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Research Article

First record of the New Zealand mud snail *Potamopyrgus antipodarum* J.E. Gray, 1843 (Mollusca: Hydrobiidae) in Greece – Notes on its population structure and associated microalgae

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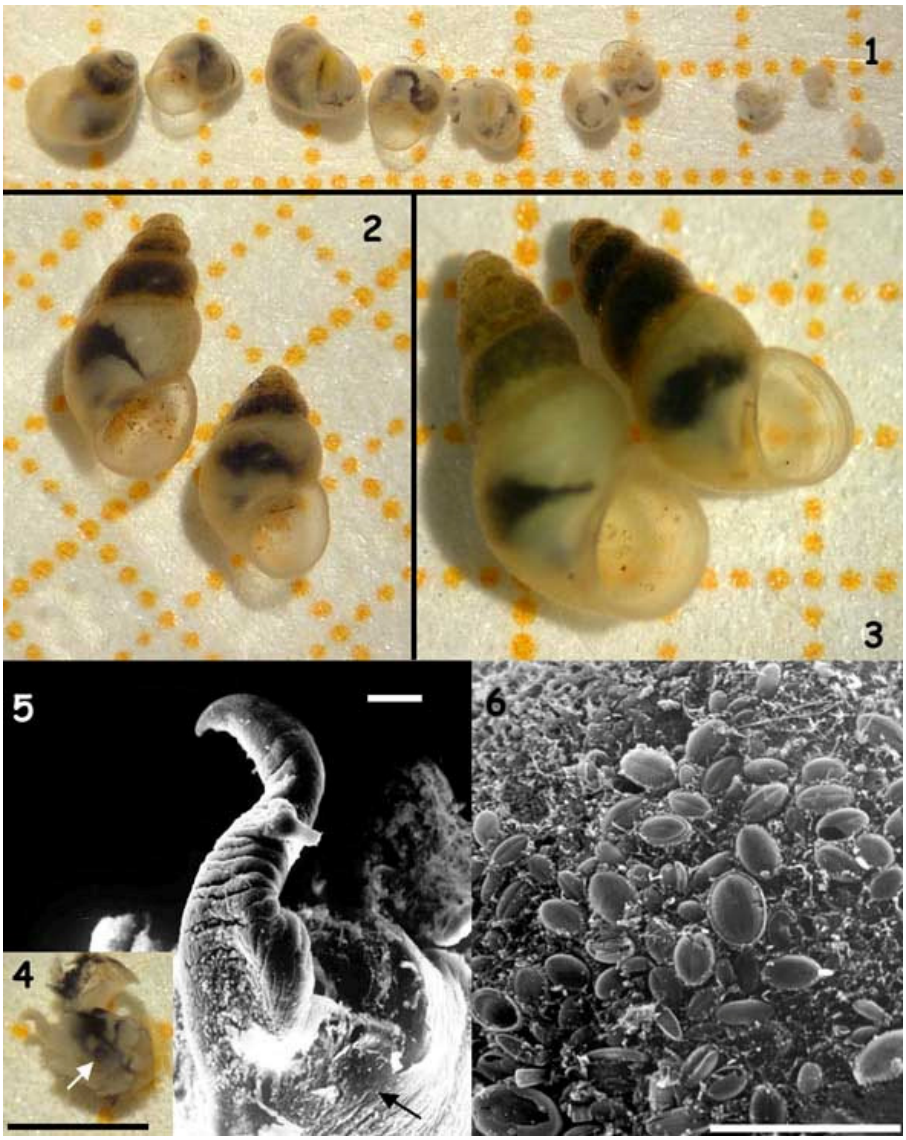
Abstract

Potamopyrgus antipodarum (Gastropoda: Hydrobiidae), a New Zealand native species, is recorded for the first time in waterbodies of Greece, being dominant in the gastropod fauna present; waterfowl transportation is suggested as its invasion mode. This species was collected (November 2007) from the aquatic plants *Myriophyllum spicatum* and *Nasturtium officinale* in Lake Trichonis (CW Greece) and an adjacent stream. Totally, 332 individuals of various ages were recorded, females being the majority. One diatom (*Cocconeis placentula* var. *euglypta*) was found in its digestive tube, also thriving abundantly on the surface of both the invader shell and the aquatic plants, and in association with other cosmopolitan periphytic diatoms (three of them new for the area, with one new record for Greece) or endemic diatoms.

