, whereas BANK, 2011: 15 gave it as 1842] then *Haitia* Clench & Aguayo, 1932 mainly on the basis of penial morphology (TAYLOR, 2003). The molecular study by WETHINGTON & LYDEARD (2007) demonstrated that *P. acuta* is best retained in the genus *Physa* rather than separated in *Haitia* or *Physella*, even if narrow genus concepts are applied. Despite the analysis by WETHINGTON & LYDEARD (2007), KADOLSKY (2012: 74) claimed that a more differentiated classification is warranted “even at this stage”, as the three

monophyletic groups recognised within *Physa* “are also morphologically definable”, largely on the basis of penial morphology. The molecular data implying these penial differences are likely to be of relatively recent origin were not discussed. He designated *Physa acuta* as type species of *Physella* subgenus *Acutiana* Fagot, 1883.

Family PLANORBIDAE

Ancylus fluviatilis O.F. Müller, 1774 agg.

PFENNINGER ET AL. (2003) reported a study of DNA sequences from numerous W. Palearctic populations that revealed existence of four cryptic species, three of which occur in Portugal and two in Spain. The cryptic taxa differ in average shell shapes, but with sufficient overlap to prevent reliable identification on that basis alone. *A. fluviatilis* s. s. (their Clade 1) is the widespread taxon in N. and C. Europe with a range extending southwards to N. Portugal and C. Spain; their Clade 2 is known only from a single population in S. Portugal; Clade 3 is unknown on the Iberian Pen.; Clade 4 is known from Portugal, S. and E. Spain and localities in the Mediterranean basin eastwards to Italy and Croatia. WELTER-SCHULTES (2012: 48) comments on subsequent research seeking morphological correlates of the genetic variation (ALBRECHT ET AL., 2006; SOLDATENKO, 2009)

MORELET (1845) named the following three species from mainland Portugal, but genetic study will probably be needed to identify them with the clades now revealed: *Ancylus vitraceus* (MORELET, 1845: p. 87, pl. 8, fig. 3), TL “les ruisseaux de l'Alemtejo supérieur entre Arronchès et Portalègre”; *A. strictus* (p. 88, pl. 8, fig. 4), TL “dans les affluens du Sadão, sur la route de San-Bendo à Santa-Margarita”; *A. obtusus* (p. 88, pl. 8, fig. 5), TL “la petite rivière de Bragançe et celle de Lamégo, dans la province de Beira”.

Anisus spirorbis (Linnaeus, 1758) s. l.

There has been much discussion of whether *A. spirorbis*, *A. leucostoma* (Millet, 1813) and the C. European *A.*

septemgyratus (Rossmässler, 1835) form two or three distinct species or are all forms of a single phenotypically variable *A. spirorbis* (e.g. HUBENDICK, 1951; LOŽEK, 1964; BERAN & HORSÁK, 2002; FALKNER *ET AL.*, 2002; ANDERSON, 2005: 630). Recently, GLÖER & MEIER-BROOK (2008) recognised all three as valid species, stating that the number of prostates diverticles is the most reliable character distinguishing them. However, their data were not treated statistically, so it was not established that the number of diverticles in different populations is anything more than a simple correlate of body or shell size. These authors claimed that adult shells can be separated by small differences in shell height and number of whorls, but the data are not treated statistically or adequately linked to the anatomical information presented. A careful study combining molecular-genetic and morphological characters is needed. In the meantime, we recognise only a single broadly defined species.

Records from Portugal have not been referred to the segregate species recognised by some recent authors. MORELET (1845: 80) reported *P. leucostoma* from “les marais d’Azambuja et dans la petite rivière de Pega, près de Coimbre”, but presumably *A. spirorbis* s. s. might also have been involved. Likewise, Portuguese records summarised by NOBRE (1941: 203-204) under *Planorbis spirorbis* could refer to either of those segregate spp. A shell figured as *A. spirorbis* from Ceira, Coimbra by MATOS (2014: 77, fig. 54) is a misidentified *Gyraulus* or *Planorbis* sp.

Bathyomphalus contortus (Linnaeus, 1758)

The only record from mainland Portugal remains that of MORELET (1845: 80), as *Planorbis contortus* (Müll.), “Dans les canaux, aux environs d’Azambuja (Estramadure)”. There is no specimen of it in part of the Morelet Collection housed at NHMUK (J. Ablett, *in litt.*).

Bulinus truncatus (Audouin, 1827)

Records from Portugal have been assigned to *B. t. contortus* (Michaud,

1829). MEDEIROS & SIMÕES (1979) presented evidence of this species disappearing from parts of the lower Mondego valley (Beira Litoral) between 1960 and 1978. It has not been recorded at all during our own fieldwork (mainly 2009-2018).

‡*Ferrissia californica* (Rowell, 1863)

Molecular genetic studies led WALTHER *ET AL.* (2006) to report that European populations of small freshwater limpets previously known as *Ferrissia wautieri* (Mirolli, 1960) should be regarded as synonyms of the N. American *F. fragilis* (Tryon, 1863), which has evidently invaded Europe (e.g. BERAN & HORSÁK, 2007). CHRISTENSEN (2016) has since found that the older name *F. californica* should replace *F. fragilis*.

The first published reports from mainland Portugal, as *F. fragilis*, were in 2008 from natural habitats at Lagoa da Vela (Beira Litoral) and in the Rio Ocreza, E. of Vale da Mua (Beira Baixa) (HOLYOAK, 2009). Nine more records from Beira Litoral, Alto Alentejo and Algarve were soon added (OLIVEIRA *ET AL.*, 2010: 42), so the species is widely established. MATOS (2014: 70-71, fig. 50) has subsequently published older records as *Ferrissia (Pettancylus) clessiniana* (Jickeli, 1882), from 1998 near Rio Maior and from 1999 for SW. Alentejo.

Gyraulus albus (O. F. Müller, 1774)

‡*Gyraulus chinensis* (G. Dunker, 1848)

First recorded for mainland Portugal in Alcácer do Sal region of Baixo Alentejo (SIMÕES, 1996) and subsequently reported elsewhere by BROWN, GRÁCIO & MEYER-BROOK (1998: 213) and OLIVEIRA (2009b: 34).

Gyraulus crista (Linnaeus, 1758)

Gyraulus laevis (Alder, 1838)

‡*Helisoma duryi* (Wetherby, 1879)

First correctly reported as *Planorbella duryi* found in 2008 in a large artificial pool at Jardim Botânico da Universidade de Coimbra by OLIVEIRA (2009b: 34). We

found fresh shells there again in 2014 alongside planted water lilies and introduced goldfish. MATOS (2014: 69, fig. 47) illustrated shells from the same pool collected in 2005 which she misidentified as *Planorbarius corneus* (Linnaeus, 1758), a species otherwise unknown in Portugal, giving a detailed account of the same locality and habitat with a photograph of the pool (MATOS, 2014: 67).

An earlier note on occurrence of this genus in Portugal (SIMÕES, 2005) did not state whether the record was from mainland Portugal, Madeira (where reported by BANK, GROH & RIPKEN, 2002: 98) or the Azores.

Hippeutis complanatus (Linnaeus, 1758)

Our only record is from ca 0.5 km NW of Almóster, Ribatejo (29SND14) from 2014 and that comprised just three old shells found in a sample of sediment from the bed of a stream (CGAH). Both of the shell figures in MATOS (2014: 87) are misidentified: fig. 63 is *Gyraulus* cf. *laevis*, fig. 64 is *Anisus spirorbis* s. l.

‡*Menetus dilatatus* (Gould, 1841)

First recorded in 2010 from lower Rio Mondego at Montemor-o-Velho (OLIVEIRA ET AL., 2010: 42). In 2012 we found it elsewhere in Beira Litoral, by the R. Mondego near Alfarelos (in shallow river) and just S. of Praia de Mira (in lake edge).

Planorbarius metidjensis (Forbes, 1838)

Planorbis carinatus O.F. Müller, 1774

Our only record of this genus is of a single old dead shell of *P. carinatus* in sediment from a stream (2014, ca 0.5 km NW of Alfarelos, Beira Litoral, 29SND14). Hence, both this and the next species appear to have declined, or possibly become extinct locally.

Planorbis planorbis (Linnaeus, 1758)

Family OTINIDAE

Otina ovata (Th. Brown, 1827)

A marine inter-tidal species, but often listed alongside Ellobiidae because of their taxonomic affinity. It was

recorded from Lagos in the W. Algarve as *Otina otis* (Turton, 1843) by MACEDO, MACEDO & BORGES (1999: 374). WELTER-SCHULTES (2012: 70) also reports it from Portugal and SW. Spain on the basis of specimens in NMR.

Family ELLOBIIDAE

Carychium ibazoricum Bank & E. Gittenberger, 1985

DNA sequence data from *C. ibazoricum* collected by DTH & GAH from Estremadura (near São Pedro de Moel) and Beira Litoral (near Conimbriga) represent the same clade as specimens from the Azores, which is discrete from *C. minimum* O.F. Müller, 1774 and *C. tridentatum* (Risso, 1826) (WEIGAND ET AL., 2013; Adrienne Jochum, *in litt.*, 2012).

The detailed molecular study of *Carychium minimum* by WEIGAND ET AL. (2012) did not reveal any material of that species from mainland Portugal among specimens analysed. Potential distribution models for *C. minimum* (WEIGAND ET AL., 2012: 10, fig. 5) showed it having a range largely confined to the Euro-Siberian vegetation zone, but not reaching N. Portugal or indeed W. Galicia.

Numerous samples of *Carychium* in CGAH were initially sorted into taller more slender ribbed shells (named as *C. ibazoricum*) and shorter, relatively wider, almost unribbed shells which were named as *C. minimum*, but some material was hard to classify. Examination of the parietal lamella by making a hole in the front part of the body whorl of representative shells from many of the samples revealed that it had the same structure in all the samples, irrespective of overall shell shape or sculpture. The lamella was always found to be strongly sinuous with a conspicuous, adapical curve in the second quarter of the body whorl, as figured in the original description of *C. ibazoricum* by BANK & GITTEBERGER (1985: 87, figs 4-6) and clearly different to the lower and smoothly curving parietal lamella of *C. minimum* (e.g. KERNEY & CAMERON, 1979: 57). It

was concluded that all the material can be referred to *C. ibazoricum*, even when the relatively broad shell shape and absence of strong ribbing were initially suggestive of *C. minimum*. Against this background, it appears very unlikely that *C. minimum* is more widespread in Portugal than *C. ibazoricum*, as implied by the maps in MATOS (2014: 95-96). Indeed, we have seen no correctly identified material of *C. minimum* from mainland Portugal.

Leucophytia bidentata (Montagu, 1808)

The basionym *Voluta bidentata* MONTAGU, 1808 (pp. 100-101, pl. 29, fig. 3) is a junior primary homonym of *Voluta bidentata* Schröter, 1804. GIUSTI & MANGANELLI (1996: 1, Case 3000) requested that the I.C.Z.N. conserve the name *Voluta bidentata* Montagu, 1808 to preserve established usage (GIUSTI & MANGANELLI, 1998; *Bull. zool. nomencl.*, 57 (1): 6, 2000). No ruling was obtained on this and the Case was closed, because a new provision of the Code ensured that after 1999 the scientists involved would be able to solve this problem themselves without involving the Commission. However, the supporting documentation required by the I.C.Z.N. Code remained incomplete until FALKNER *ET AL.* (2002: 100-101, Note 124) provided it, and formally declared *Voluta bidentata* Schröter, 1804 a “nomen oblitum” and *Voluta bidentata* Montagu, 1808 a “nomen protectum”.

Placed in genus *Auriculinea* Tausch, 1886 by GIUSTI & MANGANELLI (1998) and MARTINS (2007: 22). However, WELTER-SCHULTES (2012: 72) retained it in *Leucophytia*, pointing out that *Auriculinea* was established by monotypy for *A. whitei* Tausch, 1886, a Cretaceous fossil species from Hungary with shouldered whorls and very prominent ribs (BANDEL & RIEDEL, 1994: 25), so a very close relationship with *L. bidentata* is not obvious.

Shells figured by MACEDO *ET AL.* (1999: 261) as “*Auriculinea (Leuconia) erosa* (Jeffreys, 1883)” are not of this genus, but apparently *Myosotella* or *Ovatella*.

Myosotella denticulata (Montagu, 1803)

Treated in most of the recent literature as *M. myosotis* (Draparnaud, 1801), e.g. by MATOS (2014: 91, 93) and WELTER-SCHULTES (2012: 72). In wide ranging reviews of that species, MARTINS (1996: 200-202, 1999: 70-71) concluded that it is extremely variable, but appears to consist of only a single species in Europe and N. Africa. He cited FENAUX (1939) who, after examining hundreds of specimens from a stretch of coast between Toulon and Agde, S. France, found almost all the “species” described from Europe. Despite this, several authors have recently regarded *M. denticulata* (Montagu, 1803) as a distinct species, e.g. CLECOM and GARGOMINY *ET AL.* (2011: 323). FALKNER *ET AL.* (2002: 100) noted a clear ecological segregation of the two in the Netherlands. Nevertheless, WATSON (1943) had noted that intermediate shells occur in Britain, an observation which is confirmed by CGAH material.

MARTINS (1996: 194, 197-198 fig. 41) selected a lectotype (RAMM 4100) for *Voluta denticulata* MONTAGU, 1803 (p. 234, pl. 20 fig. 5), with TL Devon, England, and considered the taxon to be a synonym of *M. myosotis* (MARTINS, 1996: 194).

Continuing detailed studies by MARTINS & MENDES (2013) and MARTINS (2014) have led to a radical reappraisal of *Myosotella* taxonomy based on remarkable discoveries about the anatomy of the penial papilla, the significance of which is supported by molecular-phylogenetic analyses. The new work shows that populations on Mediterranean coasts of Europe have the penial papilla flap-shaped (leaf-like, with the pore opening at the base of the right margin) and these should apparently be referred to *M. myosotis* *s. s.* In contrast, populations on non-Mediterranean coasts of Europe from Portugal to Great Britain have a hood-shaped penial papilla (with retractile papilla at centre of a protective cover), and these should be referred to *M. denticulata* irrespective of shell characters. Thus, we

regard the Portuguese populations as the latter species. Additional types of penial papilla were found in populations on the Azores they treat as endemic species.

Ovatella firminii (Payraudeau, 1827)

Recorded on coasts of mainland Portugal from Algarve (Sagres: MARTINS, 2007: 26; MARTÍNEZ-ORTÍ & ROBLES, 2009: 45) and Estremadura (Cascais: MATOS, 2014: 92-93). MARTINS (1999: 61, 73) treated *O. aequalis* (R.T. Lowe, 1832) and *O. firminii* as distinct species, illustrating shells of each of them side by side (MARTINS, 1999: figs 1 and 2 on p. 61) and tabulating numerous morphological and anatomical characters separately for each of them (MARTINS, 1999: table 1 on p. 73). MARTINS (2007: 26) listed *O. firminii* from Sagres, Portugal. BANK ET AL. (2002: 99) recorded *O. aequalis* as endemic in Macaronesia, where known only from the Canary Is., Madeiran Is. and Is. Selvagem. Occasional reports from Portugal and Andalucía (GOFAS, MORENO & SALAS, 2011) of *O. aequalis* therefore seem likely to be errors of identification, or locality.

Some doubt may exist over the date of publication, which is given as 1826 in the book. However, a review by the Académie des Sciences issued in March 1827 is bound with the book and the MolluscaBase website accepts 1827 as correct for this species.

Pedipes dohrni d'Ailly, 1896

MARTINS (2007: 26) listed *Pedipes dohrni* d'Ailly, 1896 from the Algarve (Albufeira) and *Pedipes pedipes* (Bruguière, 1789) from the Azores, Madeira and Senegal. His reasons for treating these as separate species were not made clear, although following this the MolluscaBase website (MOLLUSCABASE, 2018) treats each of them separately. More study may be needed though, since records from S. Spain (GOFAS ET AL., 2017) were regarded as being of *P. pedipes*.

The genus was also reported by MACEDO ET AL. (1999: 261, 374) as *Pedipus* [sic] *afér* (Gmelin, 1857, sic)

(from Lagos, on p. 261) and *Pedipus* [sic] *afér* (Gmelin, 1791) (on p. 374).

Pseudomelampus exiguus (R.T. Lowe, 1832)

Reported from Sagres, Algarve by MARTINS (2007: 26). The genus was also reported as *Pseudomelampus* sp. from Armação de Pêra (Algarve) by MACEDO ET AL. (1999: 260).

FALKNER ET AL. (2002: 101) pointed out that the date of publication of this name is correctly cited as 1832 (July).

Family ONCHIDIIDAE

Onchidella celtica (Cuvier, 1816)

Onchidium celticum Cuvier, 1816 was published before 2 Dec. 1816 (CUVIER, 1816: 411 footnote 4, in CUVIER, "1817"; ROUX, 1976) so the 1817 date often adopted is incorrect. The original description was very short ("petite espèce"), but it has traditionally been regarded as sufficient.

Recorded in Portugal as supralittoral on coasts, from Berlengas, Vila Nova de Milfontes, and in the Algarve (MACEDO ET AL., 1999: 374).

Family SUCCINEIDAE

Oxyloma elegans (Risso, 1826)

‡*Succinea* sp., subgenus *Calcisuccinea* Pilsbry, 1948

HOLYOAK ET AL. (2013) recorded an unidentified species of this subgenus new to Europe in C. Portugal and Spain. Extensive taxonomic revision of forms from the American tropics will be necessary to identify the species involved. The Portuguese records are of established populations outdoors in a public park at Porto de Mós (Estremadura) and around the grounds of a school at Leiria (Beira Litoral).

