AES BIOFLUX

Advances in Environmental Sciences – International Journal of the Bioflux Society

Preliminary study of the terrestrial gastropods diversity (Gastropoda: Stylomatophora) from Cefa Nature Park (NW of Romania)

[1]Matilda C. Amza, [1]Milca Petrovici, [2]Voichița Gheoca

[1]West University of Timisoara, Faculty of Chemistry, Biology, Geography, Dept. of Biology, Timisoara. [2]Blaga University of Sibiu, Faculty of Sciences, Dept. of Ecology and Environmental Protection, Sibiu.
Corresponding author: Petrovici Milca, milcapetrovici@yahoo.com

Abstract. The paper presents the first investigation over the terrestrial gastropods fauna from Cefa Nature Park (NW of Romania). The samples were collected every month (April 2009 - March 2010), using hand collection, soil collection from 25x25 cm squares which were processed in the laboratory through sieving as well as installation of Barber traps. On the whole, 22 species were determined (without slugs), of which dominant were the Holarctic species (31.82%), followed by the European elements (27.27%). The identified species belong to the following categories: mesophilous, hydrophilous and meso-hydrophilous, with close percentages (27.27 % – 31.82 %). The least of the elements are those of meso-xerophilous (13.64%). The dams habitat between fishponds supports the largest diversity of terrestrial gastropods (21 species), followed by the forest one (9 species) and finally the grasslands one (5 species). The species with the highest frequency (100%) met during every month of investigations, was *Vallonia pulchella*, for the dams habitat between fishponds. All these results argues once more the importance and the need to protect these artificial habitats (like the dams between fishponds), which often undergo large anthrop pressures resulting from the piscicultural management (repeated setting on fire in order to stop the expansion of reed surfaces). It is also necessary to continue to investigate the gastropods fauna both in Cefa Nature Park, and in the protected area to which this park has common border and habitat (Körös-Maros National Park – Hungary).
Key words: Gastropods, diversity, land snails, Cefa Nature Park.

Rezumat. Articolul reprezintă o primă investigaţie a faunei de gasteropode terestre din Parcul Natural Cefa (Nord-Vestul României). Probele au fost colectate lunar (Aprilie 2009 - Martie 2010), utilizând colectarea cu mâna, colectarea solului din pătrate de 25x25 cm care au fost prelucrate în laborator prin cernere, precum şi cu ajutorul capcanelor Barber. În total, au fost determinate 22 de specii (fără speciile de limacşi), dintre care domină speciile holarctice (31.82%), urmate de elementele europene (27.27%). Speciile identificate aparţin categoriilor: mezofile, hidrofile şi mezo-hidrofile, având procente apropiate (27.27 % – 31.82 %). Cele mai puţine sunt elementele mezo-xerofile (13.64%). Habitatul de diguri între heleştee susţine cea mai mare diversitate a gasteropodelor terestre (21 de specii), urmat de cel de pădure (9 specii) şi în final, de cel de pajişte (5 specii). Specia cu frecvenţa cea mai mare (100%) întâlnită în fiecare lună de investigaţii, a fost *Vallonia pulchella*, pentru habitatul de diguri între lacuri. Toate aceste rezultate argumentează în plus, importanţa şi necesitatea protejării acestor habitate artificiale (cum sunt digurile între heleştee), care sunt deseori supuse unor presiuni antropice de intensitate mare rezultate din managementul piscicol (incendieri repetate, pentru stoparea măririi suprafeţelor acoperite cu stuf). De asemenea, este necesară continuarea investigării faunei de gasteropode, atât în Parcul Natural Cefa, cât şi în aria protejată cu care acest parc are graniţă şi habitate comune (Parcul Naţional Körös-Maros– Ungaria).
Cuvinte cheie: Gastropoda, diversitate, melci tereştrii, Parcul Natural Cefa.

