

Notes on new or rare taxa of Crustaceans and Molluscs from a “fontanile” in Arzago d'Adda, Bergamo, Italy (Crustacea, Mollusca)

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ABSTRACT The present work is a continuation of previous researches and censuses carried out by the Author, reports on Italian biotopes characterized by typical fauna inhabiting springs and other fluvial (or freshwater). During the last decades, many of these areas were severely altered and/or even obviated; nevertheless, at the same time, new stations harbouring a rich biodiversity were discovered. This paper provides data on ecology and fauna composition of some “fontanili” of Lombardia Region, (Italy), focusing on new or rare taxa of molluscs and crustaceans found in a “fontanile” of Arzago d'Adda (Bergamo).

KEY WORDS Census, Freshwater Ecology; North Italy “fontanili”, *Alzoniella*.

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INTRODUCTION

When listing biotopes with a restricted distribution, presenting microhabitats with very specific abiotic conditions and abundant in rare and/or endemic taxa, the “fontanili” (springs fed by phreatic water) of the Padana alluvial plain are an automatic choice.

A detailed revision of literature (Girod, 1965a; 1969; Bianchi et al., 1975; AA.VV., 1994; Lavorano et al., 1993) and data on the environmental status of the “fontanili” of Lombardia Region (Pezzoli & Spelta, 2000; Pezzoli, 2004; 2007; AA.VV., 2008) are useful tools in order to locate the stations the ecological conditions of which have been better preserved and maintained despite of environmental alterations occurred in the last decades.

Molluscs and crustaceans inhabiting and characterizing these highly interesting biotopes were chosen as biological models due to the presence of many species highly sensitive to ecological changes, including pollution and lowering of groundwater level which make them

extremely powerful biological indicators (Arcangeli, 1942; Girod, 1965b; Ruffo & Vigna Taglianti, 1967; Karaman, 1975; 1977; 1993; Karaman & Ruffo, 1979; Giusti & Bodon, 1984; Stoch, 1988; Bodon & Giovanelli, 1995).

Currently, data on the presence of these taxa in Lombardia are available in several studies carried out in the western part of the region and, to some extent, in Bergamo surroundings during the ‘60s and the ‘90s (see Pezzoli et al., 1994 and references quoted therein).

One of these studies reported on the “fontanile Brancaleone” (51 BG Pezzoli et al., 1994; Pezzoli & Spelta, 2000), Gavazzolo locality (Caravaggio), in the southern part of Bergamo province, which, till the second half of the XX century, resulted to be the most interesting “fontanile” of the Region due to its ecological, zoological and botanical assets.

The list of mollusc and crustacean species inhabiting such an important biotope (the census of which was made during the past years), along with a some information on the history of the station, are reported below.

<p style="text-align: center;">UTM Coordinates 32 TNR 51 41</p> <p style="text-align: center;">Geographic coordinates sexagesimal 9°39'53" E, 45°31'17"N</p> <p style="text-align: center;">Table IGM F 46 IV SE, Treviglio</p> <p style="text-align: center;">Height above the sea level 120 m</p>
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1. The “fontanile” Brancaleone was added to the list of biotopes and geotopes of Lombardia Region (regional council no. 471 of 3/12/1981) on the recommendation of the Museum of Natural Sciences of Bergamo that considered the rich community of Crustacea (see below) of this station, which included also a few endemic species (Arrigoni, 1974; Karaman, 1993), as worth-recording.

Crustacea:

Niphargus bajuvaricus grandii Ruffo, 1937
Niphargus elegans elegans (Garbini, 1894)
Niphargus microcerberus Sket, 1972
Niphargus pupetta Sket, 1962
Niphargus transitivus Sket, 1971
Synurella ambulans (O. F. Müller, 1846)
Asellus aquaticus (Linnaeus, 1758)

Mollusca:

Lymnaea stagnalis (Linnaeus, 1758)
Radix peregra (O. F. Müller, 1774)

2. A few years later, thanks to the Author and the late lamented Antonio Valle, a few interesting species of Mollusca Hydrobiidae (Pezzoli & Giusti, 1980) were added to the list:

Graziana alpestris (Frauenfeld, 1863)
Sadleriana fluminensis (Küster, 1852).

3. In “Natura in Lombardia. Biotopi e Geotopi” (AA.VV., 1982), the “fontanile” was described as characterized by an extremely important fauna of invertebrates, although malacological species and relative literature were not reported in details. A similar

description can be found in the volumes “Riserve Naturali della Lombardia” edited by Lombardia Region (1987).

