



Research Paper

Endemic, Relict And Endangered Species Of Mollusks In Dobrogea, Romania-Case Study: Conacu-Negresti Valley

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Abstract: Conacu-Negrești Valley is located in the south-eastern part of Romania (southwest of Dobrogea), particularly in an area with excessive continental climate. The valley is characterized by a series of specific habitats, of which the most important are the dry steppe meadows, exposed limestone rocks and Conacu-Negrești Lake. The biodiversity of the valley is very interesting, characterized by a number of rare, endemic and relict species, specific to Dobrogea Province. This paper presents the data concerning the gastropods diversity, identified in this area so far, focusing on endemic, relict and endangered species, and climate change that have succeeded in this geographical area. The data represent the results of the research activities developed within the framework of our scientific and educational program on the Conacu-Negrești Valley from 2002 until now (2016).

Keywords: Gastropods diversity, Endemic, relict and endangered species, Climate change, Conacu-Negrești Valley, Dobrogea Region, Romania

Abbreviations: Zoogeoelements: Central and South European-Anatolian (CESEAN), European (E), Dobrogean Endemic (ED), Regional Endemic (ER), European-Turanian (ET), Holarctic (H), Holopalaearctic (HP), North Mediterranean (NM), North Mediterranean-Turanian (NMT), Mediterranean-Lusitanian (ML), Pontian (P), Ponto-Mediterranean (PM), Pontian-Southeast European (PSEE), Caspian Relict (RC), Preglacial Relict (RP), South European-Turanian (SET), Transpalaeartic (TP), West and Central Eurosiberian (WCES), West and Central Palearctic (WCP), West-Palaearctic (WP).

Ecological data, conservation status (after COUNCIL DIRECTIVE and IUCN): brackish (B), limiting freshwater level for

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marine and salinity level for the freshwater form (B-%), 3-Bern Convention (BC), calciphilous (CA), crenobiont (CR), data deficient (DD), European importance (E), the Red List of Threatened Animals and Plants in Europe (ESC), eurybiont (EU), V-Habitats Directive (HD), hygrophilous (HG), freshwater (L), lithophilous (LI), mesophilous (ME), not-evaluated (NE), pelophilous (PE), phytophilous (PH), pomatophilous (PO), rare (R), rhithrophilous (RH), stenoepibathic (SC), stagnant water (SW), terrestrial (T), troglaxene (TX), xerophilous (XPH), world importance (W), α - β -mesosaprobic (α - β), β - mesosaprobic (β), o- β -mesosaprobic (o- β).

INTRODUCTION

Dobrogea is located on the northern Balkan Peninsula in southeastern Central Europe (44°17'03, 77°N, 28°21'53, 27°E). It occupies an area of approximately 23.142 km², of which 15.570 km² are located in Romania (making up 6.52% of the total area of Romania) and 7.572 km² in Bulgaria. The Dobrogea Region is bordered by the lower Danube River to the southwest, west, northwest and north, the Danube Delta to the northeast, the Black Sea to the east and the Ludogorie Plateau to the southeast and south.

Conacu-Negrești Valley is located in the extreme south-eastern part of Romania (south-eastern part of Europe), in the center of Cobadin Plateau, subunit of Negru-Vodă Plateau, by Iana (1970), falls within the following geographical coordinates: the parallel 10 43°58'48,93" north latitude and the meridian 28°10'05,12" east longitude. This explains position in the world in temperate climate zone. Location of the valley in the extreme south-eastern of Romania justify the excessive continental climate characteristics of this area, with environmental influences in all components.

Cobadin Plateau landscape consists of large and almost flat interflaves. There start a series of short valleys discharging into the Danube River (Brezeanu, 1997).

