

NOTES ON THE FRESHWATER MOLLUSCA OF MADEIRA INCLUDING RECORDS OF SPECIES NEW TO THE REGION

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With 1 figure

ABSTRACT. This paper presents a list of the freshwater mollusca of Madeira, following extensive collections in six of the island's major catchments. There are three new records for the Region, *Lymnae (Radix) peregra* (MÜLLER) var. *oblonga* JEFFR., *Physa fontinalis* L. and *Planorbis (Coretus) corneus* (L.), bringing the total number of freshwater mollusca species to nine. The species are predominantly palaeartic, presumably accidentally introduced to the Region.

RESUMO. Neste trabalho o autor apresenta uma lista de moluscos de água doce da Ilha da Madeira, resultantes de um programa de colheitas efectuadas em seis das mais importantes nascentes de água desta ilha. Das espécies recolhidas, três constituem novos registos para a região, *Lymnaea (Radix) peregra* (MÜLLER) var. *oblonga* JEFFR.; *Physa fontinalis* L. e *Planorbis (Coretus) corneus* (L.), ficando, deste modo, o número de espécies de moluscos de água doce conhecidos para a Madeira em nove.

As espécies são predominantemente paleárticas, presumivelmente introduzidas acidentalmente na ilha.

INTRODUCTION

The comprehensive works on Madeira's terrestrial and aquatic mollusca by CASTELLO DE PAIVA (1867), WOLLASTON (1878) and AUGUSTO NOBRE (1931) are well known. However, following these publications, there has been virtually no further work upon the aquatic mollusca, although the terrestrial mollusca are still very much under active investigation.

This paper reviews the aquatic mollusca present in the Region as well as their location's and distribution as a result of extensive collecting in the field through the

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Laboratório Regional de Engenharia Civil, Departamento de Recursos Naturais e de Hidráulica (LREC/DRNH) initiative to establish a biological monitoring Programme for the Island's surface waters.

METHOD

The rivers sampled were Ribeira de Machico, Ribeira de Santa Cruz, Ribeira de São João, Ribeira Brava, Ribeira Grande/Ribeira de São Vicente and Ribeiro Frio/ Ribeira de São Roque do Faial. Collections were made at monthly intervals over one year (1991) at selected sites along the aforementioned rivers. Kick samples were made into a standard hand-net (mesh 0.98mm) for a fixed period of time (5 minutes). Also, rocks and stones were hand sorted at the site. The collected invertebrates were placed in a plastic bag and sorted later on in the laboratory using a stereo microscope. Specimens were preserved in 70% ethyl alcohol.

The molluscs collected were identified to species level, a relatively easy task considering the paucity of freshwater fauna on Madeira. Specimens where identification was unclear were compared to collections housed at the Natural History Museum (BM(NH)), London in December 1993.

RESULTS

Hydrobidae

Amnicola

Pseudamnicola confusa (FRAUENFELD)

Cyclostoma simili Draparnaud, Hist. Nat. des Moll 34.pl.1.f.15 (1805)

Hydrobia similis Jeffr., Brit Conch. i 64; Paiva, Mon. Moll. Mad. 161 (1867); Watson, J. de Conch. p.224 (1876); Wollaston, Test Atlant., p.281.

Amnicola similis Drap., Nobre, Mol. Portugal, p.203, f.37, p.202, est. 8, f.25 (1930); Nobre, Mol. Ter. Fluv. Ag. Sal. Arq. Mad., p.190, f.92 (1931).

Pseudamnicola similis (Drap.), Stauder, Bol. Mus. Mun. Funchal 43 (235): 243-299, 191 1991.

February 1991: Ribeira São Roque do Faial: Lombo de Baixo; Faial. R. Santa Cruz: Village. R. São João: Penteadá & Muro de Coelho. Ribeira de Machico: Marços; Fazenda.

March 1991: R. de Santa Cruz: Pedra Mole. Ribeira de São Roque do Faial: Faial. R. de São João: São João. R de Machico: Marços; Fazenda; Torre.

May 1991: Ribeira Grande: Passo, Vila de São Vicente. R. Brava: Serra de Água. R. São João: São João. R. Machico: Marços.