4. In the re-edition of the census (Pezzoli, 1988) it was pointed out that the conservation status of the “fontanile” was heavily damaged.

5. Furlanetto (1989), on the other hand, ignored the environmental decay of the “fontanile” Brancaleone and the disappearing of the original malacological fauna.

6. Pisoni & Valle (1992) provided the first official (from the Museum of Natural Sciences of Bergamo) data on the decay of the conditions of this biotope.

7. Pezzoli et al. (1994) strongly stressed that the environmental conditions of the “fontanile” were getting worse and worse.

8. After almost ten years, at the beginning of 2000, the “Natura 2000” Network (the ecological network of protected areas in EU) was instituted, with the aim to put in practice the European Commission Habitats Directive (92/43/CEE) to protect and maintain seriously threatened species and their natural habitats. To this goal, several “S.C.I.” (Sites of Community Importance) were defined, but, unfortunately, at least in many cases, the choice was mainly based on ancient bibliographic records without an accurate check of the current status.

One of these S.C.I.s is the “fontanile” Brancaleone (code IT2060013) (Lorenzi & Ferlinghetti, 2006) which although being previously one of the most interesting “fontanile” of the Region for its extraordinary characteristics, at the moment it is just a spectre of its former self.

9. Finally, at the beginning of the new millennium, the Centre for Environmental Studies (University of Bergamo) started a rigorous survey of the status of the fontanili in Bergamo province in order to locate other biotopes characterized by the extremely interesting taxa which have to date disappeared from the “fontanile” Brancaleone.

MATERIALS AND METHODS

During the last decades many studies on several “fontanili” of Lombardia Region have

been carried out aiming to report of as many species as possible and monitoring environmental status of these very interesting biotopes. (Pezzoli & Spelta, 2000; Pezzoli, 2004; 2007; AA.VV., 2008).

These “fontanili” have been included in numerous censuses performed in the last years (Pezzoli, 1988; 1992; 1996; Pezzoli et al., 1994; Pezzoli & Spelta, 2000), even if recently a re-numbering of the “fontanili” has been proposed (Pezzoli, 2004 and successive updates released in DVD; AA.VV., 2008); in the present work, in line with the above mentioned literature, the old numbering is maintained.

Researches have been performed in the field by collecting samples both directly and with special nets for crustaceans and molluscs, employed as biological models to determine environmental integrity of the places under investigation.

Taking into account that for the systematic description and classification of Mollusca Hydrobiidae snail soft parts are needed, living animals were harvested by nets and filter-endowed pipes. It was originally planned to conduct sampling on a monthly basis but, unfortunately, within a few months, most pipes placed in the fontanili had been willfully removed, presumably by vandals, seriously compromising results of our research.

RESULTS

Our findings revealed a few critical items characterizing the area under study including periodical drying up of almost all groundwaters, environmental pollution of many different kinds and invasion of allochthonous species. Nevertheless, surprisingly, two areas showing high levels of environmental quality, attested by the occurrence of numerous and stable populations of rare Mollusca Hydrobiidae and Crustacea, were reported.

One of these areas is located in the far eastern Bergamo surroundings, on the bank of the Oglio river, at Pumenengo (Figs. 1-5), inside the S.C.I. known as “Boschetto della Cascina Campagna” code IT2060014.

“Fontanile” Fontana Vecchia, Pumenengo, Bergamo (station no. 90 BG).

<p>UTM Coordinates 32 TNR 68 35</p> <p>Geographic coordinates sexagesimal 9°52’49” E, 45°27’59”N</p> <p>Table IGM F 46 II NE, Rudiano</p> <p>Height above the sea level 96 m</p>
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Headwaters

Mollusca:

Theodoxus fluviatilis (Linnaeus, 1758)
Theodoxus danubialis (Pfeiffer, 1828)
Sadleriana fluminensis (Küster, 1852)
Graziana alpestris (Frauenfeld, 1863) (Figs. 12,13)
Iglica sp.
Pisidium personatum Malm, 1855
Pisidium casertanum (Poli, 1791)
Potamopyrgus antipodarum (Gray, 1843)
Emmericia patula (Brumati, 1838)
Corbicula fluminea (O. F. Müller, 1774)

Crustacea:

