Travaux du Muséum National d'Histoire Naturelle «Grigore Antipa»	Vol. LIII	pp. 273–286	© Décembre 2010

DOI: 10.2478/v10191-010-0019-2

CONTRIBUTIONS TO THE KNOWLEDGE OF THE HERPETOFAUNA OF THE EASTERN JIU AND UPPER LOTRU DRAINAGE BASINS (SOUTHERN CARPATHIANS, ROMANIA)

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Abstract. The results of herpetological studies in the Eastern Jiu and Upper Lotru basins in the Parâng-Lotru-Șureanu mountain massif (Hunedoara and Vâlcea counties, Romania), are presented. 16 amphibian and reptile species were identified in the field in 33 sites investigated; these are presented together with data on their habitat association and intra-specific variability.

Résumé. On présente les résultats des études herpétologiques dans les bassins hydrographiques du Jiu oriental et du Lotru supérieur, dans le massif du Parâng-Lotru-Șureanu (départements de Hunedoara et Vâlcea, Roumanie). 16 espèces d'amphibiens et reptiles ont été identifiées sur le terrain dans 33 locations étudiées; elles sont présentées avec les données concernant leur biotope et leur variabilité intra-spécifique.

Key words: intramontane basins, amphibians, reptiles, records, distribution, habitat, variability.

INTRODUCTION

One of the most important mountain massifs, in terms of area and altitude, in the Southern Carpathians of Romania is the Parâng-Lotru-Șureanu massif. Our aim was to analyze the herpetofauna of two intramontane valley systems within this massif, the upper Lotru (with its tributary Latorița) and the Western Jiu (with its tributary Jieț), as they are interesting to correlate with the altitudinal and climatic particularities of this montane area. The herpetofauna of this area is sporadically known, all data being restricted to three localities: Câlcescu Lake, an alpine lake, where *Rana temporaria* is noted (Fuhn, 1960); Voineasa on the Lotru valley where Fuhn (1960) and Fuhn & Vancea (1961) found *Salamandra salamandra*, *Bombina variegata*, *Bufo bufo*, *B. viridis*, *Rana temporaria*, *Lacerta agilis*, *L. viridis*, *Zootoca vivipara*, *Podarcis muralis* and *Anguis fragilis*; and Petrila, on the Western Jiu, where Ghira et al. (2002) record *Lissotriton vulgaris*, *Mesotriton alpestris*, *Bombina variegata*, *Hyla arborea*, *Pelophylax ridibundus*, *Lacerta agilis*, *Zootoca vivipara* and *Podarcis muralis*[1]. We have therefore tried to give a more detailed account of the distribution of amphibian and reptile species in the area by studying the upper basin of the Lotru above Voineasa, and the Latorița, Bănița and Jieț basins, not investigated to date, thus completing the knowledge of the herpetofauna of the Upper Lotru and Western Jiu basins, i. e. of the intramontane valleys of the Parâng-Lotru-Șureanu massif.

MATERIALS AND METHODS

Area description. Reaching an altitude of 2519 m. a.s.l., the Parâng-Lotru-Șureanu massif is the second highest in Romania after the Făgăraș Mountains. It is composed of several interconnected mountain ranges of variable extension and

[1] We follow mostly Speybroeck et al. (2010) for the nomenclature, with some exceptions, i.e. following Carretero et al. (2009) in the use of *Mesotriton*.