Absztrakt: Az előadás bemutatja az első vizsgálat alatt a földfelszíni haslábúak fauna Cséffa Természeti Park (NW Románia). A mintát vettünk minden hónapban (Április 2009 - Március 2010), segítségével kézzel gyűjtemény, a talaj begyűjtésére 25x25 cm-es négyzet, amely dolgoztak a laboratóriumban a szitálás, valamint telepítése Barber csapdák.A teljes, 22 faj határozza meg (nem meztelen csigák), amelynek meghatározó volt a Holarctic faj (31,82%), ezt követi az európai elemek (27,27%). Az azonosított fajok tartoznak az alábbi kategóriákban: mesophilous, hidrofil és mezo-hidrofil, szoros arányban (27,27% - 31,82%). A legkevésbé az elemek azok a mezo-xerophilous (13,64%). A gátak élőhely közötti halastavak támogatja a legnagyobb sokféleségét szárazföldi csigák (21 faj), ezt követi az erdőben egy (9 faj) és végül a gyepek egy (5 faj). A faj a legnagyobb gyakorisággal (100%) találkoztak havonta vizsgálatok volt *Vallonia pulchella*, a gátak élőhelyek közötti halastavak. Mindezek az

eredmények azt állítja, még egyszer a fontosságát és szükségességét, a környezet védelmét a mesterséges élőhelyek (mint például a gátak közötti halastavak), amelyek gyakran esnek át a nagy nyomás anthrop származó haltenyésztési menedzsment (ismételt beállítása a tűz megállítása érdekében a terjeszkedés a nád felületek) . Az is szükséges, hogy továbbra is vizsgálja a csigákat állat egyaránt Cséffa Természeti Park, valamint a védett terület, amelyre a park a közös határ-és élőhely (Körös-Maros Nemzeti Park - Magyarország).
Kulcsszavak: csigák, a sokféleség, szárazföldi csigák, Cséfa Természeri Park.

Introduction. Gastropods are an important part of the soil fauna in terrestrial ecosystems, having an extremely important role in coarse debris processing, which means food, shelter and site for breeding for these animals (Kapes 2005). They are also extremely important organisms in the trophic chains of the ecosystems they are part of.

Up to now, there have not been any studies on the terrestrial gastropods fauna from Cefa Nature Park (northwest of Romania), the results from this paper being the first identifications of this group (*Gastropoda*: *Stylomatophora*) in the protected area. The purpose of this paper is to describe the species richness and distribution of terrestrial gastropods in different habitats from this protected area.

Materials and Methods

The study site. Cefa Nature Park (5002 ha) is located northwest of Romania, having the western border common with the Biharugra area from Körös-Maros National Park (Hungary), the two parks forming together a cross-border protected area. The area is characterized by a large diversity of habitats and their organisation as a mosaic, as well as by its high level of their ecologic integrity. Therefore, in a restricted area, one can find various habitats like: fishponds, channels of various sizes, ditches, ponds, forest, salt marshes, crops, grasslands and humid hayfields.

The habitats investigated in this study are the following: forest, grassland and the habitat from the dams between fishponds.

Forests (F). It is a meadow forest consisting of *Quercus robur*, *Ulmus minor* and *Fraxinus excelsior*. In spring the soil is very humid up to swampy and in summer it is very dry. The phreatic water is close to the soil surface.

Grasslands (G). Most of the soils which are currently outside the agricultural area are salty, with characteristic halophile vegetation used on large surfaces as grassland and very little as. Species of plants: *Juncus gerardi, Polygonum aviculare, Trifolium fragiferum, T.ornitopodioides, Aster tripolium ssp. pannonicus, Festuca pseudovina, Artemisia santonica ssp. monogyna, Poa bulbosa, Scleranthus anuus, Scorzonera cana, Plantago maritima, Gypsophila muralis, Statice gmelini*, *Peucedanum officinale, Cirsium brachycephalum,* etc.

Dams between fishponds (D). This habitat is met on large surfaces, all over the fishery, being placed between the aquatic basins used for intensive carp breeding. Species of plants: *Juncus gerardi, J.articulatus, Ranunculus repens, Mentha arvensis, Polygonum mite, Lycopus exaltatus, Rorippa sylvestris, Rumex stenophyllus, Rumex palustris, Polygonum hydropiper, Rorippa amphibia, Glyceria maxima, Oenanthe aquatica, Sparganium erectum, Iris pseudaccorus, Phragmites australis*, *Typha latifolia, T.angustifolia.*

Sampling. Samples were collected monthly, from April 2009 to March 2010. The snails were obtained by hand sorting, from all habitats. In parallel, two more procedures were used for sampling: quantitative samples collection and Barber pitfall traps. The quantitative samples were carried out by using 25x25 cm quadrates in 10 cm soil depth. We collected surface leaf litter and soil into plastic bags for later sampling. The coarse plant matter was removed by hand. The litter samples were dried in laboratory, fractioned by sieving, sorted under a stereomicroscope and separated live animals and empty shells. In later tests, we considered only the samples found alive, because it is known that in small samples (25x25 cm), the failure to separate living individuals from dead ones (empty shells) can result into significant errors in appreciating some of the parameters (Cernohorsky et al 2010). The pitfalls were made of plastic cups 500 ml filled

with 50 ml of antifreeze solution (alcohol & glycerin). For rain protection was used linoleum covers.