Succinella oblonga (Draparnaud, 1801)

Recorded in Portugal only as *Succinea abbreviata* MORELET, 1845 (p. 54, pl. 5, fig. 4) with TL "une prairie des environs de Bragançe" (i.e. Bragança, Trás-os-Montes e Alto Douro). NOBRE (1909:

222) identified this as a form of *S. oblonga*; MATOS (2014: 99) reproduced his figures.

Family COCHLICOPIDAE

Cochlicopa cf. *lubrica* (O.F. Müller, 1774)

Cochlicopa cf. *lubricella* (Porro, 1838)

Although GITTENBERGER (1983) accepted that *C. lubrica* and *C. lubricella* are distinct species which both occur in Iberia, ANDERSON (2005: 626, note 13) stressed that there are practical difficulties in distinguishing them. This is because phylogenetic analysis (ARMBRUSTER, 1997) has indicated that *lubrica* exists as two distinct ecotypes, one found in damp habitats, the other in dry, exposed places and that *lubricella* comprises two small-shelled paraphyletic taxa, distinguishable only on genetic characters. One of the *lubricella* taxa closely approaches *C. lubrica* and may be synonymous.

There are also theoretical difficulties in recognising *lubricella* as a distinct species, in addition to the possibility of it having polyphyletic origins. In the detailed analysis of British *Cochlicopa* populations by QUICK (1954: 213) it was noted that "The idea that *lubricella* is an ecological form of *lubrica* induced by dryness is excluded because both forms are sometimes found together on the same site". We have also recorded them living together in England and OLIVEIRA (2009a) found both in Jardim de Santa Cruz at Coimbra. Such observations cannot, however, be taken as evidence of there being two species that can coexist because they are reproductively isolated. Instead, there is evidence suggesting that populations of *Cochlicopa* consist of an uncertain number of self-fertilising clones (ARMBRUSTER & SCHLEGEL, 1994). If outbreeding is infrequent or absent, taxonomic separation of the *lubricella* "morphotype" from *C. lubrica* may thus be untenable within either biological or phylogenetic species concepts. We therefore list Portuguese material as *Cochlicopa* cf. *lubrica* and *C. cf. lubricella* in recognition of the unreliable correlation between shell morphology and phy-

logeny revealed elsewhere in Europe, the likelihood that outbreeding species are not involved, and the lack of genetic studies of Portuguese populations.

FALKNER *ET AL.* (2002: 104) argued that the species name *lubricella* was made available by ROSSMÄSSLER (1834: 6) but KADOLSKY (2012: 75) pointed out that it remained as a *nomen nudum* in ROSSMÄSSLER (*loc. cit.* and 1835), being validated by PORRO (1838: 54). Other concerns about application of this and other names for small or slender forms of *Cochlicopa* are also discussed at length by KADOLSKY (2012: 75-76).

MATOS (2014: 103-104) gave only one record of *C. lubricella* (Coimbra, leg. P. Callapez, 1985). However, OLIVEIRA (2009a) had already reported it new to mainland Portugal from four locations: including two other localities in Coimbra, Buçaco (Beira Litoral) and Oliveira do Hospital, Avô (Beira Alta), along with detailed shell measurements and habitat notes. Our own records add a locality from 2008 at S. edge of Praia de Mira (Beira Litoral; 29TNE17) and additional collections from Buçaco in 2008 and 2013 (CGAH).

Family CHONDRINIDAE

***Chondrina lusitanica* (L. Pfeiffer, 1848)

KOKSHOORN & GITTENBERGER (2010) presented analyses of DNA sequence data implying this is a distinctive, taxonomically rather isolated species within this complex genus.

Granopupa granum (Draparnaud, 1801)

Family LAURIIDAE

Lauria cylindracea (Da Costa, 1778)

Leiostylia anglica (A. Férussac, 1821)

Family PYRAMIDULIDAE

Pyramidula jaenensis (Clessin, 1882)

The careful revision of Iberian *Pyramidula* using shell characters by MARTÍNEZ-ORTÍ, GÓMEZ-MOLINER & PRIETO (2007: 79) suggested that *Pyramidula*

rupestris (Draparnaud, 1801) was the widespread species in W. and S. Portugal with a tall shell and small umbilicus. Our own observations from 2007-2014 supported this impression. However, recent detailed molecular-phylogenetic studies (RAZKIN, GÓMEZ-MOLINER, ET AL., 2016; RAZKIN, SONET, ET AL., 2016) upset this by showing that the tall-shelled form in Portugal and throughout the western half of Spain is *P. jaenensis*, not *P. rupestris*. Although both are shown to be valid species from the molecular data, it has become clear that the distinctions between them based on shells can only be used to differentiate the populations with tallest adult shells as *P. jaenensis*, leaving the lower-shelled forms as indistinguishable.

Our data from 2007-2014 show this is the less common of the two species of *Pyramidula* in WC. Portugal (recorded from 6 hectads), but the only one we have found in the Algarve (3 hectads): Algarve (29SNB71, NB90, PB00), Estremadura (29SMC85, MC95, MD90, ND17, ND18), and Ribatejo (29SND37).

Pyramidula umbilicata (Montagu, 1803)

Pyramidula pusilla [Vallot, 1801] GITTENBERGER & BANK (1996: 74), was named and described with a neotype designated from France. They attributed the name to VALLOT (1801), but that work was contravening I.C.Z.N. Code Art. 8.1.1 and 8.1.2, so the name is unavailable. MARTÍNEZ-ORTÍ ET AL. (2007: 79) therefore treated valid publication of the name as dating from GITTENBERGER & BANK (1996).

WELTER-SCHULTES (on AnimalBase website; also 2012: 210, 659) agreed that VALLOT (1801) cannot be regarded as a published work, stating that it was an "Internal school script, printed for a selected audience, not issued for the purpose of providing a public and scientific record (Art. 8.1.1). [It] Was preserved in the Bibliothèque Municipale de Dijon for historical reasons and many years later in the 1850s discovered in the library. Not recognised as published work by GOFAS (2001: 1291), MARTÍNEZ-ORTÍ ET AL. (2007: 79) or REITANO, LIBERTO & SPARACIO (2007: 314)". The name *pusilla* from Vallot's work

was apparently not used for a valid taxon before 1960.

Although BANK (2011: 15, 16) and BANK & GITTENBERGER (2013) presented some additional information and arguments that the work by [Vallot, 1801] may have been published, including its presence in the public library of Lyon, as well as the copy at Dijon from which the latter paper figured small excerpts. Thus there was possible room for doubt about whether "Vallot's rare 1801 article" was indeed published in a manner that satisfied the I.C.Z.N. Code and that denying this was to "follow the same aberrant opinion of MARTÍNEZ-ORTÍ ET AL. (2007)".

A much fuller analysis of the 1801 work itself and of background information has since been presented by WELTER-SCHULTES & AUDIBERT (2013: 12-13). From this it is evident that the printed scripts involved were expressly issued for a single examination at a secondary school, which took place (translated): At 20-21 August 1801, at 4.00 p.m. in the practice room of the École Centrale in Dijon. The examinations involved just ten students, all of them named on the script, only six of whom were to be tested on the parts of the script dealing with zoology. This clear purpose for the scripts cannot meet the requirements of the I.C.Z.N. Code Art. 8, on "What constitutes published work." In particular, they do not satisfy "Art. 8.1.1. it must be issued for the purpose of providing a public and permanent scientific record", or "8.1.2. it must be obtainable, when first issued, free of charge or by purchase". The historical circumstances that are likely to have led to a few copies remaining in public libraries are adequately explained by WELTER-SCHULTES & AUDIBERT (2013), but the initial purpose of the scripts is decisive in them failing to satisfy Art. 8.1.1. The claim by BANK & GITTENBERGER (2013: 1) that it was not only printed "but definitely also sent to (at least) various public libraries" receives no support.

Pyramidula umbilicata and *P. pusilla* were regarded as separate species by GITTENBERGER & BANK (1996) and MARTÍNEZ-ORTÍ ET AL. (2007). However, extensive analyses of molecular data (RAZKIN,

GÓMEZ-MOLINER, *ET AL.*, 2016; RAZKIN, SONET, *ET AL.*, 2016) show they form a single clade and must therefore be regarded as conspecific. RAZKIN, GÓMEZ-MOLINER, *ET AL.* (2016: 13) stated that "According to GITTENBERGER & BANK (1996) *P. pusilla* (Vallot, 1801) is a valid name and has priority over *P. umbilicata* (Montagu, 1803)". However, as discussed above, MARTÍNEZ-ORTÍ *ET AL.* (2007: 79) had established that the first valid publication of *Pyramidula pusilla* was by Gittenberger & Bank, 1996 and the name can only compete for priority from that date. BANK (2011: 16) pointed out that there are several older names that are probably available for the same taxon as *P. pusilla* Gittenberger & Bank, 1996 (*Turbo myrmecidis* Scacchi, 1833; *Helix spirula* A. Vila & G.B. Vila, 1841; *Helix aliena* L. Pfeiffer, 1841; *Delomphalus saxatilis* W. Hartmann, 1842; *Helix rupestris* var. *pinii* Adami, 1886). Nonetheless, in view of the molecular data noted above they can all now be regarded as additional junior subjective synonyms of *Helix umbilicata* Montagu, 1803, so that name must be adopted.

Our data from 2007-2014 show this is the most common species of *Pyramidula* in WC. Portugal, with records from 13 hectads, in Beira Litoral (29SNE32, NE40, NE42, NE50, NE52; 29TNE43), Estremadura (29SMC69, MD93, ND07, ND08, ND17, ND27) and Ribatejo (29SND27) (CGAH). Living populations of this species and *P. jaenensis* were found within a few metres of each other at Fórnea (29SND17) in 2012. The predominance of the present species we have found in WC. Portugal contrasts with the data in MATOS (2014: 118-119), where *P. rupestris* (Draparnaud, 1801) is mapped as being much more common.

Family VALLONIIDAE

Acanthinula aculeata (O.F. Müller, 1774)

***Plagyrona angusta* D. Holyoak & G. Holyoak, 2012

Described by HOLYOAK & HOLYOAK (2012b: 155-159), TL Beira Litoral, by Rio de Mouros ca 1 km SE. of Condeixa-a-Velha. Range originally described as from

S. edge of Coimbra (Beira Litoral) southwards through W. Ribatejo and Estremadura to southern limit in Serra da Arrábida, overlapping widely with range of *P. placida* and sometimes coexisting with it. HOLYOAK *ET AL.* (2014: 45) extended the range to include the Algarve (near Fonte de Benémola, 29SNB81).

Plagyrona placida (Shuttleworth, 1852)

Separation of *P. angusta* by HOLYOAK & HOLYOAK (2012b) necessitates reassessment of the Portuguese range of *P. placida* s. s., which is known from Beira Litoral (near Coimbra) southwards to the N. part of Estremadura. MATOS (2014: 112) showed a wider range in mainland Portugal for *P. placida* s. l., with records north to 29TNF38 and inland in N. Alentejo (29SNC63), but the data mapped seem questionable since her fig. 84 shows an immature of a Geomitridae sp., probably *Xeroplexa*, while the text noted "Semelhante a *Punctum pygmaeum*" which it is not. Correctly identified photographs of shells of both *Plagyrona* species were given by CADEVALL & OROZCO (2016: 166-167).

Spermodea lamellata (Jeffreys, 1830)

Vallonia costata (O.F. Müller, 1774)

Vallonia pulchella (O.F. Müller, 1774)

Family VERTIGINIDAE

Columella aspera Waldén, 1966

All of the authors' records of the genus in mainland Portugal (from Beira Baixa, Beira Litoral, Douro Litoral, Estremadura, Ribatejo) are of this species and *C. edentula* s. s. is apparently unknown here and in adjoining provinces of Spain. Thus, records of *Columella edentula* agg. from Portugal from before 1966 (including Faro, Algarve, *vide* Castro) are almost certainly referable to *C. aspera*.

**Truncatellina beckmanni* Quintana Cardona, 2010

Originally described as an endemic from Menorca (QUINTANA CARDONA,

2010), but shells of some populations from Portugal are identical (HOLYOAK, HOLYOAK & TORRES ALBA, 2012). The species is now known from limestone districts of Beira Litoral, Ribatejo, Estremadura and Algarve and in S. Spain (Prov. Córdoba, Prov. Málaga).

Truncatellina callicratis (Scacchi, 1833)

HOLYOAK ET AL. (2012) reviewed records of the genus from mainland Portugal and Spain and found this to be much the commonest species. Populations with shells lacking apertural teeth predominate in the Algarve and S. Spain, whereas most (not all) of the populations further north develop up to three teeth. The forms without teeth have usually been misidentified as *T. cylindrica* (A. Férussac, 1807), for which there are no reliable Iberian records.

Vertigo antiwertigo (Draparnaud, 1801)

MATOS (2014: 134) described this as “Muito rara. Só foram encontrados registos antigos e não há espécimes em coleção”. GAH found two strong populations living in Beira Litoral in 2011 and 2013, at a small fen area near Lagoa de Mira (29TNE27) and on a bank bordering the R. Mondego W. of Ereira (29TNE24) where leaking water created an artificial flush with marsh vegetation.

Vertigo pygmaea (Draparnaud, 1801)

Described by MATOS (2014: 133) as “Muito rara”, but it appears to have been overlooked, with fieldwork in west-central Portugal producing three living populations since 2010 in Beira Litoral (ca 2 km W. of Verride, 29TNE24; by R. Mondego ca 3 km W. of Ereira, 29TNE24; near Lagoa de Mira, 29TNE27; all in CGAH) and five in Estremadura (Cantanhede, 29TNE45; Porto de Mós, 29SND18; Azambuja, 29SND04: A-dos-Cunhados, Torres Vedras, 29SMD73; Maceira, Torres Vedras, 29SMD63; all in CRM).

Family ENIDAE

Merdigera obscura (O.F. Müller, 1774)

Family CLAUSILIIDAE

Balea perversa (Linnaeus, 1758)

BOESVELD, MAASSEN & GITTEMBERGER (2005) and GITTEMBERGER, PREECE & RIPKEN (2006) established that the widespread European species previously known as *B. perversa* comprises two rather similar species. The latter publication designated a neotype for *B. perversa* s. s. (GITTEMBERGER ET AL., 2006: 146) and treated the second species as *B. heydeni* Maltzan, 1881.

MARTÍNEZ-ORTÍ (2006) revised specimens from Spain and referred all records from Galicia to *B. heydeni*; a single record from Portugal (Coimbra) was placed as *B. perversa* s. s., whereas *B. heydeni* had two records, from its TL at Cintra (= Sintra) and from Coimbra.

Our own records of *Balea* have almost all been identified as *B. heydeni*, showing it is locally common in western mainland Portugal, with a single new find of *B. perversa* s. s. at Castle of Trancoso (HOLYOAK ET AL., 2014: 46). MATOS (2014: 143, Mapa 74) showed *B. perversa* as much the commonest of the two species. Although her figures of *B. perversa* from three localities appear to be correctly identified as *B. perversa* s. s. (MATOS, 2014: 145, fig. 107) and *B. heydeni* (fig. 108), there can be little doubt that a majority of the old records on Mapa 74 represent *B. perversa* s. l. from literature reports among which *B. heydeni* was surely the more common species.

Balea heydeni Maltzan, 1881

When GITTEMBERGER ET AL. (2006) recognised a second European species allied to *B. perversa*, they proposed that its correct name is *Balea heydeni* Maltzan, 1881. GITTEMBERGER (2010) designated a specimen of *B. perversa* s. s. as neotype for *Balea lucifuga* J.E. Gray, 1824 in order to secure the status of the latter name as a junior synonym of *B. perversa* Linnaeus, 1758, and thus avoid the possibility of it being interpreted as an older name which could compete for priority with *B. heydeni*. From this, it follows that *Balia lucifuga* Bourguignat, 1857 (TL

Scarborough, England), even though it intentionally referred to a different species, is a junior homonym and cannot be a valid name.

WELTER-SCHULTES (2012: 347, and on AnimalBase website) argued that the designation of a neotype by GITENBERGER (2010) was ineffective, because *B. lucifuga* J.E. Gray, 1824 was unavailable since it was published only as a *nomen nudum* in synonymy (contrary to I.C.Z.N. Code Art. 11.6, and Art. 11.6.1 did not apply). Consequently, *Balia lucifuga* Bourguignat, 1857 would remain as an available name. This interpretation was disputed by BANK (2011: 18) who argued that the neotype designation is valid. It also appears uncertain whether Bourguignat's name refers to the same species as *B. heydeni* Maltzan, 1881, and hence whether it could replace it as a senior synonym. Indeed, DANCE (1970) has documented the notoriety achieved by Bourguignat because he named many new species based on very slight morphological differences. No separate neotype has been designated for *B. lucifuga* Bourguignat, 1857 and none of the recent literature adopts it as a valid species name in preference to *B. heydeni*.

PROSCHWITZ (2010) advocated that the previously overlooked name *Balea sarsii* Philippi, 1847 was a senior syn. that should replace *B. heydeni* Maltzan, 1881. "*Balea Sarsii* Phil." was introduced in a paper by PFEIFFER (1847: 84), with data "Patria: Norvegia. Misit Cl. Sars", accompanying a short Latin description adequate to confirm the generic allocation, but insufficient on its own to allow distinction of *B. heydeni* from *B. perversa* s. s. It was the last of ten similar species descriptions in this short paper, which although all written in the same style, was the only one attributed to an author other than L. Pfeiffer. However, the "Inhalt" of the published volume confirms that L. Pfeiffer was the author of all ten descriptions and this has been accepted e.g. by BANK (2011: 18), WELTER-SCHULTES (2012: 347) and WELTER-SCHULTES & AUDIBERT (2013: 17). L.