The landscape has formed predominantly on Cretaceous and Sarmatian limestone, on Precambrian basement lithology and covered by a thick blanket of 40 m of Quaternary loess. The Proterozoic foundation is composed of crystalline schists and sedimentary superstructure, which are distinguished by two types of Paleozoic-Mesozoic and Neozoic formations. Paleozoic Silurian formations are composed of clay schists with Devonian diachlases, consisting of thick marl clay, marl-limestone, etc. Mesozoic formations are composed of alternating calcareous and detritic deposits. Jurassic Period strata are composed of alternating limestone and diatomites. The Cretaceous period is represented by reef limestone and, marl-limestone, with sand, glaucenic sandstones, and micro-conglomerates in the middle strata, and marl clay at the base. Uppermost strata are dominated by debris facies with calcareous sandstones, micro-conglomerates, chalk, etc. These formations have been subjected to folding with foundation blocks revealing wavy structure (Al-Azki, 2003; 2006, 2007, 2010-2011a, b; Coteț, 1969).

The landscape of the valley consists of gorges with limestone walls, with "limestones to day", Conacu-Negrești Lake being located within this area, canyons, ravines, xerophyte steppe grasslands, grassy hills and bushes.

MATERIALS AND METHODS

By 2003, the valley was known only geographically. In 2003, we started a comprehensive long-term program of scientific research of the valley. Since then and until now, we carry on scientific research of the valley—in geological,

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paleontological, paleo-biodiversity,
biodiversity terms, and of conservation of its
geo-biodiversity.

In terms of mollusks diversity and its
conservation research, during the scientific
program carried out between 2002 and 2015,
different stations were established for field
observations, identification of species and
sampling both from the lake and the valley.

10 stations were established at different
points in the lake, taken differently
depending on the nature of the substrate,
lake depth and the existence of marsh,
aquatic and floating vegetation. From these
stations, samples were collected monthly.
All samples were taken from the shore area
of the lake, on the distance of two meters.

For the land, 12 stations were established
depending on the type of the existing
habitats in the valley: limestone walls with
“rocks to day”, grassy hills, canyons,
plateaus, ravines, debris walls, limestone
walls with fossil mollusks. For
identification, it was widely used field
observations and photographs taken monthly
by the team, during the field trips.

Subsequently, all samples have been
transported, stored and examined / studied in
our laboratories.

The nomenclature of taxa and data
processing is according to data from
literature as well as to national and
international legislation.

RESULTS AND DISCUSSION

By its characteristics different from the rest
of the country (geographical position,
presence and influence of Black Sea climate
and soil structure, history and evolution of
land with consequences for the history and
evolution of its biodiversity), Dobrogea is an
geographical "entity" characterized by a
mixture of flora and fauna elements of
Southern, Eurasian, Ponto-Caspian,
European origin, etc.; many species are rare

or endemic to this geographical region, or at
limit of areal (Axini and Tofan, 2009). The
plenty and the diversity of original
ecological and genetic fund which Dobrogea
was so generous endowed, it is more
expressive by the fact that Romania is only
2.36% of Europe surface (Axini, 2011a).

In South Dobrogea, the Conacu-Negrești
Valley (Figure 1 A, B, C) is located on a
north-west to south-east axis. It is a
“*canara*” (Axini and Alexandrov, 2011;
Iana, 1973), a term specific to Dobrogea,
and meaning a valley generally short,
narrow, with limestone slopes, high and
steep walls with small caves, partly covered
with Sub Mediterranean xerophyte meadows
and scrub forest vegetation.

By Axini and Al-Azki (2012), the Conacu-
Negrești Valley is distinguished by
spectacular landscape beauty and is
characterized by extremely rich and diverse
biodiversity, with many rare or endemic
species specific to Dobrogea Province, and
Romania too (Axini *et al.*, 2010). Its
significance also is derived from its
geological, geomorphologic, and
paleontological characteristics. Also, the
geo-diversity of the valley is very
interesting, characterized by rare geological
structures and geomorphological
phenomena, as a result of a unique
geological and paleontological history,
specific to Dobrogea Province.

In this geological, geographical and
ecological context, the species of mollusks
have appeared and developed. Currently,
309 living species occurs in Dobrogea,
which inhabit both terrestrial, aquatic,
underground and marine environments. Of
these, many species are endemic or relict.