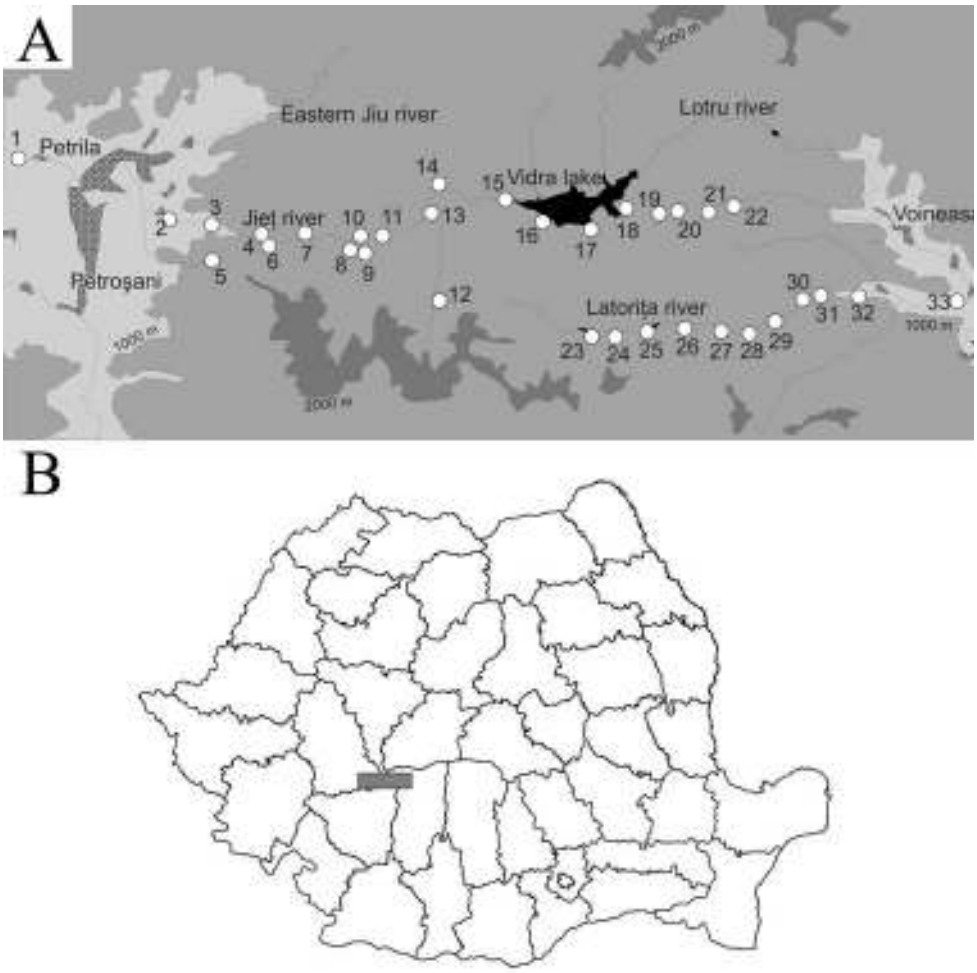

Fig. 1 - A, General location map of the investigated localities, numbered as in the text; B, Location of the study area on the map of Romania.

height: Parâng, Lotru, Șureanu, Căpățânii, Latoriței, of which the highest is the Parâng. This massif is drained by tributaries of the Olt River in the east, the Jiu River in the south-west and the Mureș River in the north-west. Of these, the Lotru, a tributary of the Olt, is the most important, creating a deep east-west intramontane valley, and having itself a quite large tributary, the Latorița. On the western versant, the Western Jiu, a tributary of the Jiu, and its tributary the Jieț, create two similar, but much shorter, roughly east-west oriented intramontane valleys, while another tributary of the Western Jiu, the Bănița, separates the Parâng-Lotru-Șureanu massif from another important division of the Southern Carpathians, the Retezat massif (Ghinea, 2002). The Lotru and its tributary Latorița have been dammed, several reservoirs being thus created: Vidra, Balindru, Malaia and Brădișor (on the Lotru), Petrimanu and Galbenu (on the Latorița), of which the largest is Vidra (surface: 12.4 km^2; average volume: 340 million m^3), which occupies an intramontane basin on the uppermost course of the Lotru. The vegetation of this area is defined by altitude:

deciduous forests, dominated by sessile oak, hornbeam, maple and beech, between 500-800 m a.s.l.; beech forests between 800 and 1100 m a.s.l.; mixed forests of beech and coniferous species between 1100 and 1550 m a.s.l.; coniferous (spruce, fir and larch) forests between 1550 and 1800 m a.s.l; and above the last altitude, subalpine and alpine shrubs and grasses (Mâciu et al., 1982; personal observations).