The gastropods were identified in the laboratory to species according to Kerney & Cameron (1979) and Grossu (1983; 1993). Nomenclature follows Fauna Europaea (Bank 2007). Slugs were not included in this study, as their activity depends largely on weather conditions (Rollo 1991) and the sampling method used was not suitable to determine slug abundance (Oggier et al 1998).

The similarity between different ecosystems has been calculated based on the Jaccard index (Jaccard 1901), by the formula: $Cj=j/(a+b-j)$, where j is the number of common taxons, a is the number of species on site and b is the number of taxons on site B. Analyses were carried out with the PAST 2.01 (Hammer et al 2001).

Results and Discussion. Following the material processing, 22 species of gastropods were identified belonging to 15 families (see Table 1). The best represented families are *Oxychilidae* and *Succinidae* Family, each of them with three species. Their appurtenance to various zoogeographic range, as well as humidity preferences are taken from Grossu (1981; 1983; 1987) and Kerney & Cameron (1979).

Table 1

The list of gastropods species identified in Cefa Nature Park, 2009-2010, the zoogeographic range and their humidity preferences (MX – Meso-Xerophilous, MH - Meso-Hygrophilous, H – Hygrophilous, M – Mesophilous)

	Zoogeografic range	Humidity preferences	Habitat
Aciculydae Family (J.e. Gray, 1847)			
*1. Platyla (Acicula) polita (*Hartman, 1840*)*	*European*	*M*	*D*
Ellobioidea Family (Jeffreys, 1830)			
*2. Carichium tridentatum (*Risso, 1826*)*	*European*	*H*	*D*
Succinidae Family (H. Beck, 1837)			
*3. Succinea oblonga (*Draparnaud, 1801*)*	*European-Siberian*	*H*	*F, D*
*4. Succinea putris (*Linné, 1758*)*	*European-Asian*	*H*	*F*
*5. Oxyloma elegans (*Risso, 1826*)*	*European-Siberian*	*H*	*D*
Ferussaciidae Family (Bourguignat, 1883)			
6. Cecilioides acicula (Müller, 1774)	*European*	*M*	*D*
Enidae Family (A. Schmidt, 1855)			
7. Chondrula tridens (Müller, 1774*)*	*European –Asian*	*MX*	*D*
Cochlicopidae Family (Pilsbry, 1900)			
8. Cochlicopa lubrica (Müller, 1774)	*Holarctic*	*H*	*F, D*
Vertiginidae Family (Fitzinger, 1833)			
*9. Columella edentula (*Draparnaud, 1805*)*	*Holarctic*	*M*	*D*
Euconulidae Family (Baker, 1928)			
10.Euconulus fulvus (Müller, 1774)	*Holarctic*	*M*	*D*
Pupillidae Family (Turton, 1831)			
11.Pupilla muscorum (Linné, 1758)	*Holarctic*	*M*	*D*
Vallonidae Family (Morse, 1864)			
12.Vallonia costata (Müller, 1774)	*Holarctic*	*MH*	*D*
13.Vallonia pulchella (Müller, 1774)	*Holarctic*	*MH*	*F, G, D*
Gastrodontidae Family (Tryon, 1866)			
14.Zonitoides nitidus (Müller, 1774)	*Holarctic*	*H*	*D*
Oxychilidae Family (P. Hesse, 1927)			
15.Nesovitrea hammonis (Strom, 1765)	*North Eurasian*	*MH*	*F, G, D*
16.Oxychilus depressus (Sterki, 1880)	*Central-South European*	*MH*	*D*
17.Aegopinella epipedostoma (Fagot, 1879)	*Carpathic*	*MH*	*F, D*
Hygromiidae Family (Tryon, 1866)			
18.Euomphalia strigella (Draparnaud, 1801)	*European*	*M*	*F, G, D*
19.Monacha cartusiana (Müller, 1774)	*European*	*MX*	*F, G, D*
Bradybaenidae Family (Pilsbry, 1934)			
20.Fruticicola fruticum (Müller, 1774)	*European*	*MH*	*D*
Helicidae Family *(Rafinesque, 1815)*			
21.Helix lutescens (Rossmässler, 1837)	*Carpathic*	*M*	*D*
22.Cepaea vindobonensis (Pfeiffer, 1828)	*Central-East European*	*MX*	*F, G, D*

The 22 species identified in Cefa Nature Park, belong to 8 zoogeographic categories (Figure 1 - up). The holarctic elements are predominant, which are 31.82% of the identified species. The following in percentage (27.27%), are the European elements, the rest of 6 having percentages below 19%. This relative homogeneity of the zoogeographic structure of the terrestrial malacofauna can be explained through the relatively small investigated area and relative homogeneity of the area habitats, at a large scale (macro habitats).