July 1991: Ribeira São Roque do Faial: Lombo de Baixo. R. São João: Penteadá; São João. R. de Machico:, Marços; Fazenda.

September 1991: R. São João: Penteadá; São João. Ribeira Brava: downstream of abbatóir. Ribeira São Roque do Faial: Faial. R. Machico, Maroços; 25m upstream of river mouth.

November 1991: Ribeira São Roque do Faial: Faial.

The Swollen Spire Shell was described by PAIVA (1867) as common in Funchal, Rabaçal and the proximities of São Vicente. WOLLASTON (1878) collected specimens in the Funchal area, not specifying sites. NOBRE (1931) also collected in Funchal, at Pontinha from plants receiving runoff from a waterfall.

P. confusa is easily identifiable since it is the only operculate freshwater species in the Region. In T.T. Macan's key for the Freshwater Biological Association (1977) the whorls are described as "tumid", hence the name "Swollen Spire Shell". The shell is generally dull and dark brown in colour, compared to the lighter, more burnished appearance of *L. (G.) truncatula* with which it can be superficially confused if the operculum is missing. The aperture of *P. confusa* is much rounder than *L. (G.) truncatula*'s, which has a more "pear shaped", elongated aperture (see WOLLASTON 1878). *P. confusa* was collected from all the rivers sampled over the year generally at the lower sites.

Lymnaeidae

Lymnaea

Lymnaea (Galba) truncatula (MÜLLER)

Buccineum truncatulum, Müller, Verm. Hist.ii. 130 (1774).

Limneus minutus, Drap., Hist. Nat des Moll., 53.13. f. 5-7 (1805).

Limnaeus truncatulus Müller, Lowe, Proc. Zool. Soc. Lond. 218 (1854); Albers, Malac. mad. p73, est 16, f. 35-36.(1854).

Limnaea truncatula, Müller, Paiva, Mon. Moll Mader., p 146, (1867); Wollaston, Test. Atl., p.272 (1878); Nobre, Mol. Portugal, p.178, 12, f. 34-38 (1930); Nobre, Mol. Ter. Fluv. Ag. Sal. Arq. Mad., p.184, (1931); Stauder, Bol. Mus. Mun. Funchal 43 (235): 243-299, 191 1991.

February 1991: R. Santa Cruz: Pedra Mole. Ribeira do Machico: approx 25m upstream of river mouth.

March 1991: Ribeira São Roque do Faial: Lombo de Baixo.

May 1991: R. São Vicente: Passos. Ribeira São Roque do Faial: Lombo de Baixo. Ribeira de São João: Penteadá. R. Machico: 25m upstream of river mouth

July 1991: Ribeira São Roque do Faial: Lombo de Baixo; Faial. R. São João: Penteadá; Muro do Coelho; São João. R. Brava: village of R. Brava. R. Machico: Torre.

Sept. 1991: R. São João: Penteadá; Muro do Coelho; São João. R. Brava: downstream of abbatóir; Village of R. Brava. Ribeira São Roque do Faial: Faial. R. Machico: Maroços; Fazenda; Torre. Ribeira de São Vicente: village of São Vicente.

Distribution: Palaearctic (Illies, 1978).

This species was found at Pontinha, Ribéria de Santa Luzia, Ribeira dos

Socorridos, Ribeira de São João, Ribeira da Corujeira, R. de Pisão and Piornais, by PAIVA and WOLLASTON. NOBRE (1931) collected specimens from a spring at the mouth of R. dos Socorridos and from R. de Calheta and Chão das Feiteiras. STAUDER (1991) found a single specimen in Ribeira das Cales, a river above Funchal, in the splash zone and further specimens in Porto Moniz.

In the collections made by LREC/DRNH, *L.(G.) truncatula* (MÜLL.) was found to be widespread, but always occurred in low numbers. On the contrary WOLLASTON (1878) stated that the species "abounds" in nearly all the streams and levadas in the Region. T.T. MACAN (1977) described *L.(G.) truncatula* as very common in Europe.

