Recurring melanism in a population of the common wall lizard: numbers and phenotypes

BALÁZS TRÓCSÁNYI & ZOLTÁN KORSÓS

Abstract

The occurrence of melanic individuals of the common wall lizard (*Podarcis muralis*) is reported for the first time in Hungary, with photographic evidence. The population, repeatedly producing totally black individuals in Mecsek Hills, Southern Hungary, was studied in 1998, with morphometric data of captured individuals and lizard counts being the subject of analysis. Data are presented on a total of three melanic specimens which appeared to be phenotypically different from each other, based on their pileal shield patterns. An assessment of the population in a semi-urban habitat revealed high abundance in the surveyed plots, and an extremely low occurrence rate for melanic individuals.

Key words: Reptilia: Sauria: Lacertidae: *Podarcis muralis*; melanism; population ecology; morphometry.

1 Introduction

The occurrence of melanism is quite common in reptiles. Although there are only few completely black reptile species, melanism is often expressed at the levels of subspecies, subpopulations or varieties in snakes and lizards. Among the European snake species melanism has been reported for *Coluber viridiflavus*, *Elaphe longissima*, *Natrix maura*, *N. natrix*, *N. tessellata*, *Vipera aspis* and *V. berus* (ZUFFI 1986). Dark or black grass snakes (*Natrix natrix*) are common (e. g. FEJÉRVÁRY-LÁNG 1944), and black adders (*Vipera berus*) are also found in a variety of places including Hungary (MARIÁN 1952, ÚJVÁRI et al. 2001). Melanism sometimes is considered as a part of a particular evolutionary lineage that may lead to the emergence of new species (e. g. *Vipera nikolskii*, GRUBANT et al. 1973, VEDMEDERJA et al. 1986), but in the case of lizards it is usually accepted as a result of ecological adaptation to a certain environment. Smaller members of the lacertid family on Mediterranean islands and in Iberian regions are often dark, with some species such as *Podarcis lilfordi* or *Lacerta oxycephala* being almost entirely black (ARNOLD et al. 1985). Most of these cases represent only generally dark colouration, with certain parts of the body (especially ventrally) not being black like in the ocellated lizard (*Timon lepidus nevadensis*) (MATEO & JURADO 1994).

A population of the *Podarcis muralis maruccii* subspecies of the wall lizard comprises brownish black or melanic individuals (TOSINI & AVERY 1993, TOSINI et al. 1991). Total blackness, however, is rare and is seldom reported. The sand lizard (*Lacerta agilis*) is an extremely varied species in terms of its colouration, with black specimens being common; a recent occurrence is reported from St Anna Lake, Romania (KRECSÁK & HARTEL 2001). Viviparous lizards (*Zootoca vivipara*) can also be totally black (BROWN et al. 1984, GVOZDIK 1999). However, there are only few occurrences of full melanism known in *Podarcis muralis* and these cases are occasional findings rather than recurring polymorphism: one individual was reported from the Middle Rhine Valley, Germany (SOUND 1994), and there was an earlier observation from Bereguardo (Pavia), Italy, on *Podarcis muralis maculiventris* (ZUFFI 1986). No occurrences, though, have been reported from Hungary.

The wall lizard is relatively common in Hungary (GUILLAUME 1997), and in suitable habitats it can reach considerable densities. Its larger populations are usually found on open rocky hillsides and quarries with warm microclimate or in anthropogenic environs with stone walls.

2 Material and Methods

2.1 Survey of lizard numbers

A wall lizard population in the southern slope of the Mecsek Hills, Southern Hungary (geographic co-ordinates: 46°05'48"N, 18°13'24"E), was studied for five months in 1998 during the second half of the lizard's yearly activity period. The target population is found in a suburban habitat, adjoining more or less continuous oakwoods of *Inulo-spiraeifoliae-Quercetum pubescensis*, with a mixture of semi-artificial microhabitats including worn-down buildings, stone and brick walls, concrete and tarmac pavements, with intercalated patches of grass, earth, and flowerbeds. Counts of lizards were made along an approximately 200 m long transect on vertical walls, at fixed locations (Fig. 1), with this type of scan repeated ten times successively per study day. The highest number of individuals counted during one transect walk was selected, this figure being considered to be the current sample size on that date. Animals belonging to the established age categories were counted on each sampling surface, the counts representing relative abundance values rather than true population samples. Any occurrence of a melanic individual was noted. Age classes were determined based on total length with the categories being (i) neonates: newly hatched, smallest individuals; (ii) adults: fully grown lizards; and (iii) juveniles (including subadults): individuals with sizes ranging between neonate and fully