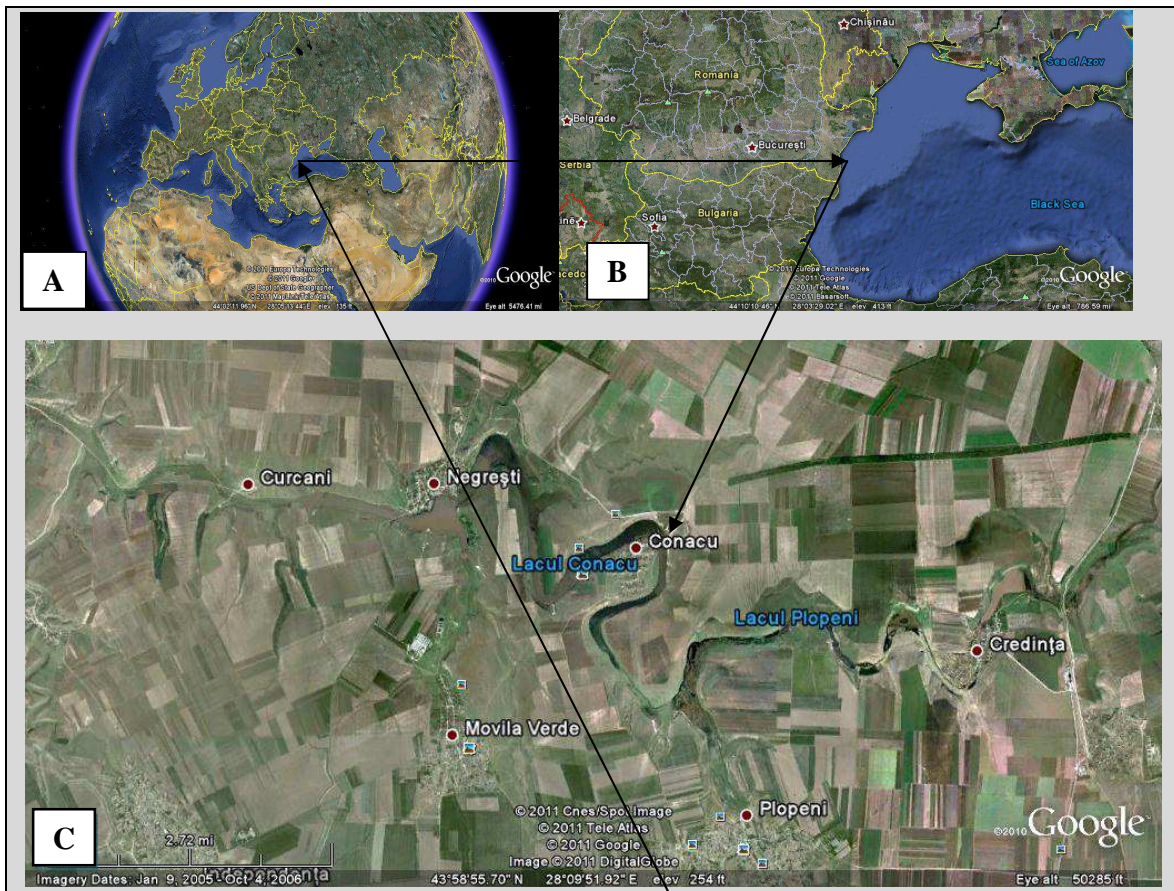


Figure 1: A - Map of Europe emphasizing the position of Dobrogea and Conacu - Negrești Valley in Europe; B - Geographical position of Conacu - Negrești Valley in Dobrogea Region; C - Conacu - Negrești Valley (from Google Earth, accessed January 18, 2016)

By Axini and Al-Azki (2015), Conacu-Negrești Valley hosts many species of invertebrate animals, of which, so far, we have identified a total of 101 terrestrial and aquatic species, belonging of 17 orders and 57 families. Of these, gastropods are second after the insects that hold the highest numerical proportion (Axini, 2012a; Axini and Skolka, 2010a, b).

Of the gastropods identified thus far, the 22 species included both terrestrial and aquatic taxa among which 9 families grouped in 3 orders (Table 1) (Axini, 2012b; Cioboiu, 2002; Grossu, 1986, 1987; Müller, 2002; Negrea, 2002; Skolka, 2008; Skolka *et al.*, 2005).