Methodology. This paper is based upon field work performed in July and August 2008, and May and June 2009. Amphibians were searched for in both terrestrial habitats and aquatic basins; due to altitudinal and climatic factors, in this area by May-June most amphibian species are in the water for reproduction. The study was carried following the active transects method (after Cogălniceanu, 1997). 33 stations were checked, with transect length between 200 and 1500 m, twice in most cases, three times when possible):

Table 1

The checked stations with their characteristics.

Station no.	Coordinates	Altitude (m)	Vegetation	Observations
1	45°26'47.4822" lat N 23°19'21.0534" long E	750	Mixed deciduous forest	
2	45°25'20.7552" lat N 23°25'21.6474" long E	750	Mixed deciduous forest clearing	With an artifical lake
3	45°25'2.1" lat N 23°26'53.7252" long E	793	Mixed deciduous forest	
4	45°23'25.5618" lat N 23°26'42.238" long E	1100	Beech and coniferous forest	In Jieț gorges
5	45°24'36.5076" lat N 23°29'52.0152" long E	1510	Beech and coniferous forest	
6	45°24'14.1618" lat N 23°30'14.8782" long E	1275	Beech and coniferous forest	
7	45°24'45.1836" lat N 23°31'42.6318" long E	1150	Beech and coniferous forest	
8	45°23'49.8624" lat N 23°34'32.577" long E	1400	Beech and coniferous forest	
9	45°23'35.109" lat N 23°34'42.1566" long E	1580	Coniferous forest	
10	45°24'33.0366" lat N 23°34'27.6342" long E	1350	Beech and coniferous forest	
11	45°24'42.5802" lat N 23°35'13.6752" long E	1600	Coniferous forest	
12	45°25'45.4764" lat N 23°37'9.8538" long E	1530	Coniferous forest	
13	45°22'58.0008" lat N 23°37'18.5052" long E	1300	Beech and coniferous forest	
14	45°26'49.8696" lat N 23°37'10.7796" long E	1550	Coniferous forest	
15	45°25'53.0652" lat N 23°39'51.1452" long E	1250	Beech and coniferous forest	
16	45°24'10.9956" lat N 23°41'57.213" long E	1250	Beech and coniferous forest	By Vidra reservoir

Table 1 (continued)

Station no.	Coordinates	Altitude (m)	Vegetation	Observations
17	45°24'45.1836" lat N 23°43'34.8558" long E	1250	Beech and coniferous forest	By Vidra reservoir
18	45°25'29.4276" lat N 23°45'53.283" long E	1300	Beech and coniferous forest	By Vidra reservoir
19	45°25'39.8388" lat N 23°47'25.3644" long E	1450	Beech and coniferous forest	
20	45°25'38.9712" lat N 23°47'59.0424" long E	1500	Beech and coniferous forest	
21	45°25'49.8018" lat N 23°49'45.336" long E	1400	Beech and coniferous forest	
22	45°26'9.762" lat N 23°51'28.2276" long E	1350	Beech and coniferous forest	
23	45°21'48.9744" lat N 23°44'6.99" long E	1350	Beech and coniferous forest	By Petrimanu reservoir
24	45°21'48.5418" lat N 23°45'41.8494" long E	1280	Beech and coniferous forest	
25	45°21'56.1384" lat N 23°46'35.3064" long E	1160	Beech and coniferous forest	By Galbenu reservoir
26	45°22'6.7764" lat N 23°47'56.8799" long E	1120	Beech and coniferous forest	
27	45°21'55.0548" lat N 23°50'9.1278" long E	1050	Beech and coniferous forest	
28	45°21'50.277" lat N 23°51'15.2532" long E	950	Beech forest	
29	45°22'24.1428" lat N 23°32'31.8828" long E	880	Beech forest	
30	45°23'0.6072" lat N 23°53'15.759" long E	800	Beech forest	
31	45°23'0.171" lat N 23°54'24.9726" long E	720	Mixed deciduous forest	
32	45°23'1.4748" lat N 23°55'41.6022" long E	700	Mixed deciduous forest	
33	45°22'55.398" lat N 24°0'16.6032" long E	680	Mixed deciduous forest	

For their disposition on the map see figure 1. Photographs were taken whenever possible.