Key words: alien species, Hydrobiidae, *Potamopyrgus antipodarum*, epizoic and periphytic diatoms, Lake Trichonis

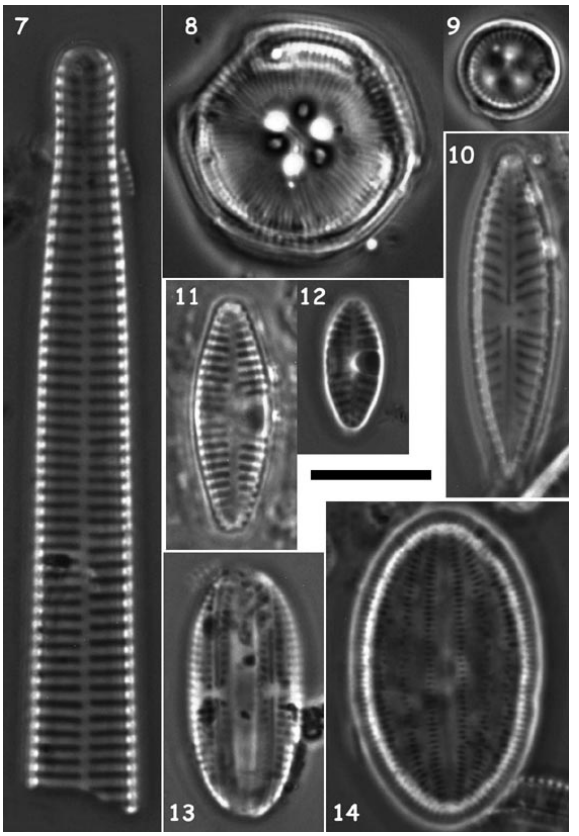
Potamopyrgus antipodarum (J.E. Gray, 1843) (Gastropoda: Hydrobiidae) is a snail species indigenous to New Zealand, which was introduced into Europe at the end of 19th century (Ponder 1988). In Europe, it is the most widespread non-indigenous prosobranch species and only a few countries have escaped invasion (Bank 2007), although its presumed absence could be due to the lack of recent field observations (Cianfanelli et al. 2007). In the Mediterranean basin, this species was recorded in Catalonia in 1952, in the Mediterranean region of France by the end of fifties (Falniowski 1987), and in Italy in 1961 (Cianfanelli et al. 2007). Shells of this species have also been found in Turkey (Demir 2003; Yildirim et al. 2006). No previous data exist on the presence of this invader in waterbodies of Greece (Bank 2007).

P. antipodarum shows a considerable variability in shell dimensions (Falniowski 1987), its shell height reaching ~ 6.5 mm (Falniowski 1987; Richards et al. 2002). Being able to reproduce parthenogenically, females prevail (Falniowski 1987; Zaranko et al. 1997) and popu-lations densities are occasionally extremely high (Kerans et al. 2005). *P. antipodarum* is classified as a scraper/grazer (Richards et al. 2002). It feeds on plant and animal detritus and it also grazes on green algae and diatoms, with valves of the latter group being found into its intestinal tube (Michaut 1968; Haynes and Taylor 1984; Kelly and Hawes 2005). It has also been reported that the surface of its shell is often encrusted and covered with sediment and periphytic micro-organisms (Falniowski 1987; Richards et al. 2002).



Figures 1-3. Specimens of *P. antipodarum* (1: immatures; 2-3: matures). Stereomicrographs. A background square represents 1 mm^2. *Figure 4*. Head with penis (eye at arrow). Stereomicrograph. Scale bar=1 mm. *Figure 5*. Penis (eye at arrow). Scanning Electron Micrograph (SEM). Scale bar=100 μm. *Figure 6*. General view of attached diatoms on the shell surface of *P. antipodarum*. SEM. Scale bar=100 μm. (Photographs by I. Louvrou and C. Radea).