Pfeiffer's collection was destroyed during the Second World War, so the type specimen of *B. sarsii* is no longer available, and hence it is impossible to check its identification.

PROSCHWITZ (2010: 17) located two samples in Scandinavian museums of Norwegian *Balea* resembling *B. heydeni* that he regarded as *B. sarsii* collected in the nineteenth century by M. Sars: 8 shells at NHMO from Sogn og Fjordane County, Flora municipality, Fløro, close to the sea, and 2 shells at NR from Hordaland County, Bergen. Proschwitz described the Fløro locality as the "*Locus typicus*" of *B. sarsii*, but no evidence was presented to show that this was the provenance of the specimen described by Pfeiffer (and WELTER-SCHULTES & AUDIBERT, 2013: 17, noted this was a "presumed type locality"). Furthermore, Proschwitz adds that at Fløro "*B. sarsii* co-occurred with *B. perversa*", and indeed *B. perversa* s. s. appears to be much the commoner of the two species in Norway as elsewhere in Scandinavia. It is therefore clear that he merely assumed that *B. sarsii* as described by Pfeiffer represented the *B. heydeni* rather than the *B. perversa* s. s. remaining among Sars' material from Fløro housed in NHMO. The fundamental doubt about whether *B. sarsii* was the same species as *B. heydeni* therefore remains and *B. sarsii* should be regarded as a *nomen dubium*, since it will remain unidentifiable in the absence of a neotype designation.

Despite these uncertainties about the identity of *B. sarsii*, it has been used as an earlier name for *B. heydeni* by some recent authors (WELTER-SCHULTES, 2012: 347, and on the AnimalBase website; WELTER-SCHULTES & AUDIBERT, 2013: 17; NAGGS *ET AL.*, 2014), although its adoption was opposed e.g. by BANK (2011: 18). Otherwise, since the name *B. heydeni* has remained much more widely used than *B. sarsii*, it would serve to stabilize nomenclature by favouring *B. heydeni*, achievable by designating a specimen of *B. perversa* s. s. from the Sars material in NHMO collected at Fløro as a neotype for *B. sarsii*.

Clausilia bidentata (Strøm, 1765)

GARGOMINY *ET AL.* (2011) spelled the author's name as Strøm rather than Ström in accordance with the original publication.

HOLYOAK & SEDDON (1988: 63) made an extensive quantitative study of shell variation from throughout most of the range of the species, concluding "Differences of shell form may make it desirable to separate the rather distinctive *crenulata* (from French Dept. Alpes-Maritimes) as a subspecies of *C. bidentata*, but other southern forms approach *crenulata* and further division into subspecies (e.g. in the Pyrenees) is undesirable because intraspecific variation is largely transitional and clinal. A further reason for avoiding recognition of numerous subspecies of *C. bidentata* is that altitudinal variation closely mimics latitudinal variation so that many specimens would be hard to assign to narrowly defined subspecies." NORDSIECK (1990: 157-159, in a publication apparently delayed from 1988) recognised four subspecies in *C. bidentata*, two of which were listed for Portugal: *C. b. abietina* Dupuy, 1849 which was listed as extending from Brittany to N. Portugal and *C. b. moniziana* Lowe, 1852 endemic to Portugal ("Beira, Estremadura"). His brief diagnoses and figures indicate that *moniziana* differs from *abietina* in having a more cylindrical spire and wider spaced ribbing on the body whorl. However, in these respects *moniziana* appears to be the end point of an often irregular cline (cf. HOLYOAK & SEDDON, 1988: 59-61); NORDSIECK (1990: 159) himself noted that the populations of *moniziana* in the Beiras "leiten offenbar bereits zu *abietina* über, die die weiter nördlichen gelegenen Regionen besiedelt". GITTENBERGER & RIPKEN (1998) also treated *moniziana* as a subspecies; FALKNER *ET AL.* (2001) treated *crenulata* and *abietina* as subspecies. NORDSIECK (2007: 60) reproduced the list of subspecies from his 1990 paper. Our recent unpublished observations suggest that classifying Portuguese specimens into two ssp. is often arbitrary as intermediates are common.

Macrogastra rolphii (Turton, 1826) (**)
ssp. *portensis* (Luso da Silva, 1871)

MATOS (2004: 101) pointed out that the name *Clausilia portensis* Luso da Silva was published in December 1871 (SILVA, 1871b: 260-261), not 1872 as cited by many subsequent authors.

NOBRE (1913: 248-249, 1930: 145, 1941: 159) noted that he saw original material of *C. portensis* collected by Luso da Silva in the Museu Bocage. He misidentified this as *Clausilia plicata* (Draparnaud, 1801), which is treated as *Laciniaria plicata* (Draparnaud, 1801) in recent literature, but his figures clearly show he did not have the latter species to hand. GITTENBERGER & RIPKEN (1998) corrected the misidentification.

GITTENBERGER & RIPKEN (1998) placed *portensis* as a species of *Macrogastra* (*Pseudovestia*), mentioning (p. 184) that it is most similar to *M. (P.) rolphii*, "Probably they are allopatric sister species. The two taxa could even be classified as conspecific subspecies." MATOS (2014: 138-139) maintained *M. portensis* at species rank. However, these authors apparently overlooked the fact that populations of *M. rolphii* in SW. France and N. Spain mainly consist of more slender shells than those from northern parts of the species' range, with closer ribbing and slightly different characters of the aperture, differences that led NORDSIECK (2006: 56; 2007: 60) to separate them as *M. r. digonostoma* Bourguignat, 1877. Hence, *portensis* with the most slender shell and close ribbing can be regarded as the end point of an irregular cline of character variation extending from N. France to N. Portugal. We therefore follow NORDSIECK (2006: 56), who placed *portensis* as a third subspecies of *M. rolphii*, mostly resembling *M. r. digonostoma*, but differing in being more densely ribbed and having the subcolumellar lamella emerging.

WALDÉN (1976: 25) noted that *Clausilia Rolphii* "Leach" TURTON, 1826 (pp. 565-566) is earlier than the oldest reference which was considered (1831) for name no. 403 in the *Official List of Names in Zoology*. BANK (2011: 18) esta-

blished that under I.C.Z.N. Code Art. 80.6.4 the normal application of the Code decides the relative precedence if a name entered in an Official List is thought to be a synonym of another available name. Hence he regarded *Clausilia rolpheii* Turton, 1831 as a synonym of *C. rolpheii* Turton, 1826, and so publication of the species name is assigned to the earlier date. WELTER-SCHULTES & AUDIBERT (2013: 16) accept the principle and result of these arguments, but point out that the 1831 reference was merely a subsequent mention of the same name, not a new name which could be classified as a synonym.

Family FERUSSACIIDAE

Cecilioides has been placed in the Ferussaciidae in recent literature (e.g. BANK *ET AL.*, 2001) but a molecular-phylogenetic study by FONTANILLA, NAGGS & WADE (2017) reveals *Cecilioides gokweanus* (O. Boettger, 1870) forming a clade among Subulinidae, Coelioxidae and Thyrophorellidae, widely separated from *Ferussacia*. Hence, it is likely that in future *Cecilioides* will be placed in a separate family.

Cecilioides acicula (O.F. Müller, 1774)

See HOLYOAK & HOLYOAK (2015) for a review of material from mainland Portugal with discussion of identification characters and new distributional records.

Mapa 76 published by MATOS (2014: 146-147) gives ten hectad records from the S. Algarve that are likely to include misidentifications of the endemic Algarve species of the genus. Her fig. 109 labelled as *C. acicula* shows three shells of *C. clessini* from Faro; fig. 110 and fig. 111 also show *C. clessini* from Faro, although labelled respectively as *Caecilianella liesvillei* Bourguignat and *Caecilianella nanodea* Bourguignat.

***Cecilioides barbozae* (Maltzan, 1886)

A distinctive endemic species from the Algarve that is missing from the book by MATOS (2014). See HOLYOAK & HOLYOAK (2015) for a review of its identification characters, figures of shells

and genital anatomy and new distributional records. That study recognises subgenus *Terebrella* Maltzan, 1886 for *C. barbozae* and *C. clessini* (type species), distinct from subgenus *Cecilioides* in the much greater development of shell apertural teeth and features of the distal genital anatomy.

***Cecilioides clessini* (Maltzan, 1886)

This is the larger of the two endemic *Cecilioides* species from the Algarve. See HOLYOAK & HOLYOAK (2015) for a review of its identification characters, figures of shells and genital anatomy and new distributional records. *Cecilioides (Terebrella) binodosa* (Maltzan, 1886) was regarded as a synonym.

CADEVALL & OROZCO (2016: 291) stated the type locality incorrectly as “Portimao y Tavira”: it was restricted to “Portimao” (i.e. Portimão, Algarve) through designation of a lectotype (SMF 157223) by HOLYOAK & HOLYOAK (2015: 36).

Although described as “Muito rara” by MATOS (2014: 148), our impression was that it was rather easy to find for a *Cecilioides* species when the ground was moist in winter. Our three short visits to the Algarve in different years produced totals of 200 shells and 32 living specimens from 10 localities (in CGAH), mainly by lifting large limestone boulders lying on soil substrata. *C. clessini* was found to coexist with *C. barbozae* at seven of the localities.

Ferussacia folliculum (Schröter, 1784)

Until recently known as *F. folliculus* or *F. follicula*, but *F. folliculum* is correct. WELTER-SCHULTES (2012: 111 & The ANIMALBASE website, accessed 9 Dec. 2012) gave the following information: Often attributed as *Ferussacia folliculus* either to Gronovius (who never published binominal names) or to GMELIN (1791, who spelled it *folliculus* and gave a reference to the same figure in Gronovius 1781 as did SCHRÖTER, 1784). SCHRÖTER (1784) spelled the name *folliculum*; this spelling is older than Gmelin’s 1791 spelling *folliculus* and takes precedence. The spellings *folliculus* and *follicula* are therefore incorrect subsequent spellings.

Family RUMINIDAE

The genus *Rumina* Risso, 1826 was placed in Subulinidae subfamily Rumininae Wenz, 1923 by CLECOM and is currently regarded as part of the Achatinidae on the MolluscaBase website. However, results of a molecular-phylogenetic study by FONTANILLA *ET AL.* (2017) imply that the Subulinidae as currently known is polyphyletic, with the Rumininae as one of several groups that apparently need to be treated as separate families. Hence we recognise Ruminidae at family rank.

Rumina decollata (Linnaeus, 1758)

SELANDER & KAUFMAN (1973) and SELANDER, KAUFMAN & RALIN (1974) reported facultative self-fertilisation in *R. decollata*, but some cross-fertilisation also occurs (BATTS, 1957; DUNDEE, 1986); CARR (2002: 571) recorded nocturnal mating on Minorca and WELTER-SCHULTES (2012: 201) refers to observations of copulation in spring.

R. decollata is regarded in most recent literature as a rather variable species that is widespread in the W. Mediterranean region (Iberian Pen., S. France, Italy, E. Adriatic coast, N. Africa) and also established as an introduction in N. America. *R. saharica* Pallary, 1901 has been separated since 1993 on the basis of its narrower, subcylindrical shell with flatter whorls (e.g. CARR, 2002; PRÉVOT *ET AL.*, 2013; WELTER-SCHULTES, 2012: 202); it has a mainly E. Mediterranean and N. African range, with no reports from mainland Portugal.

However, recent detailed molecular studies by PRÉVOT *ET AL.* (2013), imply up to six cryptic species may exist within *R. decollata* (with *R. saharica* as a seventh). Nevertheless, the exact number of species recovered depended on the analytical method used, leading the authors to comment that “as such one may wonder to what extent species delimitation methods are really useful”. These entities (MOTU) show larger genetic differences than would be expected in fixed polymorphisms due to sustained selfing, so they apparently

represent evolutionarily diverging taxonomic units. Since most of them are not known to show any morphological differences they can be regarded as cryptic species. Of the six clades involved, only Clade A was detected in mainland Portugal (with several samples analysed from localities in S. Algarve; one from WC. Portugal). Elsewhere, they recorded Clade A from N. and S. Spain, S. France, Tunisia and Malta (PRÉVOT *ET AL.*, 2013: 16, fig. 5).

Several of the cryptic species recognised by PRÉVOT *ET AL.* (2013) apparently lack names and it may serve little purpose to give binomials to those that show no morphological differences. It is also uncertain at present which clade (MOTU) should be known as *R. decollata* (Linnaeus, 1758) since the TL of this was given as “Europa australi, Oriente” and it is unlikely that the existing type specimens consisting only of dry shells (at LSL and UUZM) will allow more precise identification of the cryptic species, which are not known to differ conchologically.

Family TESTACELLIDAE

Testacella maugei A. Férussac, 1819

Family DISCIDAE

Discus rotundatus (O.F. Müller, 1774)

Family HELICODISCIDAE

‡*Lucilla singleyana* (Pilsbry, 1889)

First reported from mainland Portugal by TORRES & OLIVEIRA (2010), based on five shells from amongst dead leaves at base of rocks by the access road to Castelo dos Mouros, Sintra, Estremadura (29SMC6693), collected in 2009. HOLYOAK *ET AL.* (2014: 46) give two additional records: (a) two shells from floodline debris of stream, WNW. of Ansião, Beira Litoral (29SNE41), in 2010; (b) one shell from scree on limestone slope, W. of Querença, Algarve (29SNB81), in 2014.

Zonites singleyanus Pilsbry, 1889 was published on May 14th 1889 in *Proceed-*

ings of the Academy of Natural Sciences of Philadelphia, for 1889, vol. 41, p. 84 (of paper on pp. 81-89) (as reported also by BANK, 2011: 19; WELTER-SCHULTES & AUDIBERT, 2013: 18). The publication date was May 14th 1889 according to [p. 6] of the journal volume, on the page behind the title page. The date of 1890 often cited is therefore incorrect.

WALDÉN (1983: 268) argued that the name *Helix scintilla* R.T. Lowe, 1852 is a senior synonym of *Zonites singleyanus* Pilsbry, 1890 [= 1889]; he invoked art. 23b of the I.C.Z.N. Code [1964 ed.] to preserve the latter name, but in error as that article was only in force until 1 January 1973 [see 1985 ed. of Code, art. 79(c) (iii)]. However, BANK *ET AL.* (2002: 110) and GARGOMINY *ET AL.* (2011: 330) recognised both *L. scintilla* and *L. singleyana* as distinct species.

The form *inermis* (based on *Helicodiscus* (*Hebetodiscus*) *singleyanus inermis* H. B. Baker, 1929, which has a smaller, higher shell with only weak traces of spiral lines) has usually been treated as a subspecies; indeed, PILSBRY (1948: 636) commented that they “are so similar that their separation is most difficult”; WALDÉN (1983: 268) stated it was his opinion that *inermis* is a distinct species, but he gave no justification for this.

Family PUNCTIDAE

Paraolaoma servilis (Shuttleworth, 1852)

P. servilis (Shuttleworth, 1852) must remain the valid name of the species. Rejection of *Helix pusilla* [Vallot, 1881] herein as based on an unpublished work still leaves the name formerly adopted for the species, *Helix pusilla* R.T. Lowe, 1831, preoccupied by *Helix pusilla* Fleming, 1828 (*A history of British animals ...*, p. 265, a fossil from “Clay Ironstone, Derby-shire”). I.C.Z.N. Art. 23.9 (Reversal of precedence) cannot be invoked in this instance because, although Art. 23.9.1.1 is satisfied allowing *H. pusilla* Fleming, 1828 to become a *nomen oblitum*, Art. 23.9.1.2 would require 25 published works by ten or more authors in the past 50 years to have adopted *H. pusilla* R.T. Lowe, 1831 as the valid

species name and that condition was not satisfied.

Punctum pygmaeum (Draparnaud, 1801)

Family EUCONULIDAE

Euconulus alderi (J.E. Gray, 1840)

Recorded new to Portugal from Beira Litoral in HOLYOAK *ET AL.* (2014), in fen at edge of *Salix* carr, beside Lagoa de Mira (29TNE27), on 3 May 2011, CGAH.P145, with more collected there later in 2011 as sample P219. It was noted that the living snails had the head and body almost black dorsally, their sides blackish-grey. Identification as this species was based on the account by KERNEY & CAMERON (1979: 148-149), with the shell characters and body coloration resembling those of this common species of wet habitats in Great Britain. FALKNER *ET AL.* (2001: 47; 2002: 120-121) recognised three additional species of *Euconulus* in W. Europe, but the fuller study they promised remains unpublished. FALKNER *ET AL.* (2002: 121) treated the strongly hygrophilous taxon with almost black body coloration resembling our material from Lagoa de Mira as *E. praticola* (Reinhardt, 1883). This was based on the argument that *Helix fulva* var. 2 *alderi* is a subjective junior synonym of *E. trochiformis* (Montagu, 1803), but as noted in the ANIMALBASE website, this view was not based on a sound and published scientific study, and was not accepted by many subsequent authors (although adopted by CADEVALL & OROZCO, 2016: 309).

Euconulus fulvus (O.F. Müller, 1774)

The genus *Euconulus* was apparently under-recorded in mainland Portugal in the past, with MATOS (2014: 162, Mapa 86) showing only 4 modern and 10 older hectad records. Since 2009, the authors' records are from 30 hectads. 28 of the 30 hectad records were assigned to *E. fulvus* s. s., the other 2 being assigned only to *E. fulvus* s. l. (i.e. not excluding possibility of *E. alderi*). All of the old records from mainland Portugal should be at-

tributed to *E. fulvus* s. l. unless specimens can be critically reinvestigated. Living animals of *E. fulvus* s. s. are readily identified by the light grey to grey dorsal body coloration, compared to the darker coloration of *E. alderi*. Separation of shells is possible (see KERNEY & CAMERON, 1979: 148-149; CADEVALL & OROZCO, 2016: 308-309) but more difficult.