Although it is not possible to quantify WOLLASTON'S findings and the present results, the possibility of a decline in the population of *L.(G.) truncatula* (MÜLL.) in the Region can be considered. This may be the result of competition, increasing scarcity, degradation of suitable habitats over time or the possible effect of aquatic pollution. *L.(G.) truncatula* (MÜLL.) is an intermediate host of the sheep liver fluke *Fasciola hepatica* (Digenea).

Lymnaea (Radix) peregra (MÜLL.) var *oblonga* (JEFFR.)

Limnaea (Radix) pereger (Müll.)

July 1991: R. de Machico: Fazenda; Torre.

September 1991: R. São João, Penteadá, Muro do Coelho, São João. Ribeira do Machico: Fazenda; Torre; 25m upstream of river mouth.

Distribution: Palaearctic (Illies, 1978).

This is the first record of *L.(R) peregra* in the Region. It is impossible to say when it was introduced, although DR. MARY SEDDON (pers. comm. 1993) claims that it is a possible escape from the ponds of the Quinta Magnolia (formerly the "Country Club") in Funchal.

The species exhibits considerable variation in shell morphology. ELLIS (1923) lists 23 varieties within the species based upon differences in shell shape. The specific characteristic of *L.R. peregra* is the extremely reduced or even absent spermothecal duct, an internal feature. The BM(NH) reference collection possesses a bewildering array of shell types for the species. The possibly local form collected in R. São João and R. de Machico is highly acuminate.

The shell is dextral and pale horn in colour, and slightly hyaline. The spire is relatively tall descending to a rapidly expanding body whorl. Longitudinal growth lines and spiral striae are discernible on the last body whorl towards the peristome. The margin of the peristome is simple and not reflected outwards. The whorls are not very tumid with high sloping shoulders tapering evenly towards the body whorl. The sutures are shallow and fine. The largest specimens collected are about 10mm in height.

The whorls of the Madeiran specimens were far less tumid and displayed coarser

striation towards the peristome than most of the forms housed in the British Museum reference collection. However, from J.W. TAYLOR'S extensive collection of *L.R. peregra*, the shell morphology of *L.R. peregra* var *oblonga* JEFFR. almost exactly matched the Madeiran form.

L.(R) peregra was collected from only two rivers during 1991. São João and Machico are both situated on the south of the Island in urban areas and are considerably enriched. The sites are all low lying. This suggests a very restricted and recent introduction(s). The species is described by T.T. MACAN (1977) as the "commonest and most abundant species" regarding the European soft water mollusc groups. It would be interesting to follow the distribution of the specie.

Physidae

Physa acuta Draparnaud

Physa acuta, Drap. Hist. Nat. 55 t3. f 10,11 (1805).

Physa fontinalis, Paiva Mon. Moll. Mad, 147 (1867).

Physa acuta, Watson, J. de Conch. 224 (1876); Wollaston, Test. Atlant. p273, (1878); Nobre, Mol. Portugal p.196, f.33; est 13, F. 33-36 (1930); Nobre, Fauna Açores, p.98 (1930); Nobre, Mol. Ter. Fluv. Aguas Sal. Do Arq. Mad., p.188 (1931).

Feb. 1991: R. Santa Cruz: village. Ribeira de São João: São João.

March 1991: R. Santa Cruz: village. Ribeira São Roque do Faial: Faial. Ribeira de São João: Muro do Coelho; São João.

May 1991: R. Santa Cruz: Pedra Mole. Ribeira de São João: Penteada; Muro do Coelho; São João.

July 1991: Ribeira São Roque do Faial: Faial. Ribeira de São João: Penteada; Muro do Coelho; São João. R. Machico: Fazenda; 25m upstream of river mouth.

Sept. 1991: Ribeira de São João: Penteada; Muro do Coelho; São João. R. Brava: village of R. Brava.

Ribeira São Roque do Faial: Faial. R. Machico: Maroços; Fazenda; 25m upstream of river mouth. R. São Vicente: Passos.

Distribution: Palaearctic except Boreal Highlands, Tundra, N. Sweden and Taiga (Illies, 1978).