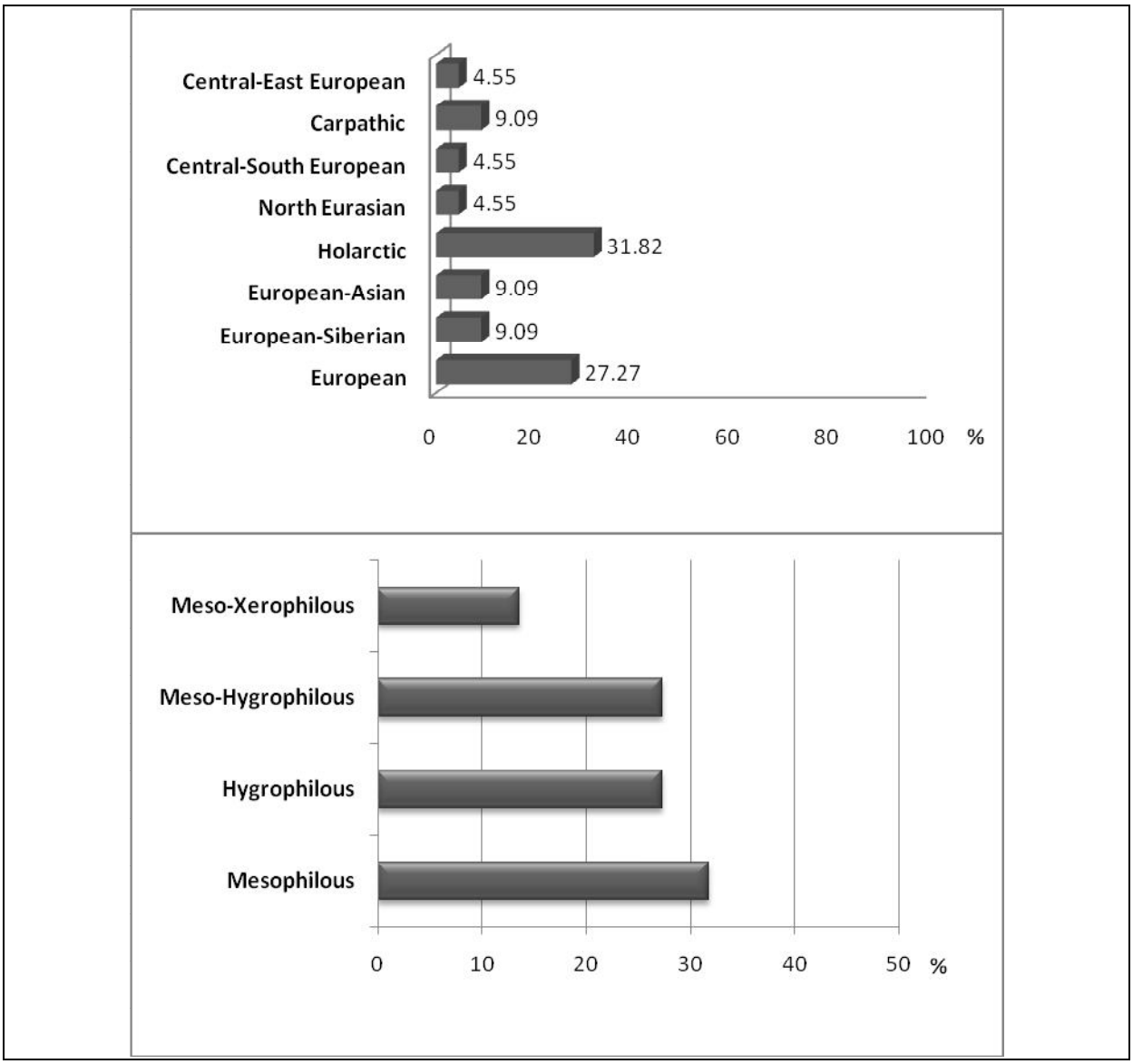

Figure 1. Zoogeographical spectrum (up) and humidity preferences spectrum (down) of the terrestrial gastropods fauna from Cefa Nature Park, 2009-2010.