Niphargus elegans elegans (Garbini, 1894)
Echinogammarus stammeri (Karaman, 1931)
Asellus aquaticus (Linnaeus, 1758)

This hydrographic system, highly complex, comprises headwaters and numerous independent springs. Moreover, waters are partly employed for the functioning of a fish farming facility and, in addition, feed the “Cavo Molinara” stream, which runs parallel to the Oglio river. Due to these contaminations a few alien species including *Potamopyrgus antipodarum*, *Emmericia patula* (Fig. 25) and *Corbicula fluminea* (Fig. 26) have been found. As for *Theodoxus fluviatilis* and *T. danubialis*, since these taxa have never been recorded before, it was not possible to establish whether they are autochthonous (i.e. native) or not.

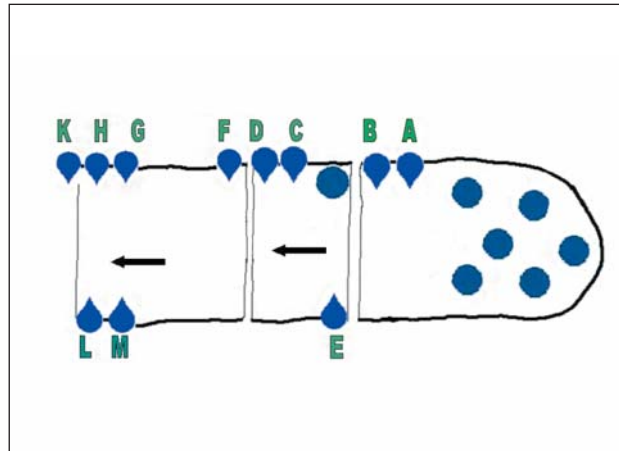


Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5

Figure 1. Outline of the initial section of the "fontanile" Fontana Vecchia, Pumenengo; the letters indicate independent springs.
 Figures 2, 3. Headwaters of the "fontanile" Fontana Vecchia, Pumenengo.
 Figures 4, 5. Initial stretch of the "fontanile" Fontana Vecchia, Pumenengo.

The second station with ecological conditions very similar to the high-quality parameters originally characterizing the “fontanile” Brancaleone is located between the Serio and Adda Rivers, in Arzago d’Adda (Figs. 6-9). This area, probably due to the lack of severe environmental threats (i.e. corn intensive cultivations), still shows an unexpected environmental “ancientness” and integrity. This is also confirmed by the fact that within Mollusca, no recent invasion of any alien species (*Haitia acuta* has been recorded in Italy from a long time) has been reported. Moreover, noteworthy, many of the species currently found are the same as those listed in the ‘60s, confirming an amazing biodiversity; in particular, most Crustacea species inhabiting this station are the same as those currently missing from the “fontanile” Brancaleone.

“Fontanile” near the Carlotta Lake, Arzago d’Adda, Bergamo (station no. 124 BG).

<p style="text-align: center;">UTM Coordinates 32 TNR 43 3</p> <p style="text-align: center;">Geographic coordinates sexagesimal 9°32’57” E, 45°27’59”</p> <p style="text-align: center;">Table IGM F 46 III NO, Rivolta d’Adda</p> <p style="text-align: center;">Height above the sea level 101 m</p>
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Headwaters “B”

Crustacea:

Niphargus cfr. *bajuvaricus grandii* Ruffo, 1937
Niphargus microcerberus Sket, 1972
Niphargus pupetta Sket, 1962
Niphargus transitivus Sket, 1971
Niphargus stygocharis italicus G. Karaman 1976
Niphargus duplus G. Karaman, 1976

Mollusca:

Sadleriana fluminensis (Küster, 1852)
Graziana alpestris (Frauenfeld, 1863)
Alzoniella cfr. *bergomensis* n. sp.
Iglica sp.