Family GASTRODONTIDAE

Zonitoides nitidus (O.F. Müller, 1774)

A widespread hygrophilous species over much of Iberia that we have collected repeatedly in mainland Portugal. Our records from 2009 onwards are from hectads in Alto Alentejo (29SND97), Beira Baixa (29SPE20), Beira Litoral (29SNE41, 29TNE17, 29TNE27, 29TNE44), Estremadura (29SMC68, 29SMD73, 29SMD82, 29SND04) and Ribatejo (29SND56), with voucher specimens in CGAH or CRM from nine locations. The species is missing from the works by NOBRE (1941) and MATOS

(2014), although the latter book figures misidentified shells of it (p. 161 fig. 125, as *Zonitoides excavatus*; p. 134 fig. 134, as *Aegopinella nitidula*).

‡*Zonitoides arboreus* (Say, 1816)

Recorded new to mainland Portugal by HOLYOAK ET AL. (2014: 46-47), from Estremadura, in Jardins de Alcabrichel at A-dos-Cunhados, Torres Vedras (29SMD73), where well established in 2013 and 2014 in a flower bed and beneath a planted hedge. Subsequently found in July 2018 in Minho at Caminha (29TNG13; in CRM).

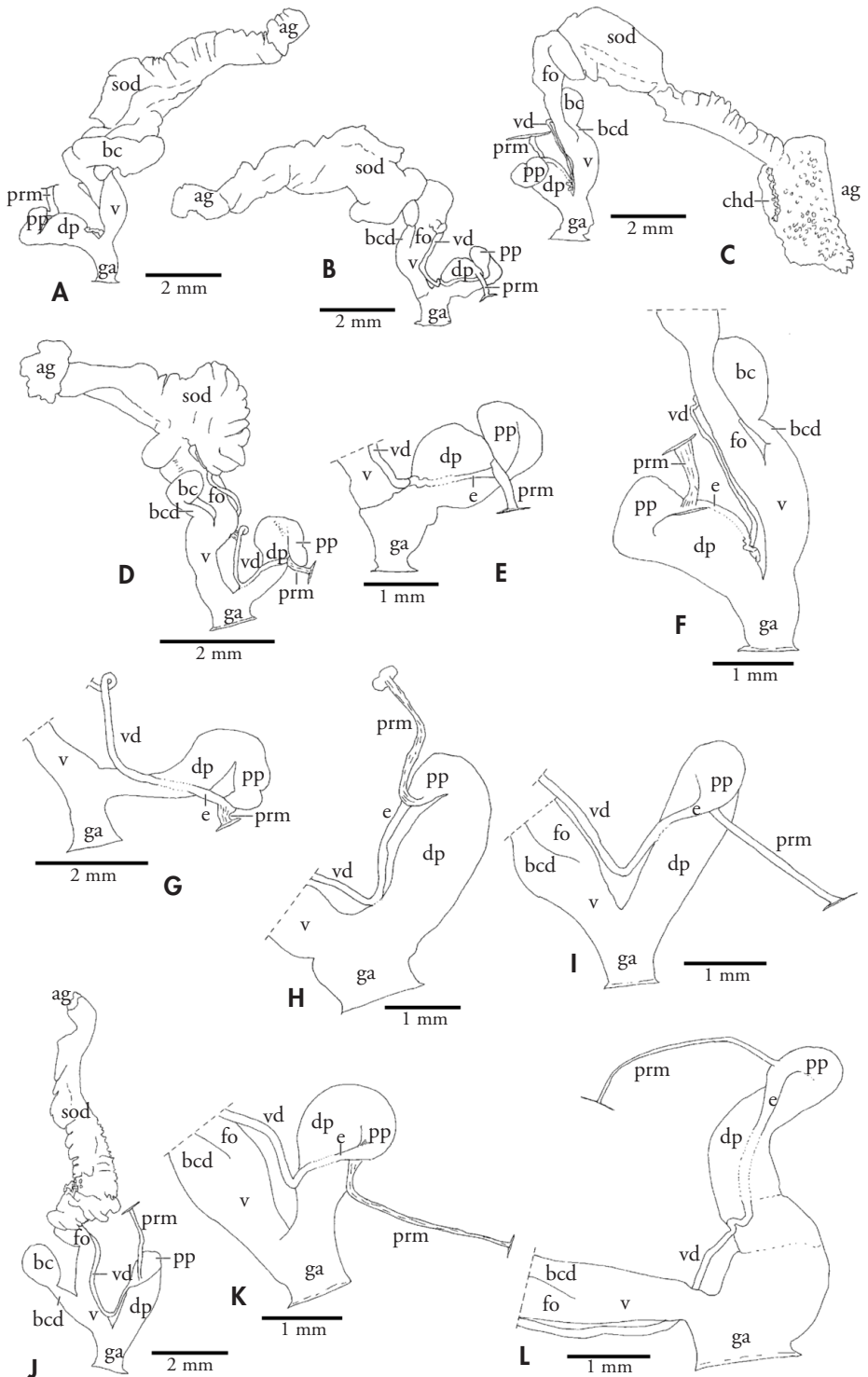
Family OXYCHILIDAE

Aegopinella epipedostoma (Fagot, 1879) (Fig. 1 A-G)

Reported new to Portugal here, on the basis of collections from five localities (in CGAH): (i) Beira Litoral, W. of Prazo de Santa Marinha (NE. of Cabo Mondego), 29T 05098/44495 (hectad 29TNE04), in mature and young *Eucalyptus* plantations with low limestone rocks locally, 251 m

(Right page) Figure 1. Genital anatomy of *Aegopinella epipedostoma* and *A. nitidula* from Iberian Peninsula. A-G: *A. epipedostoma* (A-C, E, F: Portugal, Estremadura, São Martinho, Sintra, leg. RM, 29 Mar. 2014; A, B and E show different views of same individual; C and F different views of second individual; D, G: Spain, Prov. Guipúzcoa, E. of Madariaga (NW. of Azkoitia), leg. GAH & DTH site E148, 8 May 2011, two views of same individual); H-L: *A. nitidula* s. s. (Portugal, Estremadura; H-K, ca 0.5 km W. of Alpedriz, leg. GAH & DTH site P351A, 5 Mar. 2014, I and J show different views of same individual, H and K show two other individuals; L: by Fonte Santa (NE. of Castanheira), leg. GAH & DTH site P422, 9 May 2015). See text for additional details of localities. Abbreviations, ag: albumen gland; bc: bursa copulatrix; bcd: bursa copulatrix duct; chd: common hermaphrodite duct; dp: distal part of penis; e: epiphallus; fo: free oviduct; ga: genital atrium; pp: proximal part of penis; prm: penis retractor muscle; sod: spermoviduct; v: vagina; vd: vas deferens. All specimens figured are in CGAH.

(Página derecha) Figura 1. Anatomía genital de *Aegopinella epipedostoma* y *A. nitidula* de la Península Ibérica. A-G: *A. epipedostoma* (A-C, E, F: Portugal, Estremadura, São Martinho, Sintra, leg. RM, 29 de marzo de 2014; A, B y E muestran diferentes vistas del mismo ejemplar; C y F diferentes puntos de vista del segundo ejemplar); D, G: España, Prov. Guipúzcoa, E. de Madariaga (Noroeste de Azkoitia), leg. GAH & DTH sitio E148, 8 de mayo de 2011, dos vistas del mismo ejemplar); H-L: *A. nitidula* s. s. (Portugal, Estremadura; H-K, ca 0.5 km Oeste de Alpedriz, leg. GAH & DTH sitio P351A, 5 de marzo de 2014, I y J muestran diferentes vistas de un mismo ejemplar, H y K muestran otros dos ejemplares; L: cerca de Fonte Santa (Nordeste de Castanheira), leg. GAH & DTH sitio P422, 9 de mayo de 2015). Ver texto para detalles adicionales de las localidades. Abreviaturas, ag: glándula de la albúmina; bc: bolsa copulatrix; bcd: conducto de la bolsa copulatrix; chd: conducto hermafrodita común; dp: parte distal del pene; e: epifalo; fo: oviducto libre; ga: atrio genital; pp: parte proximal del pene; prm: músculo retractor del pene; sod: espermioviducto; v: vagina; vd: vaso deferente. Todos los especímenes figurados están en CGAH.



alt., leg. GAH & DTH site P267, 30 Dec. 2012, 2 adults dissected; (ii) Beira Litoral, Buçaco (ca 1.5 km SE. of Luso), 29T 05539/44697 (29TNE56), leg. GAH & DTH site P316, 13 May 2013, estate woodlands and grounds, mortared walls, ca 393 m alt.; (iii) Estremadura, Usseira, Santa Maria, Óbidos, 29SMD 86166/55366 (29SMD85), on soil and under stones, ca 81 m alt., leg. RM, 22 Feb. 2014, 3 adults dissected; (iv) Estremadura, near Sintra, 29S 04655/42936 (29SMC69), leg. GAH & DTH site P248, 17 July 2012, mature *Eucalyptus globulus* plantation with *Acer*, *Laurus*, old walls and granitic rocks, 354 m alt.; (v) Estremadura, Estrada da Pena, São Martinho, Sintra, 29SMC 65531/93723 (29SMC69), leg. RM, 29 Mar. 2014, vivo em manta morta.

The revision of *Aegopinella* by FORCART (1959) provided the first detailed analysis of the differences between *A. epipedostoma* and *A. nitidula*. He pointed out that the main difference between them is in the anatomy of the penis, with *A. epipedostoma* having the portion adjoining the epiphallus to which the penial retractor muscle is attached (termed distal by Forcart, but here regarded as proximal because nearer the gonad) longer in proportion to the other part (distal part in our terminology). His figures (FORCART, 1959: p. 18 figs 3-5 cf. p. 23 figs. 6-8) show a sharper bend between the two portions of the penis in *A. epipedostoma* than in *A. nitidula*. They also show without any comment in the text that the penial retractor muscle is short and wide in *A. epipedostoma* but longer, and more slender in *A. nitidula*, which is evident also in our material. GITTENBERGER (1993c: 334) designated a neotype for *A. nitidula* and figured its genitalia as showing characters corresponding to those described by Forcart. Fig. 1 shows the genital anatomy of representative mature specimens we have studied from Portugal, which clearly fall into two groups on the basis of the relative development of proximal and distal parts of the penis as well as the character of the penial retractor muscle. The position of insertion of the retractor muscle is not clearly different in the Portuguese samples, although its greater

width in *A. epipedostoma* often makes it unclear whether the insertion is on the proximal end of the proximal penis (as in Fig. 1L of *A. nitidula*) or on the adjoining end of the epiphallus (as in Figs 1F, G) of *A. epipedostoma*.

A. epipedostoma is a rather surprising addition to the Portuguese fauna, hitherto reported no nearer than S. France (Pyrenees) and NE. Spain (RIEDEL & VILELLA, 1968). However, we have another unpublished record, from NW Spain: 8 May 2011, E. of Madariaga (NW of Azkoitia), Prov. Guipúzkoa, 30T 05560/47840, on N.-facing slope with few limestone crags, under mature *Fagus* woodland, 650 m alt., leg. GAH & DTH site E148, CGAH (two fully mature shells with bodies in ims); see Fig. 1D, G for the genital anatomy. Its range elsewhere apparently shows large gaps, with records in W. Germany, Carpathians, isolated localities in NW Russia, S. Slovenia and N. Croatia (FORCART, 1959: 18, 21; SYSOEV & SCHILEYKO, 2009: 120). RIEDEL (1980: 65) recognised two subspecies with the nominate form in the Pyrenees and *A. e. iuncta* Hudec, 1964 in C. Europe. KUŹNIK-KOWALSKA (2006: 71) and KUŹNIK-KOWALSKA, POKRYSZKO & PROĆKÓW (2012: 115) pointed out that the status of the two subspecies and their distribution require more detailed studies.

Aegopinella nitidula (Draparnaud, 1805) (Fig. 1 H-L)

Discovery of *A. epipedostoma* in Portugal necessitates revision of all older records of *A. nitidula*. Study of the distal genitalia is necessary for reliable species identification since the shell characters are not diagnostic, although mature *A. epipedostoma* tend to have a wider body-whorl and proportionately larger umbilicus than in *A. nitidula* (FORCART, 1959: pl. 2 figs 3, 4; CADEVALL & OROZCO, 2016: 330).

A. nitidula s. l. has a wide range in mainland Portugal and is relatively common in many northern and central regions. The distribution map in MATOS (2014: 170, mapa 90) presumably includes errors since *Zonitoides nitidus*

was not recognised (see above). Our own records of *A. nitidula s. l.* are from Beira Alta, Beira Baixa, Beira Litoral, Estremadura, Ribatejo and Trás-os-Montes e Alto Douro, with none from areas we have searched in Alto Alentejo, Baixo Alentejo or Algarve. However, no focussed effort has been made by us to look for the genus in southern Portugal.

We have begun to establish the range of *A. nitidula s. s.* on the basis of dissected material, i.e. excluding *A. epipedostoma* which appears from the scarce data available to be more widespread in Portugal. The confirmed records of *A. nitidula s. s.* are only from two adjacent localities in Estremadura (both in hectad 29SND08, specimens in CGAH): (i) ca 0.5 km W. of Alpedriz, 29S 05035/43864, leg. GAH, DTH & RM, 9 Nov. 2013 (site P344), 5 Mar. 2014 (P351A), 9 May 2015 (P423B), limestone rocks and slopes, wooded banks, ca 35-45 m alt.; (ii) by Fonte de Santa (NE. of Castanheira), 29S 05062/43837, leg. GAH & DTH site P422, 9 May 2015, deciduous woodland (with some pines) and scrub, low on slopes of small limestone valley, ca 85 m alt.

Aegopinella pura (Alder, 1830)

The species was omitted from the book by MATOS (2014), although OLIVEIRA (2008a: 43) published two records from Douro Litoral, from Gaia (NF2947) and Porto, in Cemitério do Prado do Repouso (NF3454).

The record of *Hyalinia callarobdata* given for Famalicao by Locard (1899) might be referable to this species, but ALTONAGA (1992: 23) suggested immature shells of *A. nitidula* may have been involved.

A. pura was listed for Sintra by PALAZZI (1988: 17), with comment that it was “possibly mistaken with *Vitrea crystallina*”. Since no *Vitrea* spp. are in his list and *V. crystallina* is unknown in Portugal an error for *V. contracta* seems likely.

Mediterranea hydatina (Rossmässler, 1838)

HOLYOAK *ET AL.* (2014: 47) give recent records from Alto Alentejo, Baixo

Alentejo and Estremadura additional to those mapped by MATOS (2014: 168).

Morlina glabra (Rossmässler, 1835)

This species was omitted from the book by MATOS (2014), despite it being published new to Portugal by OLIVEIRA & ALTONAGA (2009). Their report as *Oxychilus (Morlina) glaber* was from near Belver, Alto Alentejo (29SND8972). GAH & DTH collected three living individuals at or near this locality, on the S. bank of the R. Tejo, in 2009.

Oxychilus alliarius (J.S. Miller, 1822)

The species was omitted from the book by MATOS (2014), despite published records of material confirmed anatomically from Douro Litoral and Minho given by OLIVEIRA & ALTONAGA (2010: 46). HOLYOAK *ET AL.* (2014: 47) added records of it from Trás-os-Montes e Alto Douro and Beira Alta.

Oxychilus cellarius (O.F. Müller, 1774)

Oxychilus draparnaudi (H. Beck, 1837)

Family PRISTOLOMATIDAE

#*Hawaiiia minuscula* (Binney, 1841)

Recorded new to mainland Portugal in QUIÑONERO *ET AL.* (2013) from two localities in Estremadura: (a) beside stream in mature plantation of *Eucalyptus globulus*, near São Pedro de Moel (29SME90), 1 shell, leg. DTH & GAH, 12 Aug. 2010, CGAH.P67; (b) flower-beds in public park, Parede, Cascais (29SMC68), numerous living and dead shells, leg. DTH, GAH & RM, 28 Apr. 2013, CGAH.P313 & CRM. The year of publication of the name was confirmed as 1841 not 1840 by BANK (2011: 19) and WELTER-SCHULTES & AUDIBERT (2013: 18).

Vitrea contracta (Westerlund, 1871)

Family PARMACELLIDAE

See RODRIGUEZ & HERMIDA (1993) for data on all families of slugs known in mainland Portugal.

**Drusia valenciennii* (Webb & Van Beneden, 1836)

Until recently known as *Parmacella valenciennii* Webb & Van Beneden, 1836. MARTÍNEZ-ORTÍ & BORREDA (2012) transfer the species to *Drusia* J.E. Gray, 1855 subgenus *Drusia*.

The name of the second author is given as "Vanbeneden" six times in the original publication ("WEBB & VANBENEDEN", 1836), on each of plates 75-77 and their pages of explanation, never as Van Beneden as used by most subsequent authors. However, the latter form is adopted here because that is how the author presents himself in the majority of his papers.

Family AGRIOLIMACIDAE

Deroceras agreste (Linnaeus, 1758)

D. agreste and *D. reticulatum* have often been confused, especially in the 19th century. NOBRE (1941: 45-47) listed records only for "*Agriolimax agrestis* (Linn.)" which doubtless consisted mainly of *D. reticulatum*. The only modern report of *D. agreste* s. s. from mainland Portugal is given by ALTONAGA ET AL. (1994: 464) as "[locality] 395, PO[rtugal], Malhadas, QG2302, 740 m, Pastizal y cultivos". This locality is in Trás-os-Montes e Alto Douro, as are their localities 387-397 for *D. reticulatum* (ALTONAGA ET AL., 1994: 468).