Figure 1 (down) shows a relatively balanced distribution of the snails, depending on the humidity preferences. With close values (between 27.27% and 31.82%) the identified species belong to the following categories: mesophilous, hydrophilous and meso-hydrophilous. Those belonging to the meso-xerophilous category are in a smaller percentage (13.64%), the entire investigated area being characterized by a high level of humidity during the entire year.

As you can see in Table 1, most of the species were found only in one of the three investigated habitats. *Succinea oblonga*, *Cochlicopa lubrica* and *Aegopinella epipedostoma* were found in two habitats each (forest and dams between fishponds). 5 species were identified in all three types of habitats: *Vallonia pulchella*, *Nesovitrea*

hammonis, *Euomphalia strigella*, *Monacha cartusiana* and *Cepaea vindobonensis.* These species are described as having a high tolerance degree to anthropogenically modified habitats such as field-edge stone piles, road verges, intensive grasslands and old fields. (Grossu 1983; Grossu 1993; Nekola 2004). *Nesovitrea hammonis* and *Vallonia pulchella* are Meso-Hydrophilous, and their association in the same habitats with *Cepaea vindobonensis* and *Monacha cartusiana* (which are Meso-Xerophilous) is unexpected and can be explained only through the heterogeneity of the habitats that form the investigated habitats.

The forest habitat has a community of snails consisting of 9 species, of which only one species (*Succinea putris*) was found only in this habitat, the rest of the species being found also in the other two investigated habitats.

The dams between fishponds habitat has the most various community of snails, consisting of 20 species some of them being identified only in this habitat, like: *Platyla polita, Carichium tridentatum, Oxyloma elegans, Cecilioides acicula, Chondrula tridens, Columella edentula, Euconulus fulvus, Pupilla muscorum, Vallonia costata, Zonitoides nitidus, Oxychilus depressus, Fruticicola fruticum* and *Helix lutescens.*

The habitat with the least diversity of snail's fauna is the grasslands, where only 5 species were identified using all the three methods: *Vallonia pulchella, Nesovitrea hammonis, Euomphalia strigella, Monacha cartusiana* and *Cepaea vindobonensis*, these species being common to the other two investigated habitats.

If we analyze the frequency of the gastropods species for a period of 12 months, the only species with 100% frequency identified in every investigated month is *Vallonia pulchella*, for the dams between fishponds habitat. Čejka & Hamerlík (2009) studying snails as indicator of soil humidity, find this species as having an insignificant answer to the change of soil humidity. Also, Nekola (2004) find it in his studies often present in sites that had been subjected to intense levels of anthropogenic disturbance.

From the point of view of the similarity calculated by taking into consideration the species presence / absence, the three investigated habitats from Cefa Nature Park, are different, the calculated Jaccard indices being below 0.6. Therefore, the least similar are the communities from grasslands and dams between fishponds (0.25 value of Jaccard index), followed by the communities from the forest and fishponds habitat (0.32). The biggest similarity was between the grassland habitat and forest habitat (0.56).

Conclusions. The diversity of the gastropods fauna from Cefa Nature Park, studied for the first time, includes 22 species (without slugs), of which the holarctic species are dominant, followed by the European ones. The dams between fishponds habitat supports a higher diversity of terrestrial gastropods than the forest or grasslands ones. These results argue once more the importance and the need to protect these artificial habitats (like the dams between fishponds habitats). These habitats from the Cefa Nature Park often undergo anthropic pressures of high intensity as a result of activities that refer to fisheries management. Therefore, repeated setting on fire of the vegetation from the dams between fishponds occur (almost every year), as a measure for stopping the expansion of reed surfaces which would decrease the surface of water necessary for industrial and semi-industrial fish breeding.

If we compare the diversity of terrestrial gastropods from Körös-Maros National Park, with the one of Cefa Nature Park (the two protected areas having similar habitats), of the 22 species identified in the Cefa area, only 14 were found in the Hungarian part, 8 of them being identified only in Cefa (Déli 2000; Domokos 2000; Domokos & Lennert 2000). The existence of such a difference between the gastropods in the two areas proves the need to continue the investigations over the terrestrial gastropods fauna in both parts of the protected area. The common list that will be drafted is the argument and basis for a joint management plan for snail's fauna preservation in the entire cross-border protected area.