In November 2007 during a student field excursion, *P. antipodarum* specimens were found in central-western Greece: a) in the littoral zone of Lake Trichonis (38°36'00"N, 21°34'11"E), a warm monomictic, rather oligotrophic lake (Overbeck et al. 1982; Tafas and Economou-Amilli 1997), and b) in a permanent, slowly flowing stream discharging into Trichonis near Dougri (38°36'01"N, 21°34'13"E). Samples from all dominant aquatic vascular plants were taken (500g of plant material per species) using a grab sampler in Lake Trichonis at 1-3 m depth (with the kind help of Dr. D. Danielidis) or removed by hand from the stream. The snails occurred on macrophytes (kindly identified by Dr. I. Bazos), specifically only on the shoots of *Myriophyllum*



Figures 7-14. Epizoic and epiphytic diatoms after a light (by burning on a coverslip) valve cleaning treatment. 7. *Ulnaria ulna*, 8. *Cyclotella trichonidea*, 9. *C. trichonidea* var. *parva*, 10. *Gomphonema angustatum*, 11. *Planothidium lanceolatum*, 12. *P. frequentissimum*, 13. *Amphora pediculus*, 14. *Cocconeis placentula* var. *euglypta*. Light Micrographs (LM). Scale bar=10μm. (Photographs by I. Louvrou and A. Economou-Amilli).

spicatum L. (lake) and on the roots of *Nasturtium officinale* R. Br. (stream). Totally, 332 individuals of *P. antipodarum* of both genders and of various ages were collected (Figures 1-5) from the above plant species, making up 57% of the gastropod fauna present.

The shell length of the specimens was up to 3mm. Females constituted the majority of the mature individuals, comprising approximately 78% of dissected specimens with 4 and/or 5 whorls.

The intestinal tubes' contents of 20 dissected individuals of *P. antipodarum* were also examined and valves of the diatom *Cocconeis placentula* var. *euglypta* were found. This diatom variety (Figure 14) abundantly colonizes, as epizoic taxon on the shell surface of these gastropods (Figure 6) and as periphytic taxon on the external surface of the aquatic plants (*M. spicatum* and *N. officinale*). Among the accompanying algal species present we recorded the scattered presence of the known periphytic (Krammer and Lange-Bertalot 1986, 1991a, 1991b) diatoms *Ulnaria ulna* (Nitz.) Compère, *Planothidium lanceolatum* (Bréb.) Round et Bukht., *P. frequentissimum* (Lange-Bert.) Round et Bukht, *Amphora pediculus* (Kütz.) Grunow, *Gomphonema angustatum* (Kütz.) Rabh. (Figures 7, 10-13); also *Cyclotella trichonidea* Ec.-Am. (Figure 8) and *C. trichonidea* var. *parva* Ec.-Am. (Figure 9), endemic (Economou-Amilli 1979, 1982) planktonic and periphytic (Economou-Amilli and Tafas 2000) diatoms. It is worth mentioning, that in Lake Trichonis, *Ulnaria ulna* and *C. placentula* var. *euglypta* have already been found as epizoic diatoms on another gastropod, i.e. on *Valvata piscinalis* O.F. Müll. (Falniowski et al. 1988); in addition, *Planothidium lanceolatum* was also found there as a planktonic diatom (Tafas and Economou-Amilli 1997). The other three diatom taxa are considered as new records for Lake Trichonis, and in fact, *Planothidium frequentissimum* as a new record for Greece.

Potamopyrgus antipodarum is distributed in most European countries (Bank 2007) and in Turkey (Aegean Sea, and Sea of Marmara) (Demir 2003; Yildirim 2006), but it has not been reported from the Balkan peninsula (Bank 2007) except for the Romanian Danube (Cioboiu 2006). Although the invasion mode of *P. antipodarum* in the wider area of Lake Trichonis still remains unknown, we suggest that it has possibly been transported from Europe and Turkey by resting and/or wintering waterfowl. It should be mentioned that Lake Trichonis is included in the Important Bird Areas of Greece (BirdLife International 2008) since numerous migratory waterfowl - many of them protected species - are recorded there every year. According to the existing information, *P. antipodarum* is able to withstand desiccation several days and is transported long distances by birds adhered to their bills and legs (Falniowski 1987; Global Invasive Species Database 2008; Bersine et al. 2008).

High abundance of *P. antipodarum* in studied Greek water bodies indicates an instant dominance in the indigenous gastropod community. In some cases, presence of the invader *P. antipodarum* may have a negative influence on native macroinvertebrates (Kerans et al. 2005), especially in disturbed ecosystems

(Strzelec 2005). In other cases, there is evidence of a positive influence between densities of *P. antipodarum* and of some native benthic invertebrate species (Schreiber et al. 2002). Further investigations in the wider area of Lake Trichonis should clarify the influence of this invader on the indigenous benthic community structure and on the ecological processes related to it.

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