Along watercourse

Crustacea:

Asellus aquaticus (Linnaeus, 1758)

Mollusca:

Bithynia tentaculata (Linnaeus, 1758)
Haitia acuta (Linnaeus, 1758)
Valvata piscinalis (O. F. Müller, 1774)
Valvata cristata O. F. Müller, 1774
Planorbarius corneus (Linnaeus 1758)
Planorbis carinatus O. F. Müller, 1774

Roggia Renga close to the “Fontanile” no. 124, Arzago d’Adda

Mollusca:

Bithynia tentaculata (Linnaeus, 1758)
Valvata piscinalis (O. F. Müller, 1774)
Physa fontinalis (Linnaeus, 1758)
Stagnicola sp.
Radix peregra (O. F. Müller, 1774)
Planorbarius corneus (Linnaeus, 1758)
Planorbis carinatus (O. F. Müller, 1774)
Acroloxus lacustre (Linnaeus, 1758)

Beyond the very common crenobiont species *Sadleriana fluminensis* and *Graziana alpestris*, powerful biological indicators of unpolluted and perpetual waters, two stygobiont species, never recorded before in the “fontanili” of Lombardia Region, were reported. For the first taxon, many living specimens, in addition to some empty shells, were collected in Arzago d’Adda. This little Hydrobiidae was found for the first time in a spring on Monte Canto-Monte dei Frati (Figs. 10, 11) (Pezzoli, 1993 sub “*Bythiospeum forumjulianum?*”; Pezzoli, 1996 sub “*Bythiospeum* sp.” see Manganelli et al., 2000), and in a few neighboring stations, while, more recently, at Sombreno (on the hills of Bergamo) (Pezzoli & Spelta, 2000 sub “*Bythiospeum* sp. 2”).

Although anatomical description of soft parts of a few specimens was already employed to briefly describe this taxon as “*Alzoniella bergomensis*” (*nomen nudum* in Pezzoli, 2004), nevertheless, aiming at conforming such a record to the ICZN current instructions (1999) it is re-described.

Alzoniella bergomensis n. sp.

Shell (Figs. 14-19, 27, 30, 32, 34): very small, more or less elongate, conical; spire consisting of 3-4 convex whorls, last whorl wide; sutures deep; aperture wide and ovoid; umbilicus open, narrow.

Dimensions: shell height 2.2-3 mm; shell diameter 1-2 mm.

Male genitalia (Figs. 28, 29, 31) are characterized by the simple penis, without lobes but little dilated on left side before the apex.

Female genitalia (Figs. 33, 35, 36) are characterized by a pallial oviduct with two seminal receptacle and one bursa copulatrix.

Type material: the holotype collected in "Cascinale Arzuffi", Sombreno (station no. 325 A BG: Pezzoli & Spelta, 2000), 28.XI.1998, legit E. Pezzoli, is deposited in the collection E. Pezzoli (Bedulita, Bergamo). Paratypes: 114 shells and 50 specimens complete of soft parts collected in type locality have been deposited as follows: 4 paratypes at the Museum of Natural Sciences "E. Caffi", Bergamo (nos. MNSBG 9347-9348-9349-9350), 100 paratypes in E. Pezzoli collection (Bedulita, Bergamo), 60 paratypes in the M. Bodon collection, 24.IV.2002, legit E. Pezzoli et M. Bodon (Genova).

Etymology: from Bergamo province, (Lombardia, Italy), where the new species was found.

Distribution: The new species is present in some stations in Bergamo province, Lombardia Region, in particular in some springs in the outskirts of Bergamo hills, slope of Sombreno and Monte Canto-Monte dei Frati, between the Adda and Serio Rivers. This species is likely to be endemic of Lombardia Region.

Stations currently known are: springs close to the farmhouse San Bartolomeo, Valle San Martino, Monte Canto, Pontida, Bergamo (station no. 144 BG see Pezzoli & Spelta, 2000); spring of Valle San Martino, northern slope of Monte Canto-Monte dei Frati ridge and, adjacent to the previous one, spring of Valle San Martino (station nos 226 BG and 227 BG, respectively cf. Pezzoli & Spelta, 2000); Bergamo hills, Sombreno: spring inside the

cellar of the old farmstead "Cascinale Arzuffi" at the medieval centre of Sombreno (station no. 325 A BG: Pezzoli & Spelta, 2000); not far from the previous area, the well in the locality known as "I Rucc", Paladina (station no. 325 B BG Pezzoli & Spelta, 2000); Fontanile at the Lake Carlotta, Arzago d'Adda, Bergamo (station no. 124 BG).

The genus *Alzoniella* Giusti & Bodon, 1984 is characterized by the shape of the male genital tract. Infact, the penis shows 1-2 glandular appendices, rounded or pointed, one of these located further up on the left side, the other, when present, located at the base, on top of the penis.