References

Bank R., 2007 Fauna Europaea: Mollusca, Gastropoda. Fauna Europaea version 2.3, http://www.faunaeur.org (Accessed, February 2011, last update 27.01.2011).

Čejka T., Hamerlík L., 2009 Land snails as indicators of soil humidity in Danubian woodland (SW Slovakia). Polish Journal of Ecology **57**:741-747.
Cernohorsky N. H., Horsák M., Cameron R. A. D., 2010 Land snail species richness and abundance at small scales: The effects of distinguishing between live individuals and empty shells. Journal of Conchology **40**:233-241.
Déli T., 2000 [Molluscs monitoring of Mályvádi forest]. A Puszta **17**:59-75. [In Hungarian]
Domokos T., 2000 [Some notes on ecological and coenological examination of recent Molluscs of White Lake and its shore]. Folia Historico Naturalia Musei Matraensis **24**:297-315. [In Hungarian]
Domokos T., Lennert J., 2000 [The disease and the mollusc of Berettyó]. Crisicum **3**:79-108. [In Hungarian]
Grossu A. V., 1981 [Gastropoda Romaniae. Vol. 3, Ord. Stylommatophora: Suprafam. Clausiliacea and Achatinacea]. Editura Litera, Bucharest. [In Romanian]
Grossu A. V., 1983 [Gastropoda Romaniae. Vol. 4, Ord. Stylommatophora: Suprafam. Arinoacea, Zonitacea, Ariophantacea and Helicacea]. Editura Litera, Bucharest. [In Romanian]
Grossu A. V., 1987 [Gastropoda Romaniae, Vol. 2, Subclasa Pulmonata, Ord. Basommatophora and Ord. Stylommatophora: Suprafam. Succineacea, Cochlicopacea, Pupillacea]. Editura Litera, Bucharest. [In Romanian]
Grossu A. V., 1993 [Gastropods of Romania. Marine, terrestrial and freshwater snails]. Compendium, IPCT – SA Bucharest. [In Romanian]
Hammer Ø., Harper D. A. T., Ryan P. D., 2001 PAST: Paleontological Statistics software package for education and data analysis. Palaeontologia Electronica **4**(1):9.
Jaccard P., 1901 [Distribution of alpine flora in the Dranses Basin and some neighboring regions]. Bulletin de la Societe vaudoise des Sciences Naturelles **37**:241-272. [In French]
Kapes H., 2005 Influence of coarse woody debris on the gastropod community of a managed calcareous beech forest in Western Europe. Journal of Molluscan Studies **71**:85-91
Kerney M. P., Cameron R. A. D., 1979 A field guide to the Land Snails of Britain and North-West Europe, Collins Editor.
Nekola J. C., 2004 Terrestrial gastropod fauna of Northeastern Wisconsin and the Southern Upper Peninsula of Michigan. American Malacological Bulletin **18**:21-44.
Oggier P., Zschokke S., Baur B., 1998 A comparison of three methods for assessing the gastropod community in dry grasslands. Pedobiologia **42**:348–357.
Rollo C. D., 1991 Endogenous and exogenous regulation of activity in *Deroceras reticulatum*, a weathersensitive terrestrial slug. Malacologia **33**:199–220.

Received: 14 February 2011. Accepted: 18 February 2011. Published online: 10 March 2011.
Authors:
Matilda Claudia Amza, West University of Timişoara, Faculty of Chemistry, Biology, Geography, Department of Biology, Pestalozzi Street No. 16A, 300115, Timişoara, Romania, e-mail: matilda.amza@yahoo.com,
Milca Petrovici, West University of Timişoara, Faculty of Chemistry, Biology, Geography, Department of Biology, Pestalozzi Street No. 16A, 300115, Timişoara, Romania, e-mail: milcapetrovici@yahoo.com,
Voichiţa Gheoca, Blaga University of Sibiu, Faculty of Sciences, Dept. of Ecology and Environmental Protection, 31 Oituz St., 550337, Sibiu, Romania, e-mail: vgheoca@yahoo.com.
How to cite this article:
Amza M. C., Petrovici M., Gheoca V., 2011 Preliminary study of the terrestrial gastropods diversity (Gastropoda: Stylomatophora) from Cefa Nature Park (NW of Romania). AES Bioflux **3**(1):17-22.