‡*Deroceras invadens* Reise, Hutchinson, Schunack & Schlitt, 2011

REISE ET AL. (2011) demonstrated that the widespread pest slug known for many years as *D. panormitanum* (or *D. caruanae* (Pollonera, 1891)) is a distinct species from *D. panormitanum*. HUTCHINSON ET AL. (in preparation) examined specimens from mainland Portugal from CGAH and reidentified samples from Alto Alentejo and Beira Litoral as *D. invadens*, whereas other material was *D. panormitanum* s. s. (*q.v.*).

Deroceras laeve (O.F. Müller, 1774)

Deroceras lombricoides (Morelet, 1845)

**Deroceras nitidum* (Morelet, 1845)

‡*Deroceras panormitanum* (Lessona & Pollonera, 1882)

D. panormitanum s. s. is newly recorded from mainland Portugal by HUTCHINSON ET AL. (in preparation), on the basis of their reidentification of specimens in CGAH from Estremadura and Ribatejo, along with another recent collection from the W. Algarve. Records mapped by RODRIGUEZ & HERMIDA (1993: 389, fig. 9, map C) should be referred to *D. panormitanum* s. l. (i.e. including *D. invadens*).

Deroceras reticulatum (O.F. Müller, 1774)

**Furcopenis circularis* Castillejo & Mascato, 1987

For Portuguese records see RODRÍGUEZ & HERMIDA (1993: 389).

**Furcopenis geresiensis* (Rodríguez, Castillejo & Outeiro, 1989)

For Portuguese records see RODRÍGUEZ, CASTILLEJO & OUTEIRO (1989) and RODRÍGUEZ & HERMIDA (1993: 389).

Family LIMACIDAE

Lehmannia marginata (O.F. Müller, 1774)

Lehmannia valentiana (A. Férussac, 1821)

GARGOMINY ET AL. (2011: 359, note 154) followed by ROWSON, ANDERSON, ET AL. (2014) and ROWSON, TURNER, ET AL. (2014: 76) treated this species as *Ambigolimax valentianus* (A. Férussac, 1822), but the anatomical reasons given seem slight (different shape of penial flagellum: PROSCHWITZ, 2009, and perhaps different shape of the bursa copulatrix) and the molecular data supporting separation appears to have been published merely as a brief abstract (KLEE, FALKNER & HASZPRUNER, 2005). Further, molecular data given by ROWSON, ANDERSON, ET AL. (2014: 11, fig. 5) are based on few species of Limacidae and the genera involved are mostly unresolved in a polytomy in their study. Although adopting *Ambigolimax* for the species, VENDETTI ET AL. (2018: 17) emphasise that a generic revision of this and allied Limacidae is still needed. Hence, until

there is fuller and clearer treatment of generic limits, we follow WELTER-SCHULTES (2012: 442) in regarding *Ambigolimax* Pollonera, 1887 as a synonym of *Lehmannia*. We follow VENDETTI *ET AL.* (2018: 18-19) in giving the year of publication as 1821 rather than 1822.

Limacus flavus (Linnaeus, 1758)

Limax maximus Linnaeus, 1758

Family VITRINIDAE

Oligolimax annularis (S. Studer, 1820)

MORELET (1845: 50) reported *Vitrina subglobosa* Michaud, 1831 from “le nord-est du Portugal sur les hauts plateaux qui avoisinent Chavès, Bragance et Torre de Moncorvo”. MORELET (1877: 259) reassigned this taxon to *V. annularis*. NOBRE (1941: 50-52) treated these early records as *Vitrina pellucida*, an error that was corrected by MATOS (2014: 174), who did not note any subsequent reports from Portugal. More recent records that are also from Trás-os-Montes e Alto Douro were given by ALTONAGA *ET AL.* (1994: 451) from Duas Igrejas 29TQF2093 and by HOLYOAK *ET AL.* (2014 (47-48) from collections made in 2011 in 29TPG83 and 29TQG00 (CGAH). Allocation of this species to *Oligolimax* follows GIUSTI *ET AL.* (2011).

Vitrina pellucida (O.F. Müller, 1774)

Family ARIONIDAE

See CASTILLEJO & RODRÍGUEZ (1993) for a detailed monographic study of the genus *Arion* in mainland Portugal which forms the basis of the present account.

Arion ater (Linnaeus, 1758)

Intermediates between *A. ater* and *A. rufus* apparently occur in Britain, which may be hybrids; see CAIN & WILLIAMSON (1958) and NOBLE & JONES (1996) for discussions of their variation and species-limits. However, the DNA sequence study of Iberian material by QUINTEIRO *ET AL.* (2005) suggests separate species might be involved, within a

clade that also contains slugs that resemble *A. lusitanicus s. l.* However, the authors caution that “Likely, the taxonomic uncertainty about this clade reflects an absence of distinct biological species and the existence of various ecotypes”.

**Arion fuliginus* Morelet, 1845

DNA sequence data reported by QUINTEIRO *ET AL.* (2005) suggest rather close affinity to *A. lusitanicus s. s.*, although both were retained by them as distinct species.

**Arion hispanicus* Simroth, 1886

For taxonomic and distributional notes see GARRIDO *ET AL.* (1994: 42-43). Placed as a valid species in Subgenus *Mesarion* P. Hesse, 1926 by QUINTEIRO *ET AL.* (2005).

Arion intermedius Normand, 1852

Self fertilisation may be normal in this species (MCCRACKEN & SELANDER, 1980; FOLTZ *ET AL.*, 1982), perhaps accounting for occurrence of low levels of divergence in DNA sequences between populations e.g. in Spain and the U.K. (QUINTEIRO *ET AL.*, 2005).

**Arion lusitanicus* J. Mabille, 1868

CASTILLEJO & RODRÍGUEZ (1993: 22, 34 fig. 128) and RODRÍGUEZ & HERMIDA (1993: 390, fig. 10, map F) accepted records from mainland Portugal only from a small part of Estremadura (Serra da Arrábida 29SNC06 (TL); Sintra 29SMC69; Oeiras 29SMC79; Montserrat 29SMC59). Our own data based on dissected specimens (in CGAH) collected in 2013 extends the range further northwards in Estremadura (W. of Alpedriz, 29SND08; A-dos-Cunhados, 29SMD73). Two collections from 2014 were still further north, in Beira Litoral (Vale da Couda, 29SNE40; 2 km NE. of Almagreira, 29TNE32). The species thus appears to be widespread in WC. Portugal, where it may be endemic, although molecular data given by QUINTEIRO *ET AL.* (2005) suggest it is present also in NW Spain. *A. lusitanicus* was listed for the Azores and Madeira (*vide* BANK *ET*

AL., 2002: 117), but it is apparently uncertain whether *A. lusitanicus* s. s. or *A. vulgaris* was involved (see below).

CASTILLEJO (1997a, 1997b) redescribed *A. lusitanicus* based on topotypes from Serra da Arrábida. ANDERSON (2005) noted that this name has been misapplied to species from C. and NW Europe (*A. vulgaris* Moquin-Tandon, 1855, *A. flagellus* Collinge, 1893) which differ in spermatophore and internal morphology (cf. ALTENA, 1956; QUICK, 1952, 1960; DAVIES, 1987; CASTILLEJO, 1998; FALKNER ET AL., 2002; ROWSON, ANDERSON, ET AL., 2014; ROWSON, TURNER, ET AL., 2014). DNA sequence data reported by QUINTEIRO ET AL. (2005) show that a taxon from Prov. Girona (Spain), France, Italy and S. England belongs in a clade widely divergent from the *A. lusitanicus* s. s. they studied from the W. and NW Iberian Pen. This taxon is part of a clade that also contains *A. ater* and *A. rufus*, despite its closer morphological similarity to *A. lusitanicus* s. s. It is therefore likely that a substantial literature dealing with the “*A. lusitanicus*” that is an agricultural pest in C. Europe refers to other taxa (e.g. SOROKA ET AL., 2009).

BANK, FALKNER & PROSCHWITZ (2007: 49-50) proposed to maintain the habitual [incorrect] usage of the name *A. lusitanicus* for the widespread European species because this usage has become widely established. This would require the I.C.Z.N. to endorse selection of a neotype that is not conspecific with the original species concept (Article 75.6), but no application to the I.C.Z.N. to achieve this had been made by 2012. KADOLSKY (2012: 77-78) therefore proposed that the name *A. rufus* var. *vulgaris* Moquin-Tandon, 1855 (currently an objective synonym of *A. rufus* under I.C.Z.N. Art. 72.7) should be used for the widespread European species, allowing *A. lusitanicus* J. Mabilbe to remain correctly named as the Portuguese species. This would require a ruling of the I.C.Z.N. to set aside Art. 72.7 in this instance; the species identification should also be fixed by selection of a neotype of *vulgaris*. BALASHOV (2018) has recently

requested the I.C.Z.N. to validate the availability of *Arion vulgaris* Moquin-Tandon, 1855, and its authorship. Until this application is ruled upon the correct usage of *lusitanicus* for the Portuguese species should be maintained.

**Arion nobrei* Pollonera, 1889

DNA sequence data reported by QUINTEIRO ET AL. (2005) suggest this species shows rather close affinity to *A. lusitanicus* s. s., although both were retained by them as distinct species.

**Geomalacus anguiformis* (Morelet, 1845)

CASTILLEJO, GARRIDO & IGLESIAS (1994) give a detailed account of this and other *Geomalacus*.

Geomalacus maculosus Allman, 1843

Recorded from Beira Litoral at 2 km N. of Favaçal, 2012 in hectad 29SNE52 (HOLYOAK ET AL., 2014: 48). This appears to be the southernmost record of the species (cf. RODRÍGUEZ & HERMIDA, 1993: 390, fig. 10 map C), contrary to the schematic map in CASTILLEJO ET AL. (1994: 25).

**Geomalacus moreleti* (Hesse, 1884)

CASTILLEJO (1997a: 67) regarded *Geomalacus malagensis* Wiktor & Norris, 1991 as a synonym of *G. moreleti* (Hesse, 1884). Reported (as *G. malagensis*) new to Portugal from the Setúbal peninsula of S. Estremadura (at Sesimbra and Azeitão) by PATRAO ET AL. (2015).

**Geomalacus oliveirae* Simroth, 1891

Family GEOMITRIDAE

Backeljaia gigaxii (L. Pfeiffer, 1847)

This is the type species of the genus *Backeljaia* CHUECA ET AL. (2018: 366). Previously known as *Candidula gigaxii* (L. Pfeiffer, 1847), with year of publication, identification characters and Portuguese records reviewed by HOLYOAK & HOLYOAK (2014: 641-644).

Cochlicella acuta (O.F. Müller, 1774)

Cochlicella barbara (Linnaeus, 1758)

Cochlicella conoidea (Draparnaud, 1801)

Cerņuella virgata (Da Costa, 1778)

**Helicella cistorum* (Morelet, 1845)

Treatment of this species by MATOS (2014: 193-194) was confused by misidentifications. Her fig. 155 (Serra da Arrábida) represents *Xeroplexa arrabiden-sis*; fig. 156 (Berlenga) represents *X. olisippensis*; fig. 157 ("Loulé, como *Helicella stiparum*") represents *X. scabiosula*; the dot on Mapa 106 for the Farilhões also represents *Xeroplexa* sp. (the only Geomitridae sp. known there). Our records of *H. cistorum* checked anatomically were reported by HOLYOAK *ET AL.* (2014: 49-50) as extending from a wide scatter in the Algarve northwards through Alentejo to much of eastern Beira Baixa (north to 29SPE52). To that list we can now add finds much further north in Trás-os-Montes e Alto Douro in 2014, (a) on sandstone rocks of road-cutting by N221 ca 10 km E. of Barca d'Alva (29TPF84), CGAH.P391; (b) at base of old town wall, Miranda do Douro (29TQF29), CGAH.P394. Both populations were sparse with very small adult shells somewhat resembling those of *Xeroplexa ponsulensis*, but dissection of a single subadult from each site revealed the paired dart sacs of *H. cistorum*.

Microxeromagna lowei (Potiez & Michaud, 1838)

The date of publication in 1838 rather than 1835 follows KADOLSKY (2012: 83-84).

***Ponentina curtivaginata* D. Holyoak & G. Holyoak, 2012

Described by HOLYOAK & HOLYOAK (2012c: 211) from ca 1 km S. of Vale de Águia, NE. of Miranda do Douro, Trás-os-Montes e Alto Douro. It is still known only from the TL.

**Ponentina excentrica* G. Holyoak & D. Holyoak, 2012

Described by HOLYOAK & HOLYOAK (2012c: 206) from TL in W. Prov. Badajoz, Spain. The distinctive shells were also found in 2012 at two localities near Bar-

rancos in Baixo Alentejo. RM found an empty shell in Dec. 2012 at Vila Verde de Ficalho, Serpa, Baixo Alentejo (29SPC50) and another empty shell in Mar. 2015 at Elvas, Alto Alentejo (29SPC59).

***Ponentina foiaensis* G. Holyoak & D. Holyoak, 2012

Described by HOLYOAK & HOLYOAK (2012c: 206) from W. slope of Fóia, Algarve, which remains the only known locality.

***Ponentina grandiducta* G. Holyoak & D. Holyoak, 2012

Described by HOLYOAK & HOLYOAK (2012c: 209) from Beira Baixa, Beira Alta and adjoining parts of E. Beira Litoral.

***Ponentina monoglandulosa* D. Holyoak & G. Holyoak, 2012

Described by HOLYOAK & HOLYOAK (2012c: 216) from C. and E. Beira Baixa; also known from the opposite side of the Rio Erges in the W. edge of Prov. Cáceres (Spain).

**Ponentina octoglandulosa* D. Holyoak & G. Holyoak, 2012

Described by HOLYOAK & HOLYOAK (2012c: 205) from TL in Prov. Pontevedra of NW Spain; known by shells from several localities in adjoining parts of Prov. Minho of NW Portugal.

**Ponentina papillosa* G. Holyoak & D. Holyoak, 2012

Described by HOLYOAK & HOLYOAK (2012c: 212) from NE. and EC. Portugal (Alto Alentejo; Trás-os-Montes e Alto Douro) and a neighbouring part of W. Spain in Prov. Zamora.

***Ponentina platylasia* (Castro, 1887)

A forgotten species endemic in limestone habitats of WC. Portugal (Beira Litoral, Estremadura and Ribatejo), redescribed by HOLYOAK & HOLYOAK (2012c: 185-190). It is distinctive in the large shells with long hairs, but has similar distal genital anatomy to that of *P. revelata* (which lives as typical smaller-shelled forms in adjacent mainly coastal habitats).

**Ponentina ponentina* (Morelet, 1845)

An almost forgotten species occurring over much of mainland Portugal, but most common in WC. regions. It was redescribed by HOLYOAK & HOLYOAK (2012c: 194-200). MATOS (2014: 187, fig. 151) figured typical shells of this species from Ilha Berlenga, but identified them as *P. revelata*, using an extraordinarily broad monospecific concept of the genus *Ponentina* which follows that of NOBRE (1941).

Ponentina revelata (Michaud, 1831)

Characterised following the review by HOLYOAK & HOLYOAK (2012c: 180-185) as a medium-sized *Ponentina* species with moderately long shell hairs, but its shells are only subtly different from those of some more localised endemic species and commonly indistinguishable when the hairs have worn off. The anatomy of the distal genitalia is more distinctive, with paired dart sacs each subtending a large accessory sac from which the mucus glands (with two branches each) arise apically. It has an extensive range, including NW France and NW Spain; in Portugal alone it occurs mainly on coasts, from N. Estremadura northwards (more rarely inland). The few DNA sequence data available (from N. Spain: RAZKIN ET AL., 2015: 108, fig. 2) show two separate clades and HOLYOAK & HOLYOAK (2012c: 186-189, fig. 2) described and figured considerable variability in the distal genital anatomy, especially relative length of the vagina. Hence, *P. revelata* may include more than one cryptic or nearly cryptic species.

In addition, specimens collected by DTH & GAH (unpublished) from NW of Vimioso in Trás-os-Montes e Alto Douro may represent another undescribed taxon. They have genital anatomy very similar to that of *P. revelata*, but the shells are smaller with distinctly shorter shell hairs.

**Ponentina rosai* (Castro, 1887)

A forgotten species redescribed by HOLYOAK & HOLYOAK (2012c: 202-205). The range extends over much of C. and S. Portugal, with an old report from

further north near the R. Douro. It is, however, likely to be under-recorded because it commonly occurs at low densities, often among base-poor rocks in places with scanty vegetation such as eroding road-cuttings, it matures early in the year, and the small shells are often heavily coated with soil. *Henkia marianae* E. Gittenberger, 2012 (GITTENBERGER, 2012) from the Algarve is a synonym, and *Henkia antoni* E. Gittenberger, 2012 from Prov. Málaga, S. Spain may be another synonym based on small shells of *P. rosai* with a flat spire.

***Xerocodia codia* (Bourguignat, 1859)

An endemic of the C. Algarve, treated as *Candidula codia* (Bourguignat, 1859) by HOLYOAK & HOLYOAK (2014: 638-639), with a review of its characters and distribution. The molecular-phylogenetic study by CHUECA ET AL. (2018) showed it as an isolated clade, but with uncertain affinities. Since it is unlikely to be part of their restricted *Candidula s. s.*, pending more detailed analyses, we return it to the monotypic segregate genus *Xerocodia* Monterosato, 1892, of which it is the type species. The short hairs on the juvenile shell are among several characters which distinguish it from *Xeroplexa*.