The female genitalia are characterized by a large loop of the renal oviduct on which two seminal receptacles and a bursa copulatrix are implanted. The new species *A. bergomensis* is characterized, when compared to the congeneric ones, by the lack of glandular lobes on the penis; nevertheless it is placed within the genus *Alzoniella* based on shell features, almost indistinguishable from *Alzoniella finalina* Bodon & Giusti, 1984, and on the female genital tract, very similar to that of other species of this genus, which, in turn, is markedly different from that of the Hydrobiidae *Iglica* A. J. Wagner, 1928, *Paladilhiosis* Pavlović, 1913 and *Graziana* Radoman, 1975, always showing one seminal receptacle.

Description of this new species has been based on anatomical analyses performed on specimens collected in the spring of the farmstead "Cascinale Arzuffi", Sombreno.

The second Hydrobiidae taxon was found for the first time, one specimen, in the "fontanile" Fontana Vecchia (Pumenengo), and, successively, in other stations between the Serio and Adda Rivers, nearby Arzago D'Adda, where unfortunately only numerous empty shells were recovered (*Iglica paganii* Arzuffi & Pezzoli, 2008 *nomen nudum*: AA.VV., 2008; Pezzoli, 2010). Therefore, up to now, it has been impossible to provide an accurate description of male and female genital apparatus for taxonomic diagnosis. However, based on shell features this taxon might be ascribed to the genus *Iglica* and, at the moment, is reported as *Iglica* sp.



Fig. 6



Fig. 7



Fig. 8



Fig. 9



Fig. 10



Fig. 11

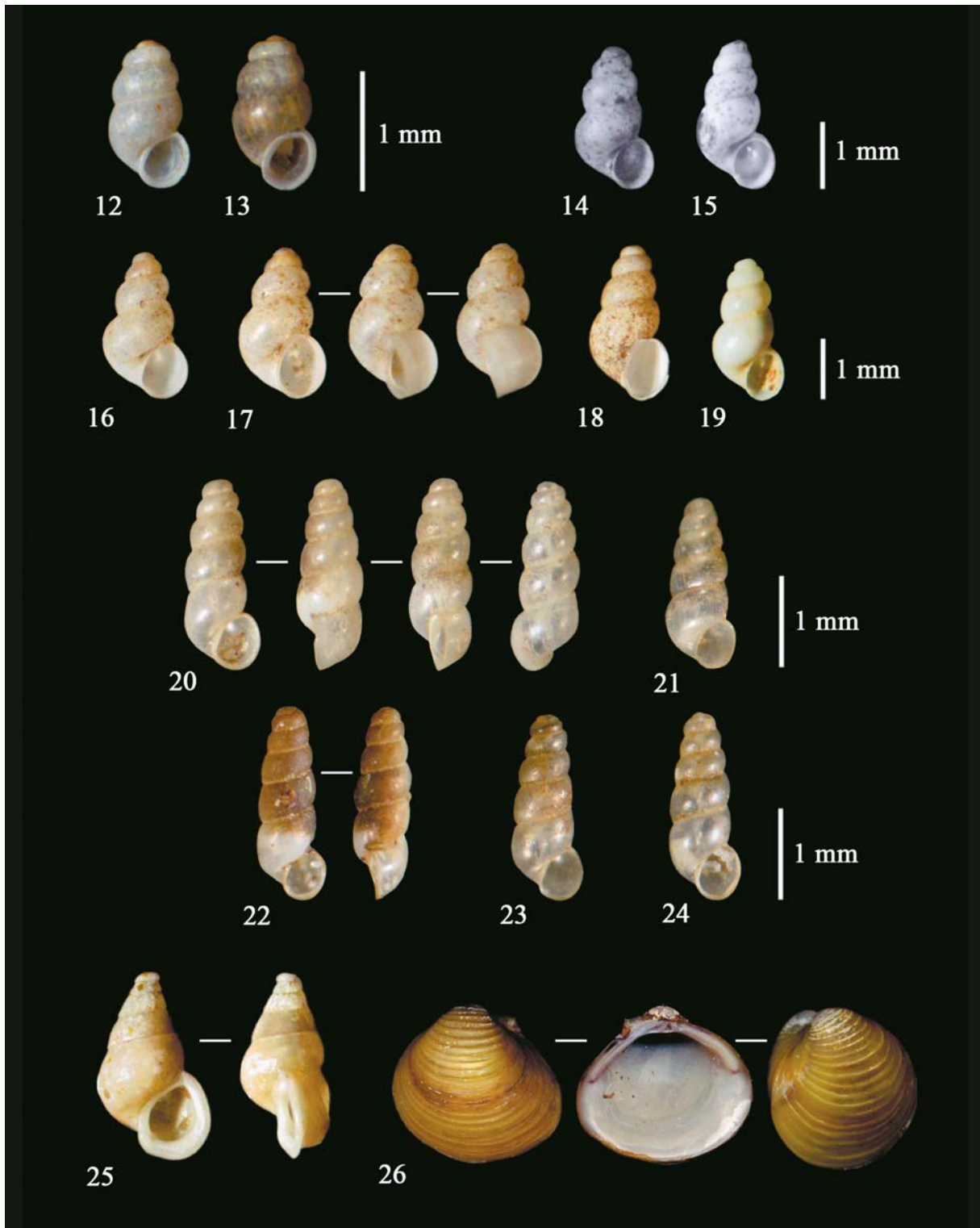
Figure 6. Headwaters "A" of the "fontanile" near the Carlotta Lake, Arzago d'Adda, high flow conditions.