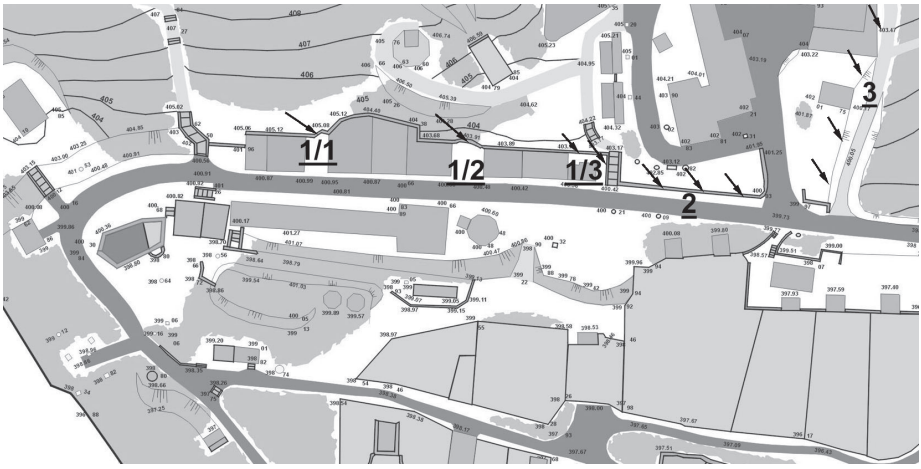

Fig. 1. Lizard count plots 1/1-3. Arrows point at vertical walls on which lizards were counted at each scan. 1/1: 20 m^2; 1/2: 25 m^2; 1/3: 35 m^2; 2: 40 m^2 (all stone); 3: 50 m^2 (brick).

Zählgebiete 1/1-3. Pfeile zeigen Wände, an denen bei jeder Zählung Eidechsen gesichtet wurden. 1/1: 20 m^2; 1/2: 25 m^2; 1/3: 35 m^2; 2: 40 m^2; (alle Stein); 3: 50 m^2 (Ziegel).

grown categories. Abundance values for age groups on a given date were obtained as cumulated count maxima of the sample surfaces. An abundance trend of observed animals in the the studied period was described, and count data obtained for the sample surfaces was crudely extrapolated for the entire habitat. The exact time, current weather conditions as well as temperature, air humidity, and barometric pressure data were also recorded. The relationship between temperature and abundance was also analysed, with the data pair from the very first sampling with only 16 °C being disregarded.

2.2 Morphological investigation of specimens

We attempted to catch any black lizard seen in or near the sampling area, and succeeded in two of a total of four sightings (plus one previous specimen). The following morphometric data were recorded: total length, snout-to-vent length, pileal and parietal length and width, length of front and hind legs, distance between front legs and hind legs. From these, morphometric indices were calculated, and the pileal shield pattern types were determined based on the system established for lacertids by DELY & STOHL (1982). The morphometric data of a preserved specimen caught years earlier in the same area are also recorded and compared with those of the newly caught individuals.

3 Results

3.1 Lizard numbers

The dynamics of the samples on the surveyed surfaces is shown in Fig. 2. There was no apparent trend in counts ($r^2 = 0.004$, NS), with the mean being 27.2.

The highest number of lizards observed in a single count was 61 which gives a density value of 0.36 individulals per m^2 on the surveyed vertical walls. Only one black individual (representing less than 2 %) was recorded within the transect sample area, seen once during the seven study occasions prior to (and including) its capture, and observed also only once during the two study days after it was released. The surveyed walls included around one fourth of all similar surfaces found in the habitat,

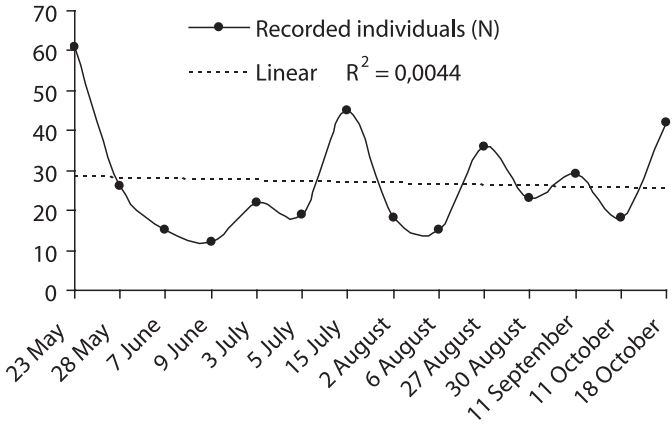

Fig. 2. Number of observed specimens on the sample surfaces.