***Xeroplexa arrabidensis* (G. Holyoak & D. Holyoak, 2014)

Treated as part of *Candidula belemensis* by GITTENBERGER (1993a) but described as *C. arrabidensis* G.A. Holyoak & D.T. Holyoak (HOLYOAK & HOLYOAK, 2014: 635-637), mainly because of the shorter penial flagellum. It is endemic in the Serra da Arrábida and neighbouring regions. CHUECA ET AL. (2018: 364) found it forms a monophyletic clade that was recovered as a valid species using molecular species delimitation analysis; they transferred it to *Xeroplexa* (CHUECA ET AL., 2018: 366).

***Xeroplexa belemensis* (Servain, 1880)

Treated as *Candidula belemensis* (Servain, 1880) by HOLYOAK & HOLYOAK (2014: 637), who reviewed its characters and distribution and separated *C. arra-*

bidensis and *C. scabiosula* from the broader definition of *C. belemensis* adopted by GITTEMBERGER (1993a). CHUECA *ET AL.* (2018: 366) transferred it to *Xeroplexa*. The latter authors also found that the taxon remaining as *X. belemensis* s. s. still comprises two clades, which are perhaps cryptic allopatric species (CHUECA *ET AL.*, 2018: 364); these are being investigated by Dr Chueca through further molecular studies.

CADEVALL & OROZCO (2016) did not cite the review of Portuguese *Candidula* (now mainly treated as *Xeroplexa*) by HOLYOAK & HOLYOAK (2014). Hence, the species *X. arrabidensis*, *X. carrapateirensis*, *X. ponsulensis*, *X. scabiosula* and *X. strucki* are not treated at all by them, even as synonyms. The phylogenetic study by CHUECA *ET AL.* (2018) has provided support from molecular data for recognition of the additional segregate species involved. Consequently, this leaves the concepts of *C. belemensis*, *C. intersecta* and *C. olisippensis* more broadly defined in CADEVALL & OROZCO (2016) than in current literature.

CADEVALL & OROZCO (2016: 404) state the type locality of *C. belemensis* (Servain, 1880) incorrectly as “Lisboa, en aluviones del Tajo, bajo la torre de Belem”: it was restricted to the less ambiguous “summit area of Serra de Montejunto, Estremadura” by HOLYOAK & HOLYOAK (2014: 637).

***Xeroplexa carrapateirensis* (G. Holyoak & D. Holyoak, 2014)

A localised endemic of sand dunes in the W. Algarve and neighbouring area of Baixo Alentejo, described as *Candidula carrapateirensis* G. Holyoak & D. Holyoak (HOLYOAK & HOLYOAK, 2014: 637-638). It was transferred to *Xeroplexa* by CHUECA *ET AL.* (2018: 366).

***Xeroplexa coudensis* (G. Holyoak & D. Holyoak, 2010)

Described as *Candidula coudensis* by HOLYOAK & HOLYOAK (2010); transferred to *Xeroplexa* by CHUECA *ET AL.* (2018: 366). A localised endemic of C. Portugal with a range only 13.5 km² in extent (MOREIRA, CALADO & DIAS, 2015).

Xeroplexa intersecta (Poiret, 1801)

Syn. *Candidula intersecta* (Poiret, 1801), with identification characters and Portuguese records reviewed by HOLYOAK & HOLYOAK (2014: 644-646); transferred to *Xeroplexa* by CHUECA *ET AL.* (2018: 366). The latter authors found two clades among material from N. Spain, that from Galicia apparently being localised with a long penial flagellum, that from the Basque country extending to NW Europe and having a short penial flagellum. The Portuguese specimens also have a short flagellum and study of these is being continued by Dr Chueca.

***Xeroplexa olisippensis* (Servain, 1880)

Syn. *Candidula olisippensis* (Servain, 1880), with identification characters and distribution reviewed by HOLYOAK & HOLYOAK (2014: 646-653); transferred to *Xeroplexa* by CHUECA *ET AL.* (2018: 366). The latter authors found that populations from Galicia with a long flagellum form a separate clade more closely allied to *X. intersecta* (*q.v.*).

***Xeroplexa ponsulensis* (D. Holyoak & G. Holyoak, 2014)

Described as *Candidula ponsulensis* by HOLYOAK & HOLYOAK (2014: 653); transferred to *Xeroplexa* by CHUECA *ET AL.* (2018: 366). Almost a cryptic species, resembling *X. intersecta* very closely in genital anatomy and general appearance of the shell, differing morphologically only in several subtle shell characters. However, CHUECA *ET AL.* (2018: 364) found it forms a monophyletic clade that was recovered as a valid species using molecular species delimitation analysis.

Xeroplexa scabiosula (Locard, 1899)

Syn. *Candidula scabiosula* (Locard, 1899), with identification characters and distribution reviewed by HOLYOAK & HOLYOAK (2014: 654); transferred to *Xeroplexa* by CHUECA *ET AL.* (2018: 366). Endemic in the Algarve and close to *X. arrabidensis* and *X. belemensis* in genital anatomy and general appearance of the shell. However, CHUECA *ET AL.* (2018: 364) found it forms a monophyletic

clade that was recovered as a valid species using molecular species delimitation analysis.

***Xeroplexa setubalensis* (L. Pfeiffer, 1850)

Syn. *Candidula setubalensis* (L. Pfeiffer, 1850), with identification characters and distribution reviewed by HOLYOAK & HOLYOAK (2014: 655). CHUECA ET AL. (2018: 366) restored usage of the generic name *Xeroplexa* Monterosato, 1892 (of which this is the type species) after establishing from molecular data that *Candidula s. l.* was polyphyletic.

***Xeroplexa strucki* (Maltzan, 1886)

An endemic in the W. Algarve and adjoining part of Baixo Alentejo. It was treated as part of *Candidula olisippensis* by GITTENBERGER (1993a: 285) but separated as *Candidula strucki* (Maltzan, 1886) by HOLYOAK & HOLYOAK (2014: 656), who reviewed its identification characters (including a shorter penial flagellum) and distribution. CHUECA ET AL. (2018: 366) transferred the species to *Xeroplexa*.

Xerosecta promissa (Westerlund, 1893)

The older records from Portugal (from Algarve, Beira Litoral and Estremadura) appear to be based only on shells, so there is some doubt whether atypical *Cernuella virgata* might have been misidentified. Recent records from Alto Alentejo and Baixo Alentejo (HOLYOAK ET AL., 2014: 50-51) were confirmed anatomically.

Xerosecta reboudiana (Bourguignat, 1863)

GITTENBERGER (1993b: 298) pointed out that shells of *X. promissa* can be similar to those of *X. reboudiana*. The records of the latter species from Portugal (LOCARD, 1899; PUENTE, 1995: 51-56; MATOS, 2014: 213-215) are old and based only on shells, so there is at least slight doubt whether atypical *Cernuella virgata* or *Xerosecta promissa* might have been misidentified.

Xerotricha apicina (Lamarck, 1822)

Xerotricha conspurcata (Draparnaud, 1801)

**Xerotricha jamuzensis* (Gittenberger & Manga, 1977)

Originally described as *Helicella jamuzensis* GITTENBERGER & MANGA (1977). The Portuguese record from Duas Igrejas (Trás-os-Montes e Alto Douro) by ALTONAGA ET AL. (1994: 278, 481) was not mentioned in MATOS (2014). HOLYOAK ET AL. (2014: 50) reported finding it in 2011 and 2013 in the same province ca 4 km NW of Vimioso (29TQG00) and in 2013 at Castle of Miranda do Douro (29TQF29).

**Xerotricha madritensis* (Rambur, 1868)

HOLYOAK ET AL. (2014) reported it as *Helicella madritensis* (Rambur, 1868) found in 2013 new to Portugal from two localities in Alto Alentejo: Forte de Santa Luzia, Elvas (29SPD50) and Forte da Graça near Elvas (29SPD50).

Xerotricha vatonniana (Bourguignat, 1867)

Reported as apparently new for Portugal as *Helicella (Xerotricha) vatonniana* (Bourguignat, 1867) by HOLYOAK ET AL. (2014: 50) from specimens collected in 2013 ca 1 km W. of Serpa, Baixo Alentejo (29SPC20). However, PUENTE (1994: 467) accepted the reports of *Helix Gibilmanica* Servain, 1880 given by LOCARD (1899: 90) from Portugal (Faro and Estói) as this species, but questioned his listing of Bragança. It is unclear whether the older Portuguese records were overlooked or excluded by MATOS (2014).

Family HELICIDAE

Cepaea nemoralis (Linnaeus, 1758)

‡*Eobania vermiculata* (O.F. Müller, 1774)

Two established populations have recently been discovered in mainland Portugal, both of them undoubtedly anthropogenic introductions. HOLYOAK ET AL. (2014: 48) reported it living in 2011 and 2013 on flower beds in a public park at Parede, Cascais, Estremadura (29SMC68). Subsequently, on 27 Oct. 2014 it was found to be well established on a strip of open ground between *Acacia* scrub and the lorry parking area

just E. of the A13 motorway at E. edge of Montijo Service Area, Baixo Alentejo (29SNC28), GAH & DTH.P414 (CGAH).

BOUAZIZ-YAHIAATENE *ET AL.* (2017) propose that the genus *Eobania* P. Hesse, 1913 should be treated as a synonym of *Massylaea* Möllendorff, 1898. However, this appears to be unwarranted. Part of a wider study of Maghreb Helicidae now being prepared for publication by D.T.H, G.A.H. and collaborators, implies that the only anatomical and DNA sequence data they present for *Massylaea* (supposedly based on its type species *M. massylaea* (Morelet, 1851)) was actually based on a misidentified subadult individual of *Eobania constantinae* (E. Forbes, 1838).

Cornu aspersum (O.F. Müller, 1774)

Numerous authors (including e.g. SCHILEYKO, 2006: 1817) adopt the generic name *Cryptomphalus* Charpentier, 1837, regarding *Cornu* Born, 1778 as a “nomen oblitum” or unavailable because based on a monstrous (scalariform) shell. An application to the I.C.Z.N. (COWIE, 2011) to place the genus-group name *Cornu* Born, 1778 on the Official List (cf. KADOLSKY, 2012: 78) was granted. I.C.Z.N. (2015, Opinion 2354) thus stated: (1) ... that the name *copiae* Born, 1778, as published in the binomen *Cornu copiae*, is not unavailable by reason of being based on a teratological specimen, as it was not explicitly described as such. (2) The name *Cornu* Born, 1778 (gender: neuter), type species by monotypy *Cornu copiae* Born, 1778, is hereby placed on the Official List of Generic Names in Zoology, with the endorsement that it is based on an available type species, as ruled in (1) above. (3) The entry on the Official List of Specific Names in Zoology for the name *aspersa* Müller, 1774, as published in the binomen *Helix aspersa*, is hereby amended to record that this is the valid name of the type species of *Cornu* Born, 1778 (a senior subjective synonym of *copiae* Born, 1778, as published in the binomen *Cornu copiae*).

See NORDSIECK (2013) for a clear and useful summary of the reasons for treat-

ing this species in a monotypic genus apart from *Helix*, *contra* the treatment on ANIMALBASE (WELTER-SCHULTES, 2012: 610). RAZKIN *ET AL.* (2015) have subsequently provided molecular-phylogenetic data demonstrating it belongs in tribe Otalini, as sister to *Cantareus* Risso, 1826, not in tribe Helicini.

Helicigona lapicida (Linnaeus, 1758)

OLIVEIRA (2008) suggested that this species may have become extinct in Portugal since there were no recent records of it from sites known formerly at Sintra (Estremadura) and in Douro Litoral where only old shells were found by him (there were old records from Porto and Vila Nova de Gaia). HOLYOAK *ET AL.* (2014: 49) reported discovery of a living population found in 2013 in Trás-os-Montes e Alto Douro at the Castle of Miranda do Douro, in crevices of the castle walls (29TQF29); it was still thriving there in 2014. In 2016 other populations were found at two locations at Baião in Douro Litoral (29TNF85, 29TNF75; CRM). These living populations are of the nominate ssp. not *H. l. andorrica* (Bourguignat, 1876), which is distinctive conchologically and genetically (GROENENBERG, SUBAI & GITTEBERGER, 2012: 117-169).

‡*Marmorana muralis* (O. F. Müller, 1774)

The ANIMALBASE website (F. WELTER-SCHULTES, 2014) lists the range of the species as “Originally Sicily, in the antiquity introduced to Istria, mainland Italy (Toscana, Umbria, Perugia, Lazio, Calabria), N. Tunis, Menorca, S. France and Portugal (Lisboa, Setúbal, Milfontes)”. Although it may indeed have been an ancient (e.g. Roman) anthropogenic introduction to Portugal inference of this appears speculative since there are apparently no records from Portuguese archaeological sites. The earliest record from Portugal appears to be the listing by SILVA (1871a: 188) as “Em Setubal, contra os muros”. Strong populations still persist in Portugal, e.g. just S. of Palmela in 2016 (CGAH).

Commonly treated as a species of *Marmorana* Hartmann, 1844 subgenus

Murella L. Pfeiffer, 1877. The Sicilian populations show complex patterns of geographical variation that have been the subject of detailed morphological and molecular studies (e.g. FIORENTINO ET AL., 2012), but the introductions to other countries have not been studied in detail in relation to contemporary sub-specific taxonomy.

Otala lactea (O.F. Müller, 1774)

A revision of the genus by HOLYOAK & HOLYOAK (2017: 445-446) designated a neotype for the species (NMW.Z.2017.012.1) from N. of Porto Covo, Baixo Alentejo (29S 051767/419559). The species is sometimes treated as polytypic, e.g. by BECKMANN (2007: 126) who recognised five subspecies and RUIZ ET AL. (2006: 170) who recognised ssp. *murcica* in Prov. Almería and ssp. *lactea* elsewhere in Andalucía. The neotype designation ensures that if subspecies are recognised, the nominate form occurs in SW. Portugal.

‡*Otala punctata* (O.F. Müller, 1774)

Established populations were reported new to mainland Portugal in Baixo Alentejo by HOLYOAK ET AL. (2014): in 2012, near Serpa, just S. of Ponte de Serpa (29SPC10); in 2012 and 2013, ca 1 km W. of Serpa (29SPC20). *Otala* spp. are widely eaten in Portugal and Spain, so they are likely to be deliberately or accidentally dispersed by man, as well as being prone to dispersal with garden plants or attached to vehicles.

Theba pisana (O.F. Müller, 1774), including (**) ssp. *almogravensis* D. Holyoak & G. Holyoak, 2016

Treated as a polytypic sp. by GITTEBERGER & RIPKEN (1983) and FALKNER ET AL. (2001), although the former authors note that "The subspecies ... are interconnected by broad zones with intermediate forms and, therefore, their morphological and geographical delimitation cannot be but rather subjectively indicated". The widespread form in mainland Portugal is *T. p. pisana*, as in

most of the European range. It is widespread and often abundant over most of Portugal, except for most of the north-east of the country and other large areas away from coasts in the north. Elsewhere in the country, the species is widely collected for food and hence often introduced by man deliberately, as well as accidentally with plants or attached to vehicles, building materials, etc.

BANK & DEKKER (1989) reported a find of *Theba pisana* with keeled adult shells from near Monte Clérigo, Algarve as subspecies *T. p. arietina* (Rossmässler, 1846), known elsewhere only as a rare endemic in Cádiz province, Spain. OLIVEIRA (2008b) made a more extensive study, finding similar populations in other sand dune areas along the western coasts of Algarve and Baixo Alentejo provinces and using the name *T. p. arietina* for all of them. After making comparisons of specimens from Cádiz Prov. with extensive new collections from the sand dunes of SW. Portugal, HOLYOAK & HOLYOAK (2016) reidentified the keeled form from Monte Clérigo as a hybrid population. The smaller-shelled widespread keeled form on these sand dunes was named as *T. p. almogravensis* D. Holyoak & G. Holyoak, 2016, with the Monte Clérigo form interpreted as one of numerous hybrids from contact zones where it meets the widespread *T. p. pisana*.

Family HYGROMIIDAE

**Portugala inchoata* (Morelet, 1845)

Monacha cartusiana (O.F. Müller, 1774)

Family TRISSEXODONTIDAE

Caracollina lenticula (A. Férussac, 1821)

CLECOM (BANK ET AL., 2001: 98), MATOS (2014: 180) and other recent treatments place *C. lenticula* in *Caracollina* H. Beck, 1837 subgenus *Caracollina*. Recognition of subgenera appears to be unnecessary though, since the Moroccan endemic *Caracollina hulotii* Pallary, 1913 is the type and only species of

Paroestophora H. NORDSIECK, 1993 (p. 9), which has led to its subgeneric treatment in *Caracollina* (*Paroestophora*). However, *C. hulotii* clearly belongs in *Oestophora*, as demonstrated long ago from its genital anatomy by HESSE (1931: 53, pl. 8, fig. 64a, b).

WELTER-SCHULTES, AUDIBERT & BERTRAND (2011) and WELTER-SCHULTES (2012: 484) corrected the authorship of the species epithet to A. FÉRUSSAC (1821) because this author established *Helix lenticula* with a description only for the subordinate variant α , whereas the nominate taxon was named and described later by MICHAUD (1831: 43). This is strictly in accordance with the I.C.Z.N. Code, because Férussac gave a description of the "taxon" (cf. Art. 12.1) since the Glossary forming part of the Code states that a taxon encompasses all included taxa of lower rank.