Figure 7. Headwaters "A" of the "fontanile" near the Carlotta Lake, Arzago d'Adda, flow regime.

Figure 8. "Roggia Renga" close to the "fontanile" no. 124, near the Carlotta Lake, Arzago d'Adda.

Figure 9. Roggia Cremasca in the western part of the municipality of Arzago d'Adda.

Figures 10, 11. Springs close to the farmhouse San Bartolomeo, Valle San Martino, Monte Canto, Pontida, where *Alzoniella* cf. *bergomensis* n. sp. was found for the first time.



Figures 12, 13. *Graziana alpestris* from "fontanile" Fontana Vecchia, Pumenengo.

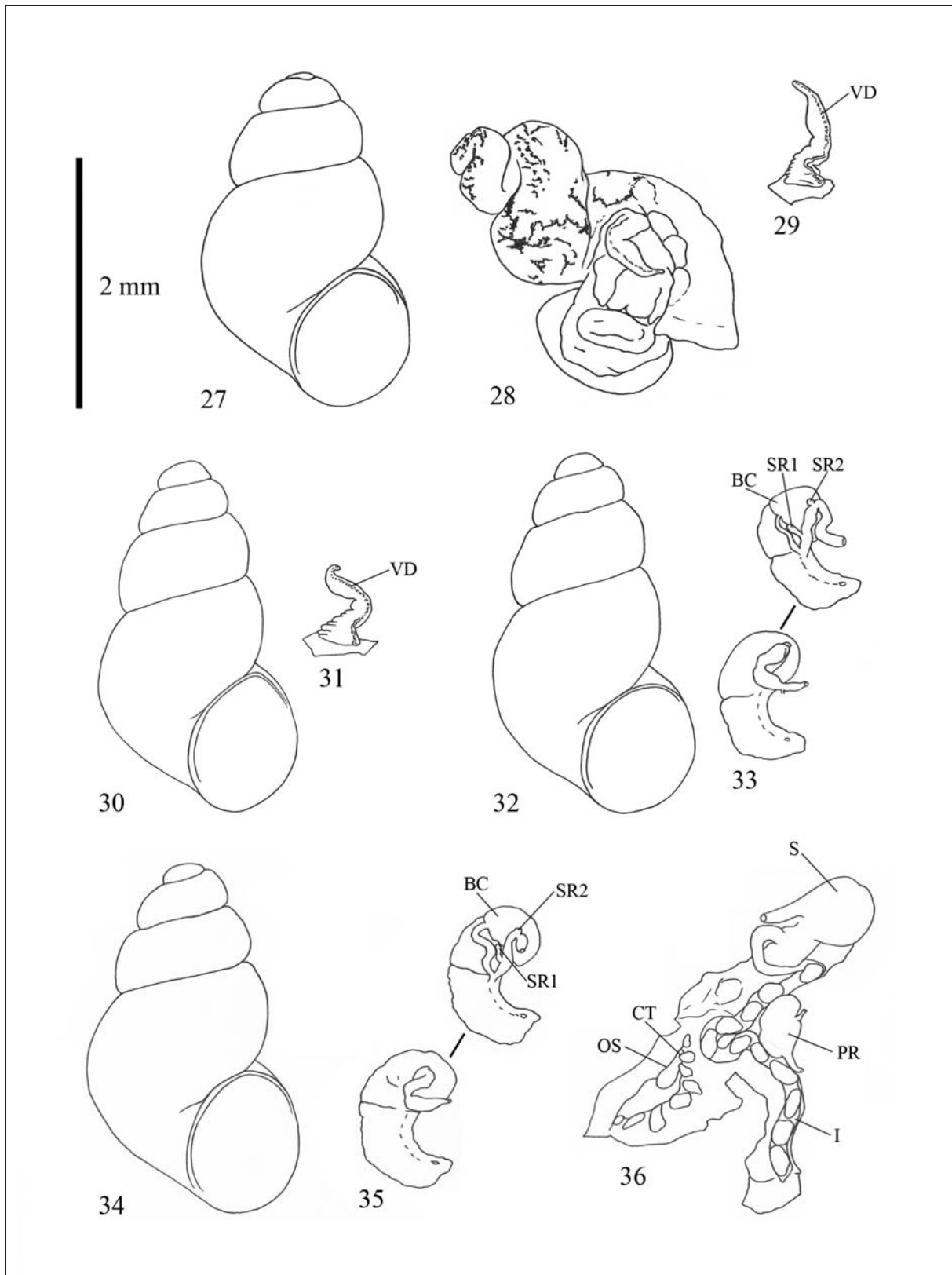
Figures 14, 15. *Alzoniella* cfr. *bergomensis* n. sp. from springs close to the farmhouse San Bartolomeo, Valle San Martino, Monte Canto, Pontida.

