

On the presence of the alien freshwater gastropod *Ferrissia fragilis* (Tryon, 1863) (Gastropoda: Planorbidae) in the Maltese Islands (Central Mediterranean)

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Abstract

An established population of the North-American freshwater gastropod *Ferrissia fragilis* (Tryon, 1863) is recorded from the island of Malta (Central Mediterranean) for the first time. This population was found in an anthropogenic habitat at the northeast of Malta. *Ferrissia fragilis* is an invader of several freshwater habitats throughout Europe and beyond. If released into the wild, it could present competition for threatened Maltese freshwater Mollusca.

Riassunto

Una popolazione stabile del gasteropode d'acqua dolce, di origine nord americana, *Ferrissia fragilis* (Tryon, 1863) è segnalata per la prima volta a Malta (Mediterraneo centrale). La popolazione è stata trovata in un ambiente antropizzato, nella parte nord-orientale di Malta. *Ferrissia fragilis* è un invasore di diversi ambienti d'acqua dolce in Europa ed altre aree. Se rilasciato negli ambienti naturali, questa specie potrebbe entrare in competizione con le specie autoctone e minacciare la fauna dulcicola di Malta.

Key words

Gastropoda, Planorbidae, *Ferrissia fragilis*, freshwater, alien species, Malta.

Introduction

The alien non-marine gastropods of the Maltese Islands have been studied in detail by various authors (**Tab. 1**). Giusti et al. (1995) list eight species as being of non-native or reintroduced origin, of which two are restricted to freshwater. Beckmann (2003) adds a terrestrial species. Mifsud et al. (2002) list five newly recorded aliens, revised in part by Barbara & Schembri (2008), of which one is restricted to freshwater. For the first time herein, a substantial population of the non-native, potentially invasive *Ferrissia fragilis* (Tryon, 1863) is being reported as living in the Maltese Islands.

Ferrissia is a genus of limpet-shaped snails which has been variously assigned to the families Ancyliidae, Lymnaeidae and Planorbidae by different authors. To conform with the latest model for gastropod classification established by Bouchet & Rocroi (2005), it is hereby understood as being a member of the tribe Ancylini of the family Planorbidae.

Material and methods

During observation of organisms in an anthropogenic freshwater habitat located in central suburban Malta, the author noticed a few hundred live individuals of a small limpet-like shape attached to the sides of the pond and a shallow ditch leading to it. A small number of individuals was collected and stored in 90% alcohol for further study, which was mostly carried out under a dissecting microscope. A small number of representative individuals of other gastropods from the same loca-

tion and habitat were collected and also preserved in 90% alcohol for further investigation.

Material studied: Blata I-Bajda, Malta; 18.III.2009, 28.IV.2009, 12.V.2009 & 1.VI.2009, several live individuals in situ; David P. Cilia leg. 18.III.2009 (8 alcohol-preserved specimens): coll. author (Santa Venera, Malta) - reg. no. R.GA723(4), coll. Constantine Mifsud (Rabat, Malta) - reg. no. LF 093a; David P. Cilia leg. 1.VI.2009 (8 shells): coll. National Museum of Natural History (Mdina, Malta) - not reg., coll. Charles Sammut (Rabat, Malta) - reg. no. L80.01, coll. Charles Cachia (Qormi, Malta) - reg. no. M52.

Results

The shell morphology was used to differentiate between *Ferrissia* from the studied location and typical *Ancylus* from other locations. When the two species are viewed from above with the apex pointing towards the right, it can be seen that the apex of *Ancylus* coincides exactly with an imaginary horizontal line bisecting the specimen, resulting in near perfect bilateral symmetry. In shells of *Ferrissia*, the apex lies a small distance above this transect. In *Acroloxus*, which is not considered further here, the apex lies beneath the transect. Shells of *Ferrissia* are very flattened relative to those of *Ancylus*, and the angle of rotation of the protoconch relative to the aperture is less. All specimens of *Ferrissia* observed are of the ancyloid form (**Fig. 1**).

The present specimens agree very well with illustrations of typical *Ferrissia* from Tryon (1870: pl. 2, figs 17,