**Gasullia gasulli* (Ortiz de Zárate Rocandio & Ortiz de Zárate López, 1961)

Reported new to Portugal from beside Rio Múrtega N. of Barrancos, Baixo Alentejo (29SPC72) (HOLYOAK *ET AL.*, 2014: 51). Subsequent records from locations in the same region are from Évora, Mourão, Mourão (29SPC54) and Évora, Mourão, Granja, (29SPC62) (both in CRM).

ORTIZ DE ZÁRATE ROCANDIO & ORTIZ DE ZÁRATE LÓPEZ (1961: 178) validly named the new species *G. gasulli*, with text commencing: "*Oestophora* (*Gasullia*) *gasulli* nov. sp. Diagnosis. Especies del género *Oestophora* y subgénero *Gasullia*." However, this did not provide a valid description of the (sub)genus *Gasullia* because I.C.Z.N. Code Art. 13.4 requires that in a combined genus and species description the taxa at genus-level and species-level are both marked as new, whereas this was only true in this instance of the species-level taxon.

ORTIZ DE ZÁRATE LÓPEZ (1962: 102-103) provided a description validating the species name *Oestophora* (*Gasullia*) *riffensis* "(Pallary)", previously used by Paul Pallary as a *nomen nudum* in 1936 as *Helicodonta riffense*. On the preceding page of the same paper (ORTIZ DE

ZÁRATE LÓPEZ, 1962: 101), he also gave a description headed "Subgénero *Gasullia* Ortiz de Zárate, 1961", followed by designation of *O. riffensis* as its type species, commenting "Creo que no es posible designar como tipo del subgénero a la especie *gasulli*, sino que el tipo debe ser la *Oestophora* (*Gasullia*) *riffensis* (Pallary)." Despite the erroneous "1961" in the heading and absence of the indication "gen. nov.", this work clearly validated the (sub)genus *Gasullia* and established its type species.

WELTER-SCHULTES (2012: 484, and on ANIMALBASE website) stated that the genus *Gasullia* Ortiz de Zárate López, 1962 (p. 101) had as type species *Macularia riffensis* Kobelt, 1903, by original designation and that this was "(= currently *Gasullia riffensis* (Kobelt, 1903) from Morocco)". This was erroneous, since it evidently refers to "*Macularia* (*lukasii* subsp.) *riffensis* Pallary" (in KOBELT, 1903, *Iconographie der Land- & Süßwasser-Mollusken ...*, p. 37, pl. 284 figs 1822, 1823) which is now regarded as a synonym of *Otala lactea* (O.F. Müller, 1774); the names are not synonyms; they have never been homonyms.

ARRÉBOLA *ET AL.* (2006: 126) introduced "*Hatumia* n. gen. Type species *Oestophora* (*Gasullia*) *riffensis* Ortiz de Zárate, 1962". They made no mention of ORTIZ DE ZÁRATE LÓPEZ (1962) having designated *O. riffensis* as type species of *Gasullia* Ortiz de Zárate López, 1962 (p. 101) on the page before he validated the species name *O. riffensis* (p. 102), but this results in *Hatumia* being its junior objective synonym. WELTER-SCHULTES (2012: 484) also regarded the genus *Hatumia* Arrébola *et al.*, 2006 as a junior objective synonym of *Gasullia* Ortiz de Zárate López, 1962, but cited the type species of both genera erroneously.

WELTER-SCHULTES (2012: 490 & on ANIMALBASE) transferred *Oestophora gasulli* to *Suboestophora* Ortiz de Zárate López, 1962, "since the genus *Gasullia* cannot be used for this species". However, the genus *Suboestophora* is clearly inappropriate for *O. gasulli*. The distal genital anatomy of *Suboestophora* has the vagina lacking both dart sac and

accessory sac, vaginal mucous glands lacking or rudimentary, and the proximal penis internally lacking a muscular verge (e.g. SCHILEYKO, 2005: 1917-1918). In contrast, despite them being separated generically by ARRÉBOLA ET AL. (2006), *O. gasulli* resembles "*Hatumia*" *riffensis* rather closely in having vagina with dart sac (containing dart) and a well developed accessory sac, branched mucous glands arising from the proximal vagina, as well as a large verge inside the proximal penis (SCHILEYKO, 2005: 1917-1919; ARRÉBOLA ET AL., 2006). The significance of the anatomical distinctions is confirmed by the detailed molecular-phylogenetic analysis by GÓMEZ-MOLINER ET AL. (2012). This showed *Gasullia gasulli* forming a clade sister only to the three "*Hatumia*" species (including "*H.*" *riffensis*), with *Suboestophora* widely separated as sister to *Oestophorella buvinieri*; there are strong statistical support values for the nodes involved. Because *G. gasulli* is now known to be sister to the clade with "*Hatumia*" *riffensis* in the molecular analysis and it shows strong resemblances to that clade in genital anatomy there appear to be insufficient grounds for separating them generically.

**Gasulliella simplicula* (Morelet, 1845)

When GITTENBERGER (1980: 206) introduced the generic name it was spelled incorrectly as "*Gasuliella* gen. nov.", as is clearly apparent from it being dedicated to Luis Gasull and always spelled correctly elsewhere in the same publication. A clear "Erratum" note was also issued by Dr Gittenberger dated 6 maart 1980. Hence, we agree with WELTER-SCHULTES (2012: 485) that the correct spelling (under I.C.Z.N. Art. 32.5.1 and 32.5.1.1) is *Gasulliella* and also agree that although the genus was established without a description (cf. Art. 13.1.1) it clearly satisfies Art. 13.4 because it was monotypic in the original publication, where the type species was described.

NOBRE (1941: 89) suggested *Helix simplicula* was based on misidentified immatures of *Oestophora*. However,

BREURE, AUDIBERT & ABLETT (2018: 430, fig. 1044) illustrate a syntype of *Helix simplicula* labelled "Portugal" in Morelet's handwriting (NHMUK). Morelet (1845: 56-57) gave the TL as "au sud-ouest du Portugal, sur les hauts plateaux qui séparent Mertola [= Mértola] de Castro Verde". We confirmed in Oct. 2018 that the species still occurs at or near the TL, alongside both *Oestophora barbella* with small shells and *Caracollina lenticula* in hectad 29SPB07, at CGAH site P477. The illustration for this species in MATOS (2014: 173, fig. 138) clearly shows misidentified *Caracollina lenticula* in the two upper shell figures, whereas the two lower shell figures are indeed of *G. simplicula*.

TALAVÁN SERNA & TALAVÁN GÓMEZ (2012: 143) report a new record from Olhos de Água (Albufeira, Algarve = 29SNB70) made in 2011 which represents a significant extension to the south-west of the known range in Portugal. Our fieldwork during 2011 and 2012 also resulted in new records from four localities in eastern Alentejo that extend the known range northwards (hectads 29SPC62, PC54, PC53, NB79; all in CRM).

***Gittenbergeria turriplana* (Morelet, 1845)

**Oestophora barbella* (Servain, 1880)

CADEVALL & OROZCO (2016: 517) state the type locality incorrectly as "Mertola y los aluviones del Tajo en Lisboa": it was restricted to Mértola through designation of a lectotype (MHNG 17059A) by HOLYOAK & HOLYOAK (2012a: 33).

***Oestophora barbula* (Rossmässler, 1838)

O. barbella was almost always treated as a synonym of *O. barbula* until they were separated by HOLYOAK & HOLYOAK (2012a), mainly on the basis of the consistently smaller penial epiphallus of *O. barbella*. An earlier attempt at recognising the same nominal taxa as distinct species by CASTILLEJO, OUTEIRO & RODRÍGUEZ (1987) based on specimens from the Serra da Estrela is now regarded as being based on individual

variation within *O. barbella* alone. *O. barbula* is endemic in WC. Portugal and lives mainly in habitats with exposed limestone rock, whereas *O. barbella* mostly replaces it in other regions of Portugal and occurs also in W. and S. Spain, in both acidic and calcareous habitats.

***Oestophora barreli* Hovestadt & Ripken, 2015

Described as a new species from Ilha da Berlenga by HOVESTADT & RIPKEN (2015). MATOS (2014: 179, fig. 43, lower shell) had erroneously figured a specimen of it as *Caracollina lenticula* from the neighbouring island of Farilhão Grande. Records from “Ilha Berlenga como no Farilhão” in her account of *C. lenticula* on the following page and on the accompanying map (MATOS, 2014: 180) were thus undoubtedly based on *O. barreli*.

**Oestophora lusitanica* (L. Pfeiffer, 1841)

The basionym *Helix lusitanica* L. PFEIFFER, 1841 (*Symbolae ad historiam Heliceorum*, sect. 1, diagn. 26, p. 40) is a junior homonym of *Helix lusitanica* Linnaeus, 1767 (as LINNÉ, *Systema naturae*, Tom. I. Pars II. Ed. 12, p. 1245) (according to WELTER-SCHULTES, 2012: 487 & on ANIMALBASE website, the latter is a junior subjective synonym of *Helix cornea* Linnaeus, 1758 which is currently treated as *Planorbarius corneus*; however, a possible syntype in LSL labelled “Europa australi” had been variously misidentified over the years as *Lanistes*, *Ampullaria*, *Zonites algirus*, and lastly “Haas (1936: 35) considered it undeterminable”, according to <https://www.gbif.org/species/8781408>, Accessed 10 Aug. 2018).

I.C.Z.N. Art. 23.9 (Reversal of precedence) allows *Helix lusitanica* Linnaeus, 1767 to be declared a “nomen oblitum” and *Helix lusitanica* L. Pfeiffer, 1841 Fitzinger, 1833 a “nomen protectum” so that prevailing usage will be maintained. This depends on both of the following conditions being satisfied:

Art. 23.9.1.1, that the senior synonym or homonym has not been

used as a valid name after 1899 (which is true for *Helix lusitanica* Linnaeus, 1767), and,

Art. 23.9.1.2, “the junior synonym or homonym has been used for a particular taxon, as its presumed valid name, in at least 25 works, published by at least 10 authors in the immediately preceding 50 years and encompassing a span of not less than 10 years.” The 25 works required are listed in the Bibliography at the end of this paper, each of those involved being marked §.

Class BIVALVIA

Family MARGARITIFERIDAE

Taxonomic treatment of Margaritiferidae and Unionidae follows ARAUJO *ET AL.* (2009), who recognised many synonyms in bringing order to the finely split nominal species introduced for Portuguese populations by CASTRO (1883, 1885), LOCARD (1899) and other nineteenth century enthusiasts. REIS (2006) gives detailed information on Portuguese populations of these and other freshwater Bivalvia.

Margaritifera margaritifera (Linnaeus, 1758)

Family UNIONIDAE

Anodonta anatina (Linnaeus, 1758)

Anodonta cygnea (Linnaeus, 1758)

Potomida littoralis (Cuvier, 1798)

**Unio delphinus* Spengler, 1793

**Unio tumidiformis* Castro, 1885

Family CYRENIDAE

‡*Corbicula fluminea* (O.F. Müller, 1774)

First reported from the Iberian Peninsula in 1981 from the estuary of the Rio Tejo in Portugal (MOUTHON, 1981, misidentified as *C. fluminalis*). SOUSA (2005) recorded it living at high densities in the Rio Minho estuary. Its subsequent rapid spread throughout the

main rivers of Portugal is documented by REIS (2006: 114), OLIVEIRA (2009: 35) and OLIVEIRA ET AL. (2010: 42-43).

Family SPHAERIIDAE

Taxonomic treatment is based on the molecular-phylogenetic study by LEE & Ó FOIGHIL (2003).

Euglesa casertana (Poli, 1791)

ALBA ET AL. (2011: 57-58) review recent work that has subdivided the genus *Pisidium* on the basis of either morphological or molecular characters. LEE (2004) noted that phylogenetic trees based on molecular-genetic data indicate a paraphyletic *Pisidium*, whereas trees based only on morphological data suggest it is a derived monophyletic clade. The phylogeny from the molecular study by LEE & Ó FOIGHIL (2003) produced more synapomorphies to inform reconstructions than the phylogenies based on morphological data. Therefore it was used as the basis of a revised generic classification that subdivides *Pisidium* into several genera e.g. by ALBA ET AL. (2011: 67) and GARGOMINY ET AL. (2011). Although a broad traditional treatment of *Pisidium* has often been retained without discussion (e.g. KILLEEN, ALDRIDGE & OLIVER, 2004; ARAUJO, [2018]; WELTER-SCHULTES, 2012: 18-23) the molecular evidence shows this should be avoided as it results in the genus *Pisidium* being paraphyletic.

LEE & Ó FOIGHIL (2003) recognised *Cyclocalyx* Dall, 1903 as a distinct clade within *Pisidium* s. l. GARGOMINY ET AL. (2011: 365, note 196) pointed out that the genus name *Euglesa* Jenyns, 1832 has priority. The genus includes *Pisidium* subgenera *Cingulipisidium* Pirogov & Starobogatov, 1974, *Cyclocalyx* Dall, 1903, *Henslowiana* Fagot, 1892 (syn. *Tropidocyclus* Dall, 1903) and *Pseudeupera* Germain, 1909 of the CLECOM list (BANK ET AL., 2001).

Syn. *Pisidium casertanum* (Poli, 1791) of REIS (2006: 89).

Euglesa henslowana (Sheppard, 1823)

Syn. *Pisidium henslowanum* (Sheppard, 1823) of REIS (2006: 93).

Euglesa milium (Held, 1836)

Syn. *Pisidium milium* Held, 1836 of REIS (2006: 97).

Euglesa nitida (Jenyns, 1832)

Syn. *Pisidium nitidum* Jenyns, 1832 of REIS (2006: 101, author was misspelled as Jennyns there).

Euglesa obtusalis (Lamarck, 1818)

Syn. *Pisidium* (*Cyclocalyx*) *obtusale* (Lamarck, 1818) of FALKNER ET AL. (2002: 57).

Pisidium barbozanum "Castro" LOCARD, 1899 (p. 210) with type locality "Pavoa de Varzim" (= Póvoa do Varzim) was incorrectly assigned by NOBRE (1941) to *P. casertanum* var. *henslowianum* (= *E. henslowana*). It was reidentified by FAVRE (1943) as *P. obtusale* on the basis of specimens in the Bourguignat Collection. REIS (2006: 120) suggested the possibility of error over the locality or provenance of the specimens studied by FAVRE (1943). However, KUIPER (1960) also reidentified specimens in the Locard Collection studied by José Da Silva e Castro (perhaps syntypes) as *Pisidium obtusale* except for one specimen of *P. milium*. Since this Holarctic species ranges southwards to Spain and Corsica there does not appear to be an overwhelming reason to doubt that the locality in Douro Litoral was correct.

Euglesa personata (Malm, 1855)

Apparently rare in Portugal, our only record, in 2014, was from a small pond with concrete walls in Jardim Botânico, Coimbra (Beira Litoral) (29T 05492/44508), CGAH (site 2014.P354).

Syn. *Pisidium personatum* Malm, 1855 of REIS (2006: 105).

Euglesa subtruncata (Malm, 1855)

Syn. *Pisidium subtruncatum* Malm, 1855 of REIS (2006: 109).

Pisidium amnicum (O.F. Müller, 1774)

WELTER-SCHULTES (2012: 18) noted that I.C.Z.N. Opinion 336 regarding the type species of *Pisidium* being designated by Gray, 1847: 185 as *Tellina amnica* Müller, 1774 is untenable.

Instead, the type species should be regarded as having been fixed as that species under the plenary powers.

REIS (2006: 85) summarised the Portuguese records.

Sphaerium corneum (Linnaeus, 1758)

REIS (2006: 77-78) summarised Portuguese records. *S. nucleus* (S. Studer, 1820) and *S. ovale* (A. Férussac, 1807) are now treated as distinct species from *S. corneum* (KORNIUSHIN & HACKENBERG, 2000: 52-53, 70-71; FALKNER, 2000: 32-34; KILLEEN *ET AL.*, 2004: 64-67). FALKNER *ET AL.* (2001: 68-69) also separated these taxa in Subgenus *Nucleocyclus* Alimov & Starobogatov, 1968 but the subgenus was not recognised by LEE & Ó FOIGHIL (2003) or GARGOMINY *ET AL.* (2011). *S. nucleus* was reported from Portugal by LOCARD (1899: 204) but the identification may be questionable and the segregate species would probably not have been distinguished with most of the other old Portuguese records. *S. corneum* was assigned to subgenus *Sphaerium s. s.* by LEE & Ó FOIGHIL (2003).

Sphaerium lacustre (O.F. Müller, 1774)

REIS (2006: 77-78) summarised Portuguese records. Sometimes separated in genus *Musculium* Link, 1807, which was treated as a subgenus by LEE & Ó FOIGHIL (2003).

ALPHABETICAL LIST OF ADDITIONAL SPECIES WITH UNCONFIRMED OR ERRONEOUS REPORTS FROM MAINLAND PORTUGAL

Abida secale (Draparnaud, 1801) - MORELET (1845: 74) and SILVA (1872: 63) apparently used the name *Pupa secale* (Draparnaud) in error for the species later described as *Chondrina lusitanica*.

Anisus vortex (Linnaeus, 1758) - LOCARD (1899: 180) reported *Planorbis vorticosus* from "Le Douro à Porto" with *Helix vortex* Linnaeus, 1758 listed as a synonym. There have been no other reports from Portugal and the species is rare in Spain (Prov. Madrid, supported by a specimen collected from río Man-

zanares in 1892, but recent surveys have failed to relocate the species which may now be extinct in the region: SOLER *ET AL.*, 2006: 221; an old report from Cataluña (GRAELLS, 1846) was regarded as doubtful by HAAS, 1929). Unless Locard's specimen can be located and checked it seems best to treat his record as unconfirmed. Several of the other *Planorbis* spp. listed for Portugal in the same work (LOCARD, 1899: 175-183) are also of uncertain identity.