According to both WOLLASTON (1878) and NOBRE (1931), CASTELO DE PAIVA (1867) mistakenly identified *P. acuta* Drap. as *P. fontinalis* L. from specimens collected at R. dos Socorridos and R. de Gonçalo Aires. WOLLASTON (1878) collected *P. acuta* from streams and water tanks around Funchal, commenting upon the extreme variability in size. Nobre (1931) collected *P. acuta* from R. São João near Santo António, R. Santa Luzia, and a spring at the mouth of R. dos Socorridos.

Physa acuta is a Mediterranean species, and may have been introduced along with imported aquatic plant material. It is abundant and widespread in the Region's rivers.

It was particularly abundant during the Summer in rivers with a considerable organic load. Almost 2000 specimens were collected in a 3 minute sample from R. São João in September 1991. There is some slight variation in the shell shape of *P. acuta* collected in the Region. The classical form exists, with the angular "shoulders" of the last whorl and the aperture jutting out at an angle to the last whorl. There also exists a more acuminate form, which at first, appears to be similar to *Physa fontinalis* L. in that it lacks the angular appearance of the previously described form. However, the pointed apex is inconsistent with that of *P. fontinalis* and the shape of the aperture is similar to *P. acuta* rather than *P. fontinalis*.

Physa fontinalis (L.)

July 1991: Ribeiro Frio: Ribeiro Frio. Ribeira São Roque do Faial: Lombo de Baixo.

Sept. 1991: Ribeira Brava: downstream of abbatoir; village of R. Brava.

Distribution: Palaearctic except N. Africa, Hellenic Western Mountains (Balkans), Iceland, Tundra and Asia Minor (Illies, 1978).

A new record for the Region, if PAIVA'S (1867) original description is regarded as a misidentification of an acuminate form of *P. acuta* L. *P. fontinalis* L. is smaller (height approx. 12mm; width approx. 6-7½ mm) than *P. acuta* with a more fragile, elegant appearance. The shell is more lustrous and in profile the outline of the aperture is continuous with the spire of the shell, compared to *P. acuta*. The apex of *P. fontinalis* L., is flattened in contrast to *P. acuta*.

Physa fontinalis L. is not as common or as widespread as *P. acuta*, generally collected singly, especially at Ribeiro Frio. These specimens may have been introduced via the trout hatchery upstream, stocked with *Salmo gairdneri* RICHARDSON 1836, an introduced species. However, 54 specimens were collected from Ribeira Brava in September 1991.

Planorbidae

Gyraulus parvus (SAY, 1817)

Planorbis albus, Müller Verm. Hist., ii, p.164, n° 350 (1774)

Planorbis parvus Say, Nicholson's Encyclopedia 1st Ed. pl.1 fig 5. (1817).

Planorbis (Gyraulus) laevis, Alder Trans. Newcast.ii. 337.

Planorbis glaber, Jeffr., Trans. Linn. Soc. Lond. xvi 387; Paiva, Mon. Mon. Moll.Mad. 149(1867); Watson, J. de Conch. 224. (1876); Wollaston, Test. Atl. p.273 (1878).

P. albus, Müller- Nobre, Mol. Portugal p.180, f.28,est.13, f. 12-18 (1930).

P. albus, Nobre, Mol. Ter. Fluv. Ag. Sal. Arq Madeira p.186 (1931).

Gyraulus parvus, Müll., Stauder: Bol. Mus. Mun. Funchal, 43 (235): 243-299.(1991).

Feb. 1991: Ribeira São Roque do Faial: Faial. R. Santa Cruz: Pedra Mole; Village of Santa Cruz. R. Machico: Maroços; 25m upstream of river mouth.

March 1991: Ribeira São Roque do Faial: Lombo de Baixo; Faial. R. Santa Cruz: Levada da Serra do Faial; Pedra Mole; village of Santa Cruz. Ribeira Grande: Ribeira Grande. R. São João: São João. R. Machico: Marçoços; Fazenda; Torre; 25m upstream of river mouth.

May 1991: Ribeira São Roque do Faial: Lombo de Baixo; Faial. R. Santa Cruz: Cabeço Gordo; Pedra Mole. R. São João: Penteadá; São João. R. Brava: Serra de Água; village of R. Brava.