Table 1: The Taxonomic Analysis of Identified Gastropod Species (original)

Order	Family	Species
Mesogastropoda	Thiaridae	<i>Esperiana esperi</i> (FÉRUSSAC 1823)
		<i>Esperiana acicularis</i> (FÉRUSSAC 1829)
	Valvatidae	<i>Valvata piscinalis</i> (O. F. MÜLLER 1774)
	Bithyniidae	<i>Bithynia leachi</i> (SCHEPPARD 1823)
<i>Bithynia tentaculata</i> (LINNAEUS 1758)		
Basomatophora	Physidae	<i>Physa acuta</i> (DRAPARNAUD 1805)
		<i>Ph. fontinalis</i> (LINNAEUS 1758)
	Planorbiidae	<i>Planorbarius corneus</i> (LINNAEUS 1758)
		<i>Gyraulus albus</i> (O. F. MÜLLER 1774)
	Lymneidae	<i>Radix ovata</i> (DRAPARNAUD 1805)
		<i>Radix peregra</i> (O. F. MÜLLER 1774)
		<i>Galba truncatula</i> (O. F. MÜLLER 1774)
Stylomatophora	Enidae	<i>Stagnicola palustris</i> (O. F. MÜLLER 1774)
		<i>Chondrula tridens</i> (O. F. MÜLLER 1774)
		<i>Zebrina detrita</i> (syn. <i>Helix detrita</i>) (MÜLLER 1774)
	Helicidae	<i>Zebrina varnensis</i> (L. PFEIFFER 1847)
		<i>Helicella obvia dobroudschae</i> (CLESSIN 1886)
		<i>Cepaea vindobonensis</i> (A. FÉRUSSAC 1821)
		<i>Helix pomatia</i> (LINNAEUS 1758)
	Limacidae	<i>Helix lucorum</i> (O.F. MÜLLER 1774)
		<i>Limax cinereo-niger</i> (WOLF 1803)
		<i>Limax flavus</i> (LINNAEUS 1758)

The analysis of the geographical elements of gastropods from Conacu-Negrești Valley (Hubenov, 2007; Zoltán *et al.*, 2004) showed that the North Mediterranean-Turanian elements dominate with 3 taxa,

followed by West Palearctic, Caspian Relict, Pontian-Southeast European, Holarctic, Holopaeartic, West and Central Eurosiberian and European elements, each with 2 taxa (Table 2).

Table 2: The Zoogeographical Elements, Ecological Data and Conservation Status of Gastropods from Conacu-Negrești Valley (original)

Species	Zoogeoelements	Ecological data/conservation status
<i>Bithynia leachi</i>	WP	L, PO, RH, SW, β
<i>Bithynia tentaculata</i>	WP	L, B, PO, SW, PH, NE, o-β
<i>Cepaea vindobonensis</i>	PM	T, XPH

<i>Chondrula tridens</i>	ET, NMT	T, XPH-ME
<i>Esperiana acicularis</i>	RC, PSEE	L, CR, RH, PO, LI
<i>Esperiana esperi</i>	RC, PSEE	L, CR, PO, LI, DD
<i>Galba truncatula</i>	H	L, EU, PE, PH, α - β
<i>Gyraulus albus</i>	WCES	L, B-8%, PO, RH, SW, PH, R, N
<i>Helicella obvia dobroudschae</i>	ED	T, XPH
<i>Helix lucorum</i>	NMT	T, ME-HG
<i>Helix pomatia</i>	E	T, XPH-ME, EU, E, ESC, BC-3, HD-V
<i>Limax cinereo-niger</i>	E	T, ME
<i>Limax flavus</i>	RP, P, NM	T, ME, N
<i>Physa acuta</i>	NMT, SET	L, EU, PC, TX, NE, α - β
<i>Physa fontinalis</i>	TP	L, PH, R, N, α - β
<i>Planorbarius corneus</i>	WCES	L, B-8%, SW, PO, NE, α - β
<i>Radix ovata</i>	HP	L, B-2,5%, SW
<i>Radix peregra</i>	HP	L, EU, PH, PE
<i>Stagnicola palustris</i>	H	L, EU, PH, PC
<i>Valvata piscinalis</i>	WCP	L, RH, PO, SW, PH, NE, β
<i>Zebrina detrita</i>	CSEAN	T, XPH, CA, E
<i>Zebrina varnensis</i>	ER	T, XPH, CA, W