RESULTS

16 species (eight of amphibians, eight of reptiles) were recorded by us (see table 2 for their occurrence in the checked transects):

Table 2

Species	Distribution in investigated sites	Observations
Salamandra salamandra	25, 26, 28, 30	
Lissotriton vulgaris	1	cf. ssp. *ampelensis*
Mesotriton alpestris	7, 12, 16, 17, 18, 19, 20, 21, 22, 27, 28	
Bombina variegata	1, 2, 3, 4, 7, 8, 10, 12, 13, 14, 18, 21, 22, 25, 27, 28, 29, 30, 31, 32, 33	
Bufo bufo	1, 7, 13, 17, 18, 19, 20, 21, 22, 24, 25	
Hyla arborea	1	
Rana temporaria	1, 4, 6, 7, 8, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31	
Pelophylax ridibundus	2	
Lacerta agilis	1, 2, 3, 4, 7, 10, 24, 25, 33	nominate subspecies; particular coloration forms present
Lacerta viridis	33	
Zootoca vivipara	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 18, 19, 20, 23, 24, 25	melanism (all-black) coloration present
Podarcis muralis	3, 7, 11, 25, 29, 30, 31, 32, 33	
Anguis fragilis	7, 32, 33	ssp. *colchicus*
*Natrix natrix**	29, 33	
*Zamenis longissimus**	33	
*Vipera berus**	5, 7, 10, 11	very dark (but not all-black) coloration present

The commonest species are *Mesotriton alpestris*, *Bombina variegata*, *Rana temporaria*, *Zootoca vivipara* (in both density and number of locations) and *Podarcis muralis* (which is found in fewer locations, but in dense populations).

DISCUSSIONS

Of the 16 species that we found, 13 were already recorded by previous workers; however, we contributed by greatly enhancing the number of locations for each species, beyond the three localities already investigated. The three snake species are apparently at their first record for the studied region (and are therefore marked by an asterisk in table 2); their presence is not surprising, considering their wide distribution in the Carpathians, including around the study area.

The only species unambiguously recorded in this area previously and not found by us is *Bufo viridis*, recorded by Fuhn (1960) at Voineasa, and possibly still present. Among reptiles, a record of *Vipera ammodytes* (no. 10) is placed by Fuhn & Vancea (1961) on their distribution map at Voineasa, while the text refers at that record as for Lotrioara (a locality confirmed by Krecsák et al., 2004). It is possible