R. Grande: R. Grande. R. São Vicente: Passos. R. Machico: Marçoços; Fazenda; Torre; 25m upstream of river mouth.

July 1991: R. Frio at Ribeiro Frio. Ribeira São Roque do Faial: Lombo de Baixo; Faial. R. São João: Penteadá; Muro do Coelho; São João. R. Brava: Serra de Água; downstream of abbatoir; village of R. Brava. R. Machico: Marçoços; Fazenda; Torre; 25m upstream of river mouth.

Sept. 1991: R. Santa Cruz: Cabeço Gordo; Levada da Serra do Faial; Santo António da Serra. R. Grande at Ribeira Grande. R. São Vicente: Passos; village of São Vicente; 15 upstream of beach.

R. São João: Penteadá; Muro do Coelho; São João. R. Brava: downstream of abbatoir; village of R. Brava. Ribeira São Roque do Faial: Lombo de Baixo; Faial. R. Machico: Marçoços; 25m upstream of river mouth.

Distribution: origin N. America, found as an introduced exotic on Central Sub-Alpine Mountains and Iceland, both in the Palaearctic Region (Illies, 1978).

There appears have been some confusion over this species in the Region. WOLLASTON (1878) identified the species as *P. glaber*, JEFFR. (= *P. laevis*, ALDER) stating that the species had become established in streams and tanks in the Funchal area, having been introduced from mainland Portugal. WOLLASTON found that the shell of *P. glaber* collected in Madeira was identical to those of specimens collected by DR. BOCAGE (Lisbon Museum) in mainland Portugal, where it was described as occurring "abundantly". Wollaston commented upon the unusual "faint traces of spiral striae" found in one of the specimens collected in the Region. This feature occurred extremely rarely in specimens from LREC/DRNH's collections.

NOBRE (1931) identified the specimens he collected in R. de São João near Santo António, R. de Santa Luzia and in mainland Portugal as *Planorbis albus* MÜLLER, in his opinion conspecific with *P. glaber* since he considered JEFFREY'S description of the latter insufficient to separate it from the former. Like WOLLASTON, NOBRE found that specimens from Madeira matched those from the mainland.

His description (translated) is as follows: "a small shell, discoid, fragile and slightly depressed on the upper surface; sometimes hyaline, sometimes covered by an opaque epiderm; slightly transparent; the spiral is formed by three or four whorls, with decorated with extremely fine transverse striae and less numerous spiral striae that are more distinct on the last whorl; the umbilical cavity is very deep; Aperture oblique and slightly oval; the peristome is simple; colour, light yellow or rust coloured, slightly hyaline in some individuals, especially younger specimens. Diameter, 5mm, height 1-1½ mm."

STAUDER 1991, identified the species of Planorbidae she collected as *Gyraulus parvus* (O.F. MÜLL) (sic). However, no reference, source or description is given beyond

a personal communication with DR. MEIER-BROOK dated 1989, who presumably identified the collected material. Previous collections and authors are not mentioned.

CLAUS MEIER-BROOK (1983) considers *G. parvus* and *G. laevis* to be sibling species, listing many common characteristics but only one characteristic unique to *G. parvus*, namely the changing width of the vas deferens. Other "character states" of *G. parvus* mentioned by MEIER-BROOK are the strongly sunken and deflected nature of the last and inner whorls and the raised penultimate whorl. *G. parvus* is a widespread North American species that, MEIER-BROOK postulates, was recently introduced to Europe with plant material. STAUDER (pers. comm 1993) postulates, that *Gyraulus parvus* may have been brought to Madeira from Central Mediterranean region where it was introduced in the 1940's and is now established.

Based upon MEIER-BROOK'S observations of the similarity between *G. parvus* and *G. laevis*, it is also possible that the specimens collected by PAIVA (1867) and WOLLASTON (1878) of what they considered *P. glaber* (= *G. laevis*), are in fact misidentification of the sibling species, *G. parvus* (SAY). Thus, *Gyraulus parvus* (SAY) may have been introduced to Madeira over 100 years ago.

Many specimens collected in the course of this study have been compared to the descriptions given in the Freshwater Biological Association's key (MACAN 1977) and MEIER-BROOK'S (1983) description of *G. parvus*. A selection of specimens was compared to the British Museum reference collection in December 1993.