By Axini (2006) among them in the basin of the lake water (43°59'15.94"N, 28°09'24.52"E), 3 species of gastropods have a great scientific importance: *Planorbarius corneus*, *Esperiana esperi*, *E. acicularis*. It is known as gastropod populations occupy an important place in the lake biocoenoses structure, by the specific and numerical diversity and biomass. They are the first organisms that are investigated when examining a stagnant water. Their presence in large numbers indicates the level of oxygen in water, and therefore the presence of life in aquatic ecosystems (Chiriac and Udrescu, 1965; Cioboiu, 1998; Gomoiu and Skolka, 2001; Țigănuș and Samargiu, 2003).

According to Axini and Al-Azki (2015), the presence of gastropod *Planorbarius corneus* in large specimens (species that indicate the existence of high levels of calcium ions in lake water) demonstrated that the valley has

a strong limestone geological structure formed by the withdrawal of the former Sarmatian Sea. Moreover, the presence of this last-geological-time sea was demonstrated by fossil species of mollusks present in large numbers here (such as *Maetra* sp.), and the limestone "to day" that dominates the valley. These fossil mollusks species are present in the limestone rocks from coastal zone of the lake, on the limestone walls of the valley, in the canyons and ravines, on the Sarmatian coasts with "limestone rocks to day" (Al-Azki, 2012a, b; Axini and Al-Azki, 2014).

The Danubian and Pontic species of gastropods, *Esperiana esperi* and *Esperiana acicularis*, are Pontian-Southeast European relicts. Identification of these species in large numbers showed that the valley was a branch of the Danube River making the connection between it and the Black Sea, or the presence of millions years ago of

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ParaThethys Sea, and later, of Sarmatian Sea
(Axini and Al-Azki, 2012). This was
demonstrated by the geological structure of
the valley, shape and position of the two

canyons in the south-west of the valley
(43°57'58.97"N, 28°10'14.88"E) (Figure
2A).



Figure 2: A - Top view of some arms of the large canyon; B - Grassy hill with Sarmatian “limestone to day” (original photos., 2009)

Also this was demonstrated by the presence
in large number of terrestrial xerophilous
gastropod species, *Zebrina varnensis*
(43°59'44.28"N, 28°10'25.59"E) - regional
endemism spread of the Black Sea coast of
Romania and Bulgaria. *Zebrina varnensis*
was found in numerous copies on the

limestone walls with “rocks to day” (Figure
2B), together with *Chondrula tridens* and
Zebrina detrita. *Zebrina varnensis* (Figure
3A) is a highly resistant species to drought,
found on sunny slopes covered with
herbaceous vegetation, in sandy areas
(Axini, 2012c).