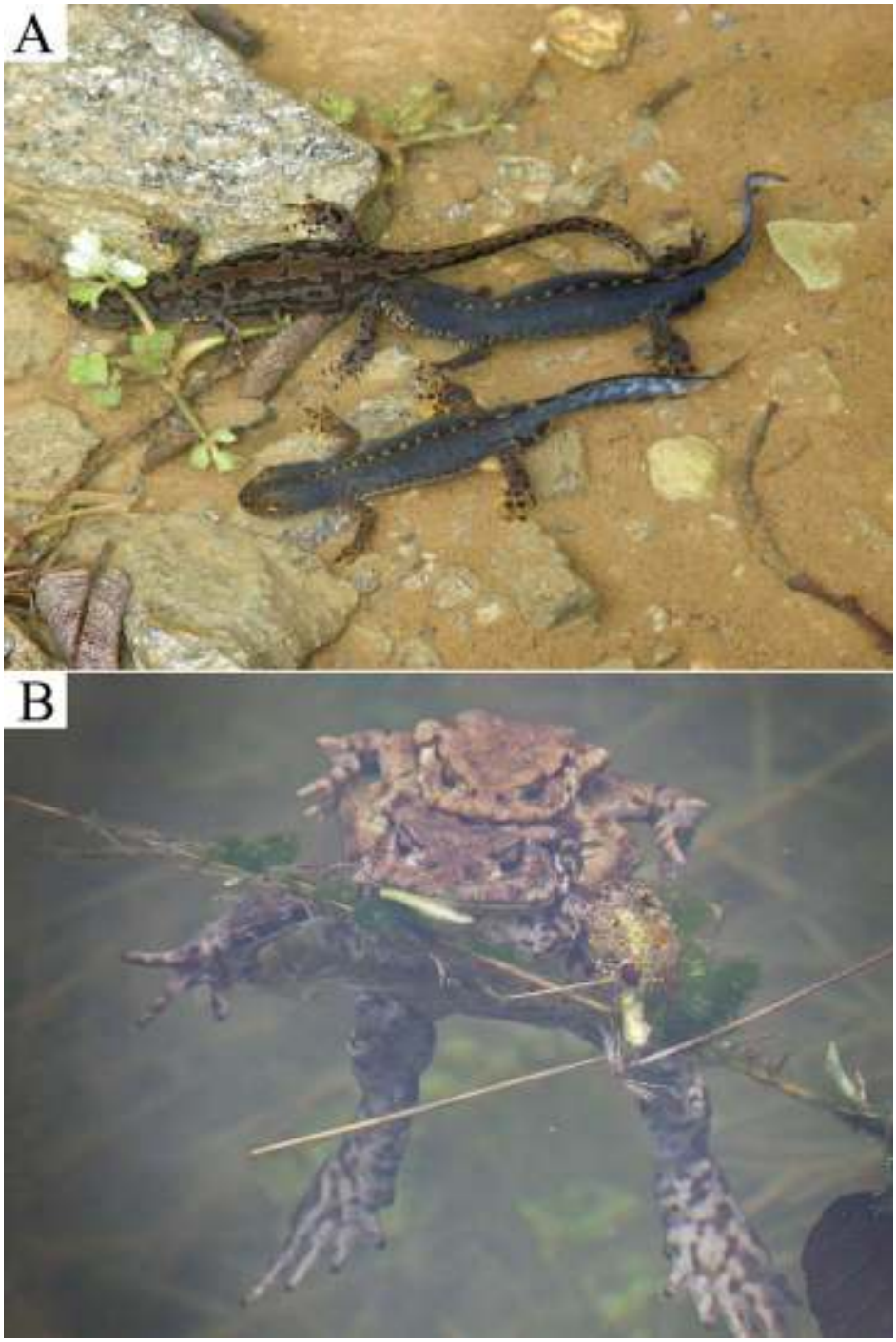

Fig. 2 - A, *Mesotriton alpestris*, one adult female and two adult males, by Vidra Lake; B, *Bufo bufo*, pair in amplexus, Galbenu dam lake. (Photos: A. Iftime)

that the record was wrongly placed on the map, but the possibility that *V. ammodytes* lives in the area requires more investigation.

The montane relief constrains the distribution of both amphibians and reptiles, but in different ways. Beyond the altitudinal limitation imposed by lower temperatures for thermophilous species, amphibians are limited by the relief dynamics, i.e. steepness of slopes that preclude formation of ponds or slower-flowing brooks, needed for amphibian reproduction; this is why newts are extremely scarce on the Jieț valley, which is very steep.