The Madeiran specimens are dissimilar to *P. albus* (sensu strictu) in that the spiral striae so commonly found in the latter species are absent in all but a few of the former examples. The reference collection specimens possessed heavy spiral striae. When striae are found on Madeiran specimens (extremely rarely), they are very weak, occurring on the last whorl of the shell. The only consistent form of shell sculpture is the transverse growth lines. The aperture of specimens observed is quite large and rounded, meeting the preceding whorl at an obtuse angle, a similar feature to *P. albus*. However, in the reference collection of *P. albus*, the body whorls were consistently flatter and wider. The umbilicus was also far shallower than the Madeiran specimens.

The shell of the Regional specimens is almost invariably a light horn colour, and slightly transparent although occasionally dull white specimens do occur. Almost all the white coloured shells collected were dead, damaged or decomposing specimens. All the specimens examined in the British Museum reference collection were dull white in colour. This amalgamation of features leads the author to conclude that the Madeiran species is not *P. albus*.

When the Madeiran specimens were compared to the reference specimens of *Planorbis parvus* (SAY) (= *Gyraulus parvus*) and compared to MEIER-BROOK'S observations (1983), the following features in shell morphology were found to be identical; the small size of the shell, the simple sculpture of close transverse growth lines, the deep umbilicus on the upper side, the elevated nature of the underside of the

penultimate whorl.

***Planorbis (Coretus) corneus* (L.)**

Planorbis corneus L.

July 1991: R. São João: São João

September 1991: R. São João: São João.

Distribution: Palaearctic.

This is another new record and undoubtedly the largest freshwater mollusc in the Region. Distribution seems to be limited to only one river, indicating, like *L. (R.) peregra*, a recent introduction.

The discoid shell is very large and can reach 28 mm in diameter and approx. 12 mm in height (see T. T. MACAN 1977). The shell sculpture is made up of heavy transverse growth lines, making the shell slightly rough to the touch. The aperture is easily eroded, and thus may be quite uneven and "ragged" in appearance. Shell colour ranges from dark to olive brown.

P. (C.) coretus L. has been collected only from R. São João, probably the most continuously polluted river sampled during this study. ANTÓNIO DOMINGOS ABREU of the Funchal Municipal Museum has also collected specimens from the same stretch of the river (pers. comm. 1993). It is thus quite interesting to speculate as to how it was introduced to this river.

DR. MARY SEDDON of the National Museum of Wales, suggests as in the case of *L. (R.) peregra* (pers. comm. 1993), that *P. (C.) coretus* L. escaped from the pond or tanks in Funchal where it was probably introduced with aquatic plant material for ponds and aquaria. The margins of R. São João are heavily populated and the dumping of rubbish into the river is an unfortunately common occurrence. There are also numerous drains discharging into the water course. These factors may have resulted in the inadvertent introduction of *P. (C.) coretus*.

Ancylidae

***Ancylus fluviatilis* MÜLLER**

Ancylus fluviatilis Müller, Verm. Hist., ii, p.201, n°386 (1774); Paiva, Mon. Moll. Mad. p.148 (1867)

Ancylus aduncus Gould, Albers Malac. mad., p.74, est 16 (1854).

Ancylus striatus Quoy & Gaimard, Wollaston, Test. Atlant. p.274 (1878).

Ancylus fluviatilis Müller, Nobre Mol. Portugal, p.167, f.21-22 (1930); Nobre Mol. Ter. Fluv. Ag. Sal. Arq Madeira p.186 (1931); Stauder Bol. Mus. Mun. Fun. 43 (235): 243-299. (1991).

Feb. 1991: R. Brava: village of R. Brava. R. Machico: Fazenda.

March 1991: R. Santa Cruz: Levada da Serra do Faial; Pedra Mole.

May 1991: R. São Vicente: São Vicente. R. de Machico: Maroços; Fazenda; Torre.

July 1991: Ribeira São Roque do Faial: Lombo de Baixo. R. São João: São João. R. Brava: downstream of abattoir; village of R. Brava.