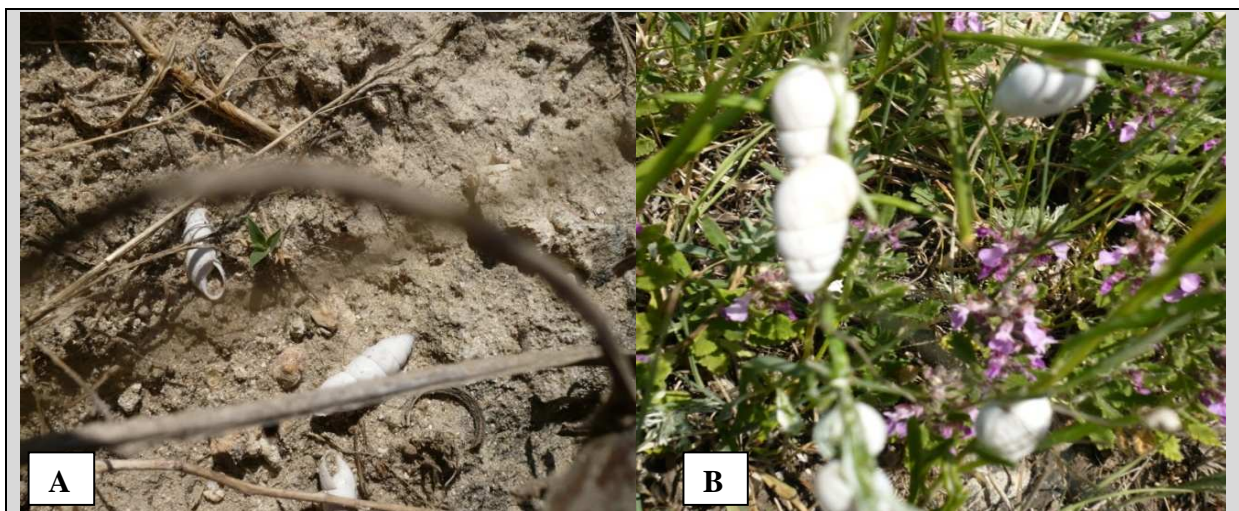




Figure 3: A - Limestone wall with *Zebrina varnensis*; B - Herbaceous plants with *Zebrina detrita*; C – picture of *Helicella obvia dobrudschae* from the large canyon (original photos, 2009)

Chondrula tridens (44°00'20.83"N, 28°08'32.99"E) and *Zebrina detrita* (Figure 3B) was found on the limestone walls with "rocks to day", in less numerous specimens. These are xerophilous species belonging to the genera of West Asian origin. The presence in areas without forests of *Zebrina detrita* (large snail) and *Chondrula tridens* (relatively common species in the foliage of oak forests) previously confirmed the existence of the pubescent oak forest (*Quercus pubescent*); however, it is no longer found in Conacu-Negrești Valley today.

The existence of this forest was proved by the limestone walls tilt and the existing of herbaceous and shrub plant species (specific such forests) in the canyons of the south-west of the valley or on the grassy hills and limestone walls. Also by Axini (2009) the proof that the valley has been dominated by an oak forest was the presence of insect species which normally live in a oak forest. This forest was part of Cobadin Forest, part of the "Deliorman" Secular Forests (name from Cumana Language, which translated "Black Wood"). These forests, largely disappeared today, spanning in southern of

two biogeographic regions, Dobrogea and Muntenia (Axini, 2011b, c). Its remnants can be seen on the lake bottom (Conacu-Negresti Lake), of recent geological time, formed by natural damming (Basarabeanu, 1969; Gâstescu & Breier, 1969; Godeanu, 2002).

On limestone slopes with "rocks to day", on plateaus, hills and canyons in the south-west of the valley is worth mentioning many individuals of the gastropod *Helicella obvia dobrudschae* (Figure 3C) (43°59'44.28"N, 28°10'25.59"E) (xerophilous species, endemic to Dobrogea).

Conclusion: Until 2003, the valley was known only from the geographical field studies and research of Mrs. Dr. Sofia Iana, University of Bucharest, on the Negru - Vodă Plateau, Dobrogea. In 2003, we developed a research project on the geo-bio-diversity of the Conacu-Negresti Valley. The own effort became a permanent research program, undertaking new research and public education projects for environmental protection of this valley. Currently, there is no research on the palaeo-bio-diversity, geological structures and

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hydro-geo-biological and climate change phenomena of this valley from Dobrogea Region. Our findings are unique. In the future, they will be upgraded with new data and research of laboratory and field.

Moreover, our research on the valley are singular. No literature data were found in this field on this region.

The data presented in this work were compiled from field and laboratory studies conducted in 2002 - 2015.

A total of 22 species of gastropods was identified in this time, which have a very important role in the demonstration of climate change in the area. Of these Mollusca, two are endemic, seven are relicts, and two are rare. One species (*Helix pomatia*) is of European importance and included on the Habitats Directive and Bern Convention lists.

The presence of these species will help us to reconstruct of palaeo-environments correlated with current ecosystems and natural history in Conacu-Negresti Valley, and also in Dobrogea.

At present, the valley does not have designated conservation status. Human impacts on different aspects may contribute to future declines and even disappearance of some gastropods species in Conacu-Negrești Valley, many species important to science and human well-being, some of which have not been described yet.

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