Species	Main records
<i>Cecilioides jani</i> (De Betta & Martinati, 1855)	Giusti et al. (1995)
<i>Cerneuella</i> (<i>Cerneuella</i>) cf. <i>virgata</i> (Da Costa, 1778) ¹	Giusti et al. (1995); Mifsud et al. (2003)
<i>Cochlicella barbara</i> (Linnaeus, 1758)	Mifsud et al. (2003)
<i>Discus rotundatus</i> (Müller, 1774)	Thake (1984); Beckmann (1987); Beckmann (1988); Mandahl-Barth (1988); Giusti et al. (1995)
<i>Ferrissia fragilis</i> (Tryon, 1863)	present study
<i>Helix pomatia</i> Linnaeus, 1758	Thake (1970)
<i>Lehmannia valentiana</i> (Férussac, 1822)	Beckmann (2003); Mifsud et al. (2003)
<i>Otala lactea</i> (Müller, 1774) ²	Mifsud et al. (2003)
<i>Otala punctata</i> (Müller, 1774)	Barbara & Schembri (2008)
<i>Oxychilus helveticus</i> (Blum, 1881)	Mifsud et al. (2003)
<i>Oxyloma elegans</i> (Risso, 1826)	Mifsud et al. (2003)
<i>Physella</i> (<i>Costatella</i>) <i>acuta</i> (Draparnaud, 1805)	Mienis (1987a); Beckmann (1987); Thake & Schembri (1989); Giusti et al. (1995)
<i>Planorbarius corneus</i> (Linnaeus, 1758)	Mifsud et al. (2003)
<i>Planorbella duryi</i> (Wetherby, 1879)	Beckmann (1987); Beckmann (1988); Giusti et al. (1995); Mifsud et al. (2003)
<i>Pomatias elegans</i> (Müller, 1774)	Thake (1973); Beckmann (1987); Mandahl-Barth (1988); Giusti et al. (1995)
<i>Succinea putris</i> (Linnaeus, 1758)	Mifsud et al. (2003)
<i>Trochoidea</i> (<i>XeroCLAUSA</i>) <i>meda</i> (Porro, 1840)	Beckmann (1987); Mandahl-Barth (1988); Giusti et al., (1995)
<i>Vallonia pulchella</i> (Müller, 1774) ³	Mienis (1987b); Beckmann (1988); Giusti et al. (1995)

Tab. 1. Alien non-marine mollusc records from the Maltese Islands since 1970. Notes: 1) reintroduced; 2) according to Barbara & Schembri (2008) this may be a misidentification of *Otala punctata* (Müller, 1774); 3) recorded by Mienis (1987b) and Beckmann (1988) as *Vallonia excentrica* Sterki, 1893.

Tab. 1. Molluschi alieni non marini segnalati per le isole maltesi a partire dal 1970. Note: 1) specie reintrodotta; 2) secondo Barbara & Schembri (2008) questa può essere un'erronea identificazione di *Otala punctata* (Müller, 1774); 3) segnalata da Mienis (1987b) and Beckmann (1988) come *Vallonia excentrica* Sterki, 1893.

18 as *Ancylus fragilis*, Glöer & Meier-Brook (1994: p. 64, figs labelled *F. wautieri*), Gittenberger et al. (1998: p. 168, figs 401, 402 as *F. wautieri*), and Walther (2008: p. 44, fig. 2.4; p. 104, fig. 5.6 as *F. fragilis*).

In living specimens, the colour of the shell of *Ferrissia* ranges from pale to bright brown, while the colour of *Ancylus* is invariably a dark greyish-green. The brown colour of *Ferrissia* is dulled considerably following preservation in alcohol, but it still remains a recognizable character. While living, individuals of *Ferrissia* were observed moving extremely slowly along the area perimeters, scraping off the green algae on which they feed. This behaviour is similar to that exhibited by *Ancylus*. Interestingly, the other freshwater gastropods co-occurring in the studied area are also North American aliens, namely *Planorbella duryi* (Wetherby, 1879) and *Physella* (*Costatella*) *acuta* (Draparnaud, 1805) (Giusti et al., 1995; Mifsud et al., 2002). Both of these belong to the superfamily Planorboidea together with *Ferrissia* (Bouchet & Rocroi, 2005). Until 2005, the only freshwater gastropod observed in the area was *P. acuta* (C. Sammut, pers. comm. VI.2009). Other macrofauna present at the site includes oligochaetes, larvae of odonates and culicid

dipterans, ostracods, isopods, and several juveniles of the Siculo-Maltese endemic amphibian *Discoglossus pictus pictus* Camerano, 1884.

Discussion

Until the study based on mitochondrial large subunit ribosomal DNA by Walther et al. (2006a), there was confusion as to what species the European specimens of *Ferrissia* belonged to. Where recorded as *Ferrissia wautieri* (Mirolli, 1960), the mollusc was assumed to be autochthonous to Europe, perhaps in need of further study (Van Der Velde, 1991; Glöer & Meier-Brook, 2002; Spyra, 2008). *Ferrissia clessiniana* (Jickeli, 1882) is a presumed North African species with very close morphological characteristics and genetic relationship to *F. fragilis* (Walther et al., 2006a). Some of the European citations of *F. fragilis* have been attributed to this species (Falkner & Proschwitz, 1995; Strzelec, 2005; Welter-Schultes, 2009). Walther et al. (2006a) proved that all sampled European populations of *Ferrissia* belong to a single species, namely the North American *Ferrissia fragilis* (Tryon,



Fig. 1. *Ferrissia fragilis* (Tryon, 1863) (Malta, Blata l-Bajda; D. P. Cilia 18.III.2009; coll. D.P. Cilia R.GA723(4)). **A.** Apical view of one specimen. **B, C.** apical and basal view of a second specimen. Scale bar = 2mm. Photographs by R. La Perna.