Assimineia eliae Paladilhe, 1875 - A species described from La Rochelle and Bayonne (France), Golfe de Gascogne (Spain) and Coimbra (Portugal). AARTSEN (2008: 171) regarded it as unrecognisable because no types are known, although other authors have used the name in error for *Paludinella littorina* (Delle Chiaje, 1828). However, BREURE & AUDIBERT (2017: 32) have recently reported the existence of syntypes from France at UM.PDL and these are being studied by Prof. S. Gofas (*in litt.*) and collaborators.

Candidula unifasciata (Poiret, 1801) - MORELET (1845: 63) reported *Helix candidula* Férussac from "environs de Montémoro [probably Montemor-o-Velho], dans la province de Beira", but presumably some other species of *Candidula* (now mainly *Xeroplexa*) was involved. MATOS (2014: 204-205) accepted a few Portuguese records, but we reidentify her fig. 166 (from Coimbra) as *Xeroplexa* cf. *olisippensis* and figura 167 (of "*Helicella rugosiuscula* Michaud" from Barreiro) as either *Microxeromagna lowei* or *Xerotricha conspurcata*. CADEVALL & OROZCO (2016: 715) do not accept any Iberian records of *C. unifasciata*, although it possibly occurs in the Pyrenees, since it is widespread on the French side.

Carychium minimum O.F. Müller, 1774 - See the account of *C. ibazoricum* above. All of the shell samples from mainland Portugal checked by the authors have proved to be *C. ibazoricum* when the parietal lamella was studied, including numerous tumid and almost smooth shells initially identified as *C. minimum*.

Columella edentula (Draparnaud, 1805) - This appears to be one of several nominal taxa still being incorrectly recorded or mapped for mainland Portugal that were listed by NOBRE (1941) but have subsequently been split taxonomically, with only a different segregate species really being present. In this case, *C. aspera* Waldén was described in 1966 and all of our numerous records of the genus in mainland Portugal are of that species. Hence, records of "*Columella edentula*" from Portugal from before 1966 were almost certainly referable to *C. aspera* so that *C. edentula* s. s. is apparently unknown here

Corbicula fluminalis (O.F. Müller, 1774) - REIS (2006: 120) noted that the first reports of *C. fluminea* from the R. Tejo were erroneously listed as this sp.

Dreissena polymorpha (Pallas, 1771) - CASTRO (1873: 245-246) found it in abundance on the banks of the R. Douro at Porto, following a severe flood, with an enormous quantity of "*Vivipara fasciata*". LOCARD (1899: 287, 288) cited records as *Dreissena fluviatilis* and *D. occidentalis*. Castro initially thought the shells might have arrived there amongst ballast from English naval ships. However, he subsequently thought this unlikely because some *Viviparus* had byssus of *Dreissena* attached, as did a perfectly preserved "*Unio batavus*" and two small *Dreissena* shells had the periostracum intact. There have apparently been no subsequent reports. REIS (2006: 120) discounted the records.

Ecreobia ventrosa (Montagu, 1803) - A widespread species of Hydrobiidae occurring in brackish water, along Atlantic coasts from Great Britain southwards to SW. Spain and around the Mediterranean (GOFAS, MORENO & SALAS, 2011; OSIKOWSKI ET AL., 2014). Its occurrence in the Bay of Cádiz is confirmed by molecular data (OSIKOWSKI ET AL., 2014: 480), although the species is restricted to the innermost facies and very rare (S. Gofas, *in litt.*). Judging from its overall range and habitat preferences it is likely to occur in Portugal, but old reports (e.g. NOBRE, 1886: 354, 1938-1940: 799A) need confirmation

because *Hydrobia glyca* (Servain, 1880) was not recognised. The account by MATOS (2014: 39) is also confused because *Turbo stagnalis* Baster, 1765 is listed as a synonym, a taxon now usually treated instead as a synonym of *Heleobia stagnorum* (Gmelin, 1791). However, her figure (MATOS, 2014: 41, fig. 19) of a shell named as *Hydrobia stagnalis* (Baster) is not convincingly identifiable as representing either *E. ventrosa* or *H. stagnorum*.

Elona quimperiana (A. Férussac, 1821) - Listed for Portugal by Bourguignat (in HIDALGO, 1891, 1897-1909; in LOCARD, 1899), without details, but regarded as an error by PUENTE & ALTONAGA (1995: 93) because of the absence of subsequent records. Nevertheless, the I.U.C.N. Red List (Accessed 8 Aug. 2018) states "the species is also present in a very narrow line over the north-western Portuguese border (BANK ET AL. 2006, GÓMEZ-MOLINER & MADEIRA 2012)." An earlier version of the I.U.C.N. Red List (GÓMEZ & SEDDON, 2012) still available online on 8 Aug. 2018, made conflicting statements within the same document in a PDF: "possibly in Portugal", "it is also found in Portugal", and "Although Fauna Europaea (BANK ET AL. 2006) cite the species from Portugal the distribution for OSES ET AL. (2011) suggests that it does not extend much over the border." Although the species is not unlikely to extend its range southwards from Galicia into Portugal, unless confirmed records of it living in Portugal are published it should be excluded from the national list. Empty shells from along the R. Minho where it forms the frontier will not suffice.

Gittenbergia sororcula (Benoit, 1859) - Listed for Portugal (Sintra) by PALAZZI (1988: 17), but unconfirmed and probably an error. GITTENBERGER (1989) suggested that misidentified *Plagyrona placida* was involved, but other possibilities include the rather similar *G. angusta* named subsequently, or *Paralaoma servilis*.

Helicopsis striata (O.F. Müller, 1774) - SILVA (1871a: 192) reported *Helix striata*

Drap. as occurring from Porto to Lisbon, probably referring to *Xeroplexa* sp. or spp.

Lymnaea acutalis Morelet, 1845 - Described by MORELET (1845: 83, pl. 8, fig. 1) with TL "vallon de Collarès, à une lieue à l'ouest de Cintra"; the genus was misspelled *Limnea* in the original. BREURE *ET AL.* (2018: 194, fig. 20) figured a syntype from NHMUK and noted that the name was considered a junior subjective synonym of *Lymnaea fontinalis* S. Studer, 1820 by KANTOR *ET AL.* (2010). The published figures suggest *Radix* cf. *auricularia* or *Radix* cf. *balthica* may be involved. Our discussion of these taxa above notes that they may not be consistently distinguishable from shell characters alone. Hence, identification of *L. acutalis* as one or another of the larger number of segregate species recognised by KANTOR *ET AL.* (2010) or as an independent Iberian species is likely to prove problematical.

Margaritifera auricularia (Spengler, 1793) - REIS (2006: 119) dismissed reports of this sp. from Portugal.

Parnacella deshayesi Moquin-Tandon, 1848 - WIKTOR (1983: 83) suggested this sp. may occur on the Iberian Pen., but confirmed records are only from Morocco and Algeria.

Planorbarius corneus (Linnaeus, 1758) - MORELET (1845: 78) apparently reported *P. metidjensis* under this name and later corrected his error (MORELET, 1877: 248-249, 260). See also above under *Helisoma duryi*.

Planorbis agraulus Bourguignat, 1864 - MATOS (2014: 74, 77, fig. 53) accepted two old records from the coast of Baixo Alentejo as this species. However, its TL is "Environs de Mostaganem" in N. Algeria (BOURGUIGNAT, 1864, vol. 2: 159) and there is continuing uncertainty about the extent of its wider range and relationships to other nominal species. GIUSTI (1968: 243) used the name *Gyraulus agraulus* for specimens from Montecristo, Sicily, Sardinia and Argentario, but GIUSTI, MANGANELLI & SCHEMBRI (1995: 184) reidentified them as *Planorbis moquini* Requier, 1848 (TL Corsica) and added records from Malta.

GLÖER & BOUZID (2008) redescribed *P. agraulus* based on Algerian material, concluding that "*P. agraulus* is not a synonym of *P. moquini*, if the *Planorbis* sp. in Italy is conspecific with *P. moquini* in fact". GLÖER & ZETTLER (2009) redescribed *P. moquini*, and argued that populations outside Corsica should be classified as different species, although WELTER-SCHULTES (2012: 69) noted they "did not provide arguments to substantiate this statement". Studies of new Portuguese specimens based on shells and genital anatomy are needed, but satisfactory conclusions regarding their identity may depend on wider research on the taxa occurring in Iberia and the W. Mediterranean basin.

Pupilla muscorum (Linnaeus, 1758) - *Pupa muscorum* variety α as published by Draparnaud, 1806 is conspecific with *Truncatellina cylindrica* (A. Férussac, 1821); NOBRE (1941: 152) treated it in the same sense as *Vertigo muscorum* (Draparnaud) in his *Secç. Isthmia*. Although MORELET (1845: 74) recorded "*Pupa muscorum* Draparnaud" from "l'Algarve et le Trás-os-Montes, où il est beaucoup plus répandu" it is likely that *Truncatellina* was intended. SILVA (1872: 63) also listed *Pupa muscorum* (Pfeiff.) from the Algarve, presumably meaning *Pupilla muscorum* (Linnaeus), but mentioned that he could not confirm its existence in Portugal; LOCARD (1899: 152) and NOBRE (1941: 146-147) also cited only a few records. However, MATOS (2014: 116-117) mapped 14 modern records from hectads in Portugal, but illustrated *Pupilla muscorum* (Linnaeus) (fig. 87 on p. 117) with a misidentified *Lauria cylindracea*. CADEVALL & OROZCO (2016: 174) likewise record and map *Pupilla muscorum* over C. and N. Portugal. Since we have found *L. cylindracea* to be a common species over much of mainland Portugal, but have never found *Pupilla muscorum*, the latter seems best removed from the Portuguese list until a definite record is obtained.

Sphaerium rivicola (Lamarck, 1818) - Cited by LOCARD (1899: 203) as *Sphaerium rivicola* and *S. gallicum* Bour-

guignat from “Le Douro à Porto” (Foz do Douro), a record supported by two shells from the collection of Da Silva e Castro in the Porto Museum. REIS (2006: 119) suggested these shells may have been transported to the R. Douro with ship’s ballast, possibly like the *Dreissena polymorpha* reported there.

Succinea putris (Linnaeus, 1758) - Old records of shells of Succineidae were accepted as this species by MATOS (2014: 98), but distinctions from *Oxyloma elegans* based on shell characters are often unreliable. To be fully acceptable, Portuguese records should therefore be confirmed by study of the distal genitalia.

Testacella haliotideae Draparnaud, 1801 - Listed by HIDALGO (1875: 218), who was cited by MORELET (1877: 252, 259); an error according to MATOS (2004: 52, 102).

Truncatellina cylindrica (A. Férussac, 1807) - The old records (MORELET, 1845: 74; NOBRE, 1913: 243-244) almost certainly refer mainly if not entirely to misidentified *T. callicratis* (*q. v.*) as do at least some modern ones (e.g. TORRES & OLIVEIRA, 2010: 32). It was also listed by PILSBRY (1921: 67) and ALTONAGA ET AL. (1994: 211) map all Portuguese records of the genus as this sp., but this is surely incorrect. Critical revision of Iberian records (HOLYOAK ET AL., 2012) has shown that edentate or weakly toothed forms of *T. callicratis* appear to have often been misidentified as this sp., for which the southernmost confirmed record was from the French Pyrenees. A possibility remains that a few shells from Bragança (Trás-os-Montes e Alto Douro) represent *T. cylindrica*, but this needs confirmation (HOLYOAK ET AL., 2012: 33).

Unio wolowichii Morelet, 1845 - Named as *Unio wolowichii* MORELET, 1845 (p. 105, pl. 13, fig. 1), with TL eaux de la vallée du Tage, entre Villa-Nova [= Vila Nova da Rainha] et Azambuja; synonym *Unio littoralis* of Sowerby, *Conch. iconica*, no. 98, as synonym (non *U. littoralis* Cuvier, 1798). JOHNSON (1971: 97) selected a lectotype (NHMUK 1893.2.4.1962), which is figured and dis-

cussed by BREURE ET AL. (2018: 485, figs 1282, 1283); a second specimen in NHMUK became a paralectotype. The latter authors illustrate one of two “original” labels in which Morelet wrote “L’espèce est probablement du Brésil. Il est certain qu’elle est étrangère au Portugal” This label was presumably added after publication of the protologue. Later, MORELET (1877: 251) commented that the taxon is certainly not from Portugal, and that it shows characters of an Australian shell. The published epithet *wolowichii* appears to be an uncorrected error for *welwitschii*, since the “original label” also states “Mr Welwitsch/ M Gassies” (BREURE ET AL., 2018: 485, fig. 1283). RUIS (2006: 119) also mentions the recent discovery of another specimen in the Museum do Instituto Zoológico Dr. Augusto Nobre at Porto, obtained on Timor, reinforcing the theory that it originated from the East Indies or Australia.

Vallonia enniensis (Gredler, 1856) - Tentative records from Coimbra and Porto were given by OLIVEIRA (2010: 42, 44, 46). The three shells from Porto were associated with six of *V. pulchella* including at least one showing intermediate characters. We have collected *V. pulchella* from a fen habitat near Mira (Beira Litoral), with shells having strongly developed growth ridges recalling characters regarded as diagnostic of *V. enniensis*. The monograph by GERBER (1996: 60-68) maintained *V. enniensis* as a valid species widespread in the W. Palearctic, but in Iberia confirmed only from NE. and S. Spain, with none from Portugal. However, KORTE & ARMBRUSTER (2003) present molecular data implying that this taxon is weakly differentiated from *V. pulchella*.

Vallonia excentrica Sterki, 1892 - MATOS (2014: 111) gives records for W. and S. mainland Portugal, some of which also appear on the map by CADEVALL & OROZCO (2016: 164). However, the thorough monograph by GERBER (1996) gives no records in mainland Portugal or neighbouring districts of Spain and the species is not represented among numerous collections we have

made here. The shell illustrated as that of *V. excentrica* by MATOS (2014: 109, fig. 83) is a misidentified *V. costata*.

Vertigo substriata (Jeffreys, 1833) - PROSCHWITZ (2004: 413) noted that a report from Porto by MORELET (1877: 257) was regarded as unreliable by subsequent authors. JAECKEL (1962: 85) lists S. Portugal, but the origin of this report is unknown.

Viviparus viviparus (Linnaeus, 1758) - Old records listed for Setúbal, Pôrto (Porto) and S. Martinho do Pôrto (São Martinho do Porto) by NOBRE (1941: 219) were stated to be of uncertain significance, perhaps based on temporary introductions. However, CASTRO (1873: 245-246) reported shells in enormous quantity on the banks of the R. Douro after a severe flood. He also mentioned that J. Allen had found the species on the banks of the R. Douro ten years earlier and that the Lisbon Museum had shells from this locality. CASTRO (1873: 246) noted that Morelet saw his *Paludina achatina* only in a collection of Portuguese molluscs and that the locality suggested ("quelque marécage de l'Alemtejo") is more than problematical. REIS (2006: 119) suggested that shells of *Dreissena polymorpha* (abundant) and *Sphaerium rivicola* found in the R. Douro in the nineteenth century may have arrived there with ships' ballast; the same may also be possible for the *Viviparus*.

Zonitoides excavatus (Alder, 1830) - There is no reliable record from Portugal. The figure attributed to it of a shell from Adémia-de-Baixo, Coimbra by MATOS (2014: 161, fig. 125) clearly represents *Z. nitidus* (*q.v.*). A report from Sintra by PALAZZI (1988: 18) (erroneously noted and mapped as from Buçaco by Matos, *loc. cit.*) seems best regarded as unconfirmed since the species listed in his paper include several that appear improbable (GITTEBERGER, 1989). The only other report mapped by MATOS (2014: 163) in 29SNC18 is not accompanied by any detailed published information. Nevertheless, *Z. excavatus* seems likely to occur at least in the far north of main-

land Portugal since it is widespread in W. Galicia and approaches closely to the border with Minho (ONDINA *ET AL.*, 1995: 86); it should be sought in base-poor woodland habitats.

CONCLUSIONS

The present list accepts a total of 195 species as having been reliably recorded in mainland Portugal, a few of which can only be tentatively identified at present. The total includes 134 terrestrial species (109 snails, 25 slugs; 131 Pulmonata; 3 "prosobranchs"), 50 freshwater species (33 snails, 17 Bivalvia; the snails including 21 Pulmonata, 12 "prosobranchs"), 2 aquatic species more or less restricted to brackish-water and 9 strictly coastal species that are not aquatic. Among the terrestrial species, 10 (7.5%) are regarded as aliens, the remainder being native or ancient introductions; among freshwater species 8 (16%) are regarded as aliens, no introductions are known among the brackish-water and coastal habitat-groups. Based on existing knowledge, mainland Portugal has 22 (16.4%) of the terrestrial mollusc species and 7 (14%) of the freshwater species (all Hydrobiidae) endemic to the region. An additional 25 terrestrial species and 3 freshwater species are Iberian endemics. Taxa unrecorded for 40 years or more and presumed extinct comprise 1 terrestrial (*Succinella oblonga*) and at least 2 freshwater species (*Bathymphalus contortus* and *Bulinus truncatus*, but possibly others not seen living recently including *Hippeutis complanatus*, *Planorbis carinatus* and *Planorbis planorbis*), none of which were endemics.

The past decade has seen 42 additions to the list (21.5% of the total fauna, either newly discovered or rescued as almost forgotten synonyms), comprising 32 native and 10 introduced species. Of these, 16 were named new to science. A modest number of further additions are doubtless still likely to occur based on thorough searching as well as taxonomic scrutiny of the fauna, including application of molecular techniques.

There also seems no likelihood that the flow of additional alien species becoming established will decline.

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