Figures 16, 19. *Alzoniella* cfr. *bergomensis* n. sp. from "fontanile" near the Carlotta Lake, Arzago d'Adda.

Figures 20, 21. *Iglica* sp. from "fontanile" near the Carlotta Lake, Arzago d'Adda.

Figures 22, 24. *Iglica* sp. from "Fontanelle al Barich", Arzago d'Adda

Figures 25, 26. *Emmericia patula* (Fig. 25) e *Corbicula fluminea* (Fig. 26) alien species from watercourses of the "fontanile" Fontana Vecchia, Pumenengo.



Figures 27, 36. *Alzoniella bergomensis* n. sp. from old farmstead "Cascinale Arzuffi", Sombreno: shells (Figs. 27, 30, 32, 34); body of a male (Fig. 28); penis (Figs. 29, 31); female genitalia (Figs. 33, 35, 36). Abbreviations: BC, bursa copulatrix; CT, ctenidium; OS, osphradium; PR, prostate; S, stomach; SR1, first seminal receptacle; SR2, second seminal receptacle; VD, vas deferens

Iglica sp.

Shell (Figs. 20-24): very small, cylindrical, acicular, translucent when fresh, spire consisting of 5-6 very convex whorls; sutures deep; aperture wide, ovoid and slightly oblique; thick margin, umbilicus very narrow.

Dimensions: shell height 2-3 mm; shell diameter 1-1.2 mm.

Male and female genitalia: unknown.

Distribution: Shells attributable to *Iglica* sp. have been found in the following sites: “fontanile” Fontana Vecchia, Pumenengo, Bergamo (station no. 90 BG); “fontanile” west of Arzago at Roggia Signora, Arzago d’Adda (station no. 125 BG); “fontanile” 2, Arzago in Monteverdi, Arzago d’Adda (station no. 127 BG); “fontanile” known as “Fontanelle al Barich”, Casirate d’Adda (station no. 128 BG); “fontanile” Cavo Carino, near the farmstead “Seriolo” (station no. 129 MI).

This taxon is a typical stygobiont, widespread from Albenza to the Alpine foothills up to Verona surrounds. It shows peculiar shell features, including a slimmer shell, convex, with a high number of whorls and aperture roundish.

Further researches are certainly needed to collect living specimens for providing a proper anatomical description.

CONCLUSION

The present study highlighted, to both the scientific community and local administration the extremely high environmental quality of the “fontanili” of Pumenengo and, in a particular way, Arzago d’Adda. As far as concerns the “fontanile” of Arzago d’Adda, bearing in mind that the ecological conditions of this very interesting biotope are highly menaced, it might be added to the list of sites of community importance. Further researches are still in progress either to locate stations with relevant environmental properties and characteristics or monitor the populations of crustaceans and molluscs already recorded.

As far as taxonomic classification is concerned, in order to address the questions raised in the present paper, further field surveys need to be carried out to collect a sufficient number of living specimens of the taxa under

study to better define the populations belonging to *Alzoniella bergomensis* n. sp. and provide a description of the taxon reported as *Iglica* sp.

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