Fig. 1. *Ferrissia fragilis* (Tryon, 1863) (Malta, Blata l-Bajda; D. P. Cilia 18.III.2009; coll. D.P. Cilia R.GA723(4)). **A.** Veduta apicale di un esemplare. **B, C.** Vedute apicale e basale di un secondo esemplare. Scala = 2 mm. Foto R. La Perna.

1863), in all probability meaning that *F. wautieri* is a junior synonym of *F. fragilis* (Dillon & Herman, 2009; Walther et al., 2006a; Walther et al., 2006b).

The lack of records of *F. fragilis* from 19th century Europe has been attributed to its small size of 2 to 4 mm and ecophenotypic shell plasticity, frequently leading to misidentification. Moreover, its conchological differences from the larger *Acroloxus lacustris* (Linnaeus, 1758) are slight (Walther et al., 2006b), though anatomically the species can be clearly differentiated on account of the apical state of *Ferrissia* (Castagnolo et al., 1982). Since the 20th century, however, this species has been recorded all over West and East Europe under synonyms or misidentifications, amongst other places in Italy (Mirolli, 1960; Castagnolo et al., 1982; Baldaccini & Papasogli, 1989; Cianfanelli et al., 2007), the Nether-

lands (Van Der Velde & Roelofs, 1977; Van Der Velde, 1991; Gittenberger et al., 1998), Sweden (Falkner & Proschwitz, 1995), Albania (Dhora & Welter-Schultes, 1996), Germany (Glöer & Meier-Brook, 2002; Böttger in Walther et al., 2006b; Walther et al., 2006a), England (Brown in Anderson, 2005), Poland (Strzelec, 2005; Spyra, 2008), France (Walther, 2008), Denmark (Walther et al., 2006a), the Czech Republic (Beran & Horsák, 2007), Moldova and Ukraine (Son, 2007), Belarus (Semenchenko & Laenko, 2008), and the Azores (Walther, 2008). Mienis records *F. clessiniana* for Israel (1983) and Syria (2008). Far outside of Europe, *F. fragilis* is an invader of aquatic habitats in Taiwan and the Philippines (Walther et al., 2006a).

In Malta, this snail has been discovered living in considerable numbers inside a reservoir and a connected ditch filled with freshwater, forming part of a formerly enclosed location used for fieldwork by Biology students. This area may be found in an educational institution at Blata l-Bajda, which lies between the towns of Ħamrun and Floriana. It is interesting to note that in its first records for Germany, England, and Sweden, *F. fragilis* was found in anthropogenic habitats (Falkner & Proschwitz, 1995; Brown in Anderson, 2005; Böttger in Walther, 2006b). The present finding in a similar habitat, which is in addition highly urbanized, strongly suggests passive introduction by a human agency, perhaps as eggs in soil or hatched on submerged or partly-submerged plants such as *Elodea* sp. or *Cyperus* sp., both of which are firmly established in the studied location. *F. fragilis* is capable of self-fertilization, therefore one individual could have been enough to start a colony (Dillon & Herman, 2009). Through this introduction, the planorbid has subsequently spread out and multiplied throughout the contained area, as evidenced by individuals of varying sizes inhabiting the same patches.

There is still a small possibility that some endemic South European populations of *Ferrissia* may eventually be found to belong to *F. clessiniana* (Walther et al., 2006a), but, since no possibly autochthonous populations of *Ferrissia* were observed at all in several investigated localities around Malta containing naturally occurring freshwater, the Maltese finding is being assigned to *F. fragilis* on account of this species' invasive nature.

Conclusions

Alien species which are strong competitors may root out native species in the communities which they manage to invade. Freshwater habitats are extremely scarce in the Maltese Islands, and are home to a number of vulnerable, presumably autochthonous, species, both molluscan and otherwise. Of the former, it is worthy to mention *Planorbis moquini* Requien, 1848 (cf. Glöer & Zettler, 2009), *Pseudoamnicola moussonii* (Calcara, 1841), *Mercuria* cf. *similis* (Draparnaud, 1805) and two species of *Pisidium*, all of these being from rare to very rare in occurrence (Thake & Schembri, 1989; Schembri, 1992; Giusti et al., 1995). Self-fertilization would mean that

single individuals or eggs transferred to systems where native ecosystems are already established could create problems. Moreover, the species is able to survive a wide range of ecological fluctuations, from temperatures of -10°C (Son, 2007) to drought, which young individuals resist by constructing a calcareous septum (Spyra, 2008), making *F. fragilis* even better adapted to the Maltese climate than the formerly cited indigenous species.

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