On east-west oriented valleys, the difference between the northern (i.e. south-oriented) and southern (north-oriented) versants is crucial, inasmuch as the south-oriented slopes receive substantially more sunshine and are consequently warmer. On the Jieț valley the difference is telling in terms of herpetofauna: the northern versant is inhabited by numerous species including *B. variegata*, *B. bufo*, *R. temporaria*, *L. agilis*, *Z. vivipara*, *P. muralis*, *A. fragilis* and *V. berus*, while the southern is only inhabited by *R. temporaria*, *Z. vivipara* and *V. berus*, by general distribution the most cold-tolerant species in European herpetofauna. The same phenomenon occurs on the upper Latorița valley. The uppermost Lotru valley (above the Balindru gorges, i. e. the basin of the large Vidra reservoir) also has an impoverished, cold-resistant herpetofauna: *M. alpestris* (Fig. 2 A), *B. variegata*, *B. bufo*, *R. temporaria*, *Z. vivipara*. *B. bufo* reproduces in the Galbenu dam lake (Fig. 2 B), but was not seen doing so in the other dam lakes in the area; less cryophilic species such as *Anguis fragilis* (Fig. 3 A), *Zamenis longissimus* (Fig. 3 B) and *Natrix natrix* (Fig. 4 A) are found together on the lower Latorița valley.

The *L. vulgaris* found on Bănița valley, a female, exhibits features (e.g. unspotted belly) suggestive of the subspecies *L. v. ampelensis*, which is found, pure or intergrading with the nominate subspecies, in Transsylvania, but also in the nearby Hațeg depression and Retezat Mountains (Ghira, 1989; Cogălniceanu et al., 2000; Rafiński et al., 2001; Babik et al., 2005); therefore we consider that these *L. vulgaris* may be either *ampelensis* or intergrades of this and the nominate subspecies.

We note the interesting variation of pattern and coloration in *L. agilis*, where we can find "typical" individuals with a brown, dark-spotted dorsal band, interrupted white vertebral line and lateral ocelli, but also specimens in which the dark spots in the dorsal band are replaced by ocelli, or specimens of the well-known "*erythronotus*" (red-backed) morph. Beside these, we found a male specimen in which the dorsal band is reddish as in *erythronotus* but has a darker median area and the lateral ocelli are anteriorily replaced by a marbling of reddish-brown hue on a yellow-green background (Fig. 4 B), and another male in which the dark spots of the dorsal band are practically fused and extending to cover the entire dorsal band, with the exception of the interrupted vertebral whitish line, the lateral ocelli are also thick and largely fused, and the green coloration of the jaws is tinged with blue (Fig. 5 A). These add to the extensive knowledge of variability in *L. agilis*.

Z. vivipara is also variable in pattern, and we have also seen a fully melanistic individual (Fig. 5 B). Fuhn & Vancea (1961) note, ap. Stugren, that melanistic *Z. vivipara* are relatively frequent in Cibin Mountains, not far from the study area; here, however, we could find only one melanistic specimen, among tens of specimens seen.

Fig. 3 - *Anguis fragilis*, adult male, showing spotting typical for ssp. *colchicus*, lower Latorița; B, *Zamenis longissimus*, adult, head detail, lower Latorița. (Photos: O. Iftime)

Fig. 4 - A, *Natrix natrix*, adult, Latorița; B, *Lacerta agilis*, adult male, Parâng Mt.; notice dorsal band and lateral marbled coloration. (Photos: A. Iftime)

Fig. 5 - A, *Lacerta agilis*, adult male, Latoriţa; notice dorsal band and partly fused lateral ocelli. (Photo: A. Iftime); B, *Zootoca vivipara*, all-black male, Lotru pass. (Photo: O. Iftime)