Sept. 1991: R. Grande: R. Grande. R. São Vicente: São Vicente; 15m above beach. R. Brava: downstream of abattoir; village of R. Brava. R. Santa Cruz: Cabeço Gordo. R. São João: Penteada; São João. Ribeira São Roque do Faial: Lombo de Baixo. R. Machico: Maroços; Fazenda; 25m upstream of river mouth.

Distribution: Palaearctic.

WOLLASTON found what he called *Ancylus striatus* occurring extremely abundantly in the streams of mid to high altitude, again not specifying sites. Wollaston commented upon the difference in sculpture between the local forms (stronger, more spaced striae) he collected in the Region and examples from more "Northern" (sic) areas, concluding albeit tentatively, that the *Ancylus* sp. from Madeira was probably a local form of the European *fluviatilis* sp.

NOBRE'S (1931) findings were contrary to WOLLASTON'S. He concluded that there was no difference between the Madeiran form and the continental form, identifying them both as *A. fluviatilis*. Comparisons of LREC/DRNH'S collections with the BM(NH) reference collection also reveal no difference between Madeiran and continental forms. STAUDER (1991) found *A. fluviatilis* in Ribeira das Cales and concluded that *A. fluviatilis* is more common at lower elevations compared to WOLLASTON'S observations. LREC/DRNH'S collections tend to agree with STAUDER'S observation. It is a fairly widespread species but does not seem to be particularly pollution tolerant.

Lammellibranchiata

Sphaeridae

Pisidium (Cyclodina)

Pisidium casertanum (Poli)

Pisidium Watsoni, Paiva Journ. de Conchologia (1866)

Pisidium? Watsoni, Paiva, Moll mad. p.167, (1867)

Pisidium? Watsoni, Nobre, Mol. Ter. Fluv. Águas. Sal. Arq. Mad (1931)

Pisidium casertanum, Kuiper, Bol. Mus. Mun. Fun. N° XX Art. 91 pp 34-37(1966).

Feb. 1991: R. Santa Cruz: Pedra Mole. R. Brava: village of R. Brava. R. Machico: Maroços; Fazenda, Torre; river mouth.

March 1991: R. Santa Cruz: Levada da Serrada Faial; Pedra Mole. R. São João: Penteada. R. Machico: Maroços; Torre.

May 1991: R. Santa Cruz: Pedra Mole.

July 1991: R. São João: Penteadá; São João. R. Machico: Fazenda; village of Machico.

Sept. 1991: R. São João: São João. R. Machico: Maroços; Fazenda; 25m upstream of river mouth.
Distribution: Palaearctic.

PAIVA originally described the specimens of *Pisidium* he collected as *P. Watsoni*. Subsequent examination of the collected material by J.G.J. KUIPER (1966) showed that the specimens were in fact *P. casertanum* (POLI). KUIPER'S description the following features of *P. casertanum* are: the shells are laterally flattened, sub equilateral (both characteristic features of the genus *Pisidium*) with a sculpture of concentric rings. The hinge plate is well developed and broad. The beaks are not prominent. KUIPER claimed that the maximum length attained was approx. 4.2mm.

KUIPER'S description and diagram of *P. casertanum* (POLI), almost exactly match the specimens collected by the author. Madeiran specimens when compared to the British Museum reference collection were found to be identical except for the consistently smaller size of the Madeiran *P. casertanum*.

Other *Pisidium* species claimed to have been collected in the Region are *P. pusillum* (Gmelin), *P. amincum* (MÜLLER) and *P. personatum* MALM. *P. casertanum* (POLI) is considered to be the most common member of it's genus in both Europe and Africa. For more details consult KUIPER 1966. *P. casertanum* generally occurred in greater abundance at sites with some organic load. It was thus more commonly found in R. São João and Machico. Numbers and individual size tend to increase in the Summer probably due to the combination of reduced flow and the increased deposition of organic detritus upon which it feeds by filtration.

DISCUSSION

Of the nine species described, all are found across the Palaearctic although some do not originate from there. Species such as *L. (R) peregra* (MÜLL) and *P. (C.) corneus* L are extremely common on the European mainland but exhibit a very restricted distribution on Madeira. They have been collected from sites on the more heavily populated South of the Island from only two or one rivers urban areas affected by human activity. This suggests recent and accidental introductions for reasons covered earlier in the text.