In *V. berus* we note a very dark melanistic (but not completely black) colour morph, having very dark blackish-brown body coloration, on which darker typical markings (such as dorsal zig-zag band) are faintly visible. Whitish and reddish coloration appear on the head, chin and lower flanks, and the whole body has a satin-like, bluish-grey lustre. This morph was seen in one roadkilled specimen (Fig. 6 A) – however, the colour was not affected by death; the specimen was found short after being run over and was still moving. Other *V. berus* specimens seen had "typical" coloration, with rusty brown background and dark brown markings. It is interesting to note that under the rubric of melanistic coloration in *V. berus* are included individuals of quite different description in pattern per se (i.e. not only all-black individuals [see, as an example, fig. 6 B, a specimen from Finland], but also black specimens with variable amounts of white spotting, mostly on labials and chin, and very dark specimens with discernible zig-zag pattern; see, e.g., Terhivuo, 1990 for different frequency of melanistic adders with and without discernible zig-zag), nature of dark coloration (both overall darkening of pattern and fusing of black markings, so-called abundism or pseudomelanism, are included – see Boulenger, 1913) and ontogeny (some dark adders are born with "typical" contrasting coloration and gradually darken to the melanistic condition, others are born with it – see Forsman, 1995, and literature quoted). This, correlated with the unknown genetic background of melanism in adders (Strugariu & Zamfirescu, 2009), may explain the contradicting results obtained as to the ecological significance of melanism (see Forsman, 1995, and literature quoted), and argue for caution in expressing hypotheses upon such ecological significance, especially when these are based upon a very limited number of specimens (e.g., Strugariu & Zamfirescu, 2009).

The higher frequency of melanistic individuals in higher/ colder/ damper habitats, in both *Z. vivipara* and *V. berus*, points intuitively to a positive ecological significance, for such conditions, of the chromatic polymorphism that includes melanism (as melanistic individuals heat quicker), but in the forest-steppe adder subspecies *V. berus nikolskii* melanism is also very common (see, e.g., Zinenko et al., 2010), although this subspecies lives in a much warmer summer climate than *V. b. berus* populations in which black individuals are frequent – once again suggesting caution and thorough investigation before inferring causalities.

Our results create the image of a typical Carpathian amphibian and reptilian community in the study area, with a gradient in distribution placing less cold-tolerant species on the outskirts (e.g. on the lower Latoriţa valley, or the Bănița valley) while uplands and intramontane valleys are occupied by cryophilic species. The detailed distribution given here can still be completed, especially in respect of snakes, the low density of which means that populations can easily go undetected – in fact, to our knowledge, there are no previous recordings of snakes in the study area. As we consider that such species as *Bufo viridis*, *Vipera ammodytes* (see discussion above) and also *Coronella austriaca*, for which good contitions are present, may well be present in this area, further study is always welcome. Distribution data are useful for conservation purposes, as all amphibians and reptiles are protected (under different protective statuses) under national and European law (see, e.g., for Romanian law: L13/1993 and OUG 57/2007; for European law, Bern Convention CETS 104, and the Habitats Directive 92/43/EEC; see also Iftime, 2005). The interesting distribution of montane and cryophilic species also gives a

Fig. 6 - A, *Vipera berus*, very dark but not all-black subadult, road-killed, Jieț Gorges. (Photo: A. Iftime); B, *Vipera berus*, all-black specimen, Finland. (Photo: M. Niskanen)

good opportunity for long-term studies in the context of global warming and its predicted impact upon biodiversity (cf., e.g., Cogălniceanu et al., 2006).

UPDATE. Following a field trip subsequent to the redaction and submission of this paper (May 2010) we add the records of *Anguis fragilis* and *Vipera berus* at station 25.

ACKNOWLEDGEMENTS

We wish to express thanks to Dr. Martti Niskanen for kindly allowing the use of his image of an all-black *Vipera berus*.

CONTRIBUȚII LA CUNOAȘTEREA HERPETOFAUNEI BAZINELOR JIULUI DE EST ȘI LOTRULUI SUPERIOR (CARPAȚII MERIDIONALI, ROMÂNIA)

REZUMAT

Sunt expuse rezultatele unor investigații herpetologice pe teritoriul bazinelor Jiului de Est și Lotrului superior, în masivul Parâng-Lotru-Șureanu (jud. Hunedoara și Vâlcea, România). Au fost identificate în teren 16 specii în 33 localități investigate; ele sunt prezentate împreună cu date privind prezența lor în diferite tipuri de habitat și variabilitatea lor intraspecifică.

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Received: May 17, 2010
Accepted: September 20, 2010

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