G. parvus (SAY), of North American origin may have been introduced via the Mediterranean Region (pers. comm. Stauder 1991) and is the only strictly non-European species listed for Madeira. However, it is possible that *G. parvus* was introduced to Madeira in the 19th century and mistakenly identified as *P. glaber* (= *P. laevis*) a sibling species. A close study of the specimens deposited in museums from WOLLASTON'S, PAIVA'S and NOBRE'S collections would establish whether this is so. MEIER-BROOK (1983) examined snails "identified as *G. laevis*" from Madeira, but found them to more

closely resemble snails from the genus *Planorbis*. He has presumably subsequently identified STAUDER'S material from Madeira as *G. parvus* as disclosed by his personal communication in her paper (1991), although this is unclear.

The uncommon form of *L. (R.) peregra* var. *oblongata* (JEFF.) was identified using comparisons upon shell morphology only. Internal morphological features will have to be examined at a later date. With the exception of *L. (R.) peregra* (MÜLL), *P. (C.) coretus* L and *P. casertanum* (POLI), all the other species were found at sites on both the North and South of the Island at some time throughout 1991.

CONCLUSION

From extensive collections made over 1991 by LREC/DRNH, a revision of the Madeiran freshwater mollusca reveals three records of species new to the Region bringing the total number of freshwater mollusca species to nine (eight species of Gastropoda, one species of Lamellibranchiata). The most recently discovered introductions show very limited distribution compared to the other more established taxa.

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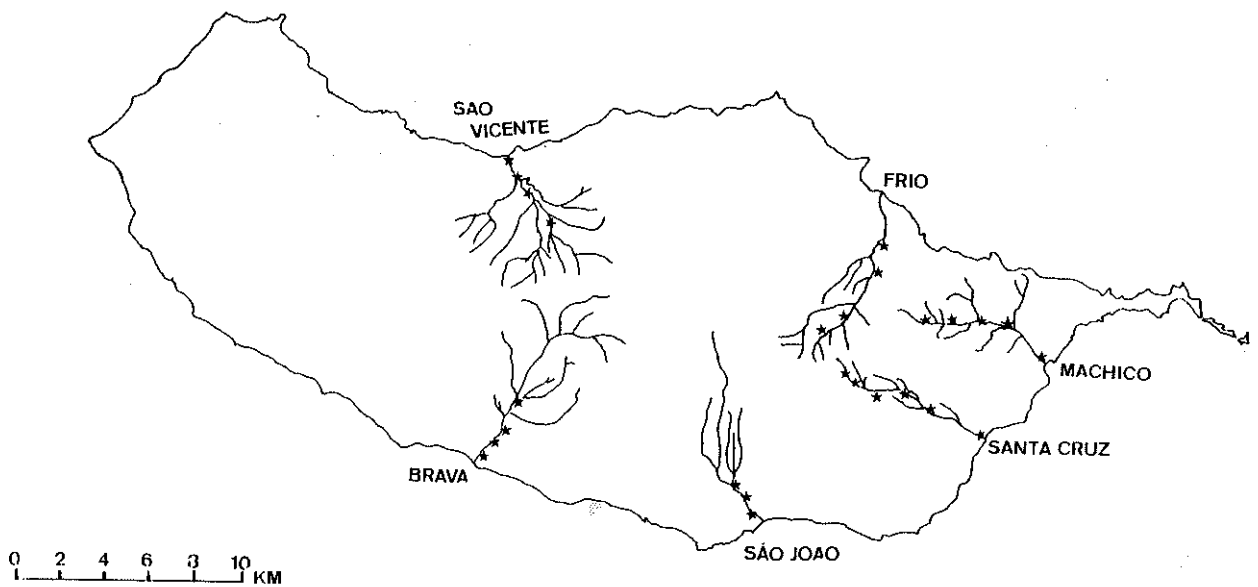


Fig. 1 - A map showing the rivers sampled during 1991 and the approximate positions of the sampling sites.

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