Anzahl beobachteter Tiere auf den Untersuchtungsflächen.

which suggests that the total number of surveyable individuals in the area can be around 240-250. The occurrence frequency of black lizards, including those seen outside the survey area (a total of 4 in 1998), is crudely estimated to be in the range of 1-2%.

The relative frequency of adults in the sample, though fluctuating, did not vary considerably from the 50-60 % range (Fig 3.), and it did not show a temporal trend. The proportion of neonate juveniles increased from mid-June onwards, with the number of neonates recorded following a significant positive linear trend ($r^2 = 0.75$, $p < 0.001$). The relative frequency of juveniles decreased, with the abundance data of this age-group dropping with a significant negative linear trend ($r^2 = 0.46$, $p < 0.01$).

Within the environmental temperature range of 19-30 °C, the number of recorded lizards was highest at 26 °C. When plotting temperature data against relative abundance values, a significantly fitting polynomial distribution was revealed by regression analysis ($y = -0.3215x^2 + 15.784x - 167.96$, $r^2 = 0.334$, $p < 0.1$), suggesting an optimal basking temperature of approximately 24 °C.

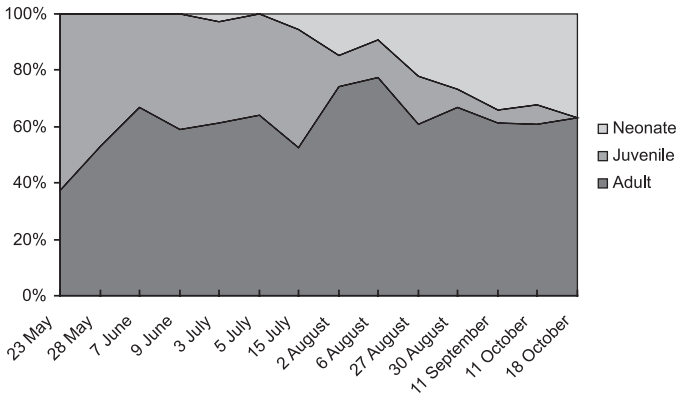

Fig. 3. Age structure of the *P. muralis* sample throughout the study period.

Altersstruktur von *P. muralis* im Untersuchungszeitraum.

3.2 Morphology

We have evidence about the occurrence of a total of five melanic specimens in the study area and its close surroundings. Out of these, three were caught and their measurements were taken (Tab. 1): One of them (Pmm_{MEL} #1) which dates back to 1987 is preserved in the Herpetological Collection of the Hungarian Natural History Museum, Budapest, whereas the two others (Pmm_{MEL} #2 and Pmm_{MEL} #3) were caught during 1998 and were released at the site of capture. The remaining two individuals were observed in 1998, but were inaccessible and could not be captured for taking measurements. The uncaught individuals include a newly hatched juvenile, seen on the tarmac pavement 40 m southeast of the survey site in August 1998, and a fully-grown, robust male with long, intact tail, observed in September 1998 where Pmm_{MEL} #3 had been caught.

The analysis of pileal shield patterns of the preserved and the captured individuals showed that the three animals shared two shield pattern types. The female Pmm_{MEL} #1 caught in 1987 had the same "AIY" pattern (Fig. 5) as the Pmm_{MEL} #3 male caught in

Specimen ID	Pmm_{MEL} #1	Pmm_{MEL} #2	Pmm_{MEL} #3
time of collection	April 1987	August 1998	October 1998
age (sex)	adult (female)	adult (female)	adult (male)
dimensions (mm)			
total length	116.1	122.2	104
snout-to-vent length	54.5	46.6	61
pileus length	11.5	12	15.5
pileus width	5.9	6	7.4
parietal height	3.3	3.4	4.7
front legs length	16.8	16.8	20.0
hind legs length	26.6	25.5	35
distance of legs	26.8	28.3	29
morphometric indices			
SVL/pileus length	4.74	3.88	3.94
pileus length/pileus width	1.95	2.0	2.09
pileus-type (Dely & Stohl)	AIY	CI	AIY

Tab. 1. Summary of data and morphometrics of captured melanic *P. muralis.*

Remarks: Pmm_{MEL} #1: Adult female with intact tail, caught 150 m south of the survey area in 1987. Pmm_{MEL} #2: Adult female with tail broken upon capture (Figs. 4/2a, 4/2b) within the survey area. The individual was held in captivity until its tail regenerated, and was released and video-taped on 11th September 1998. Re-sighted during the regular survey on 18th October. Pmm_{MEL} #3: Adult male with regenerated tail (Figs. 4/1a, 4/1b), caught 30 m south of the survey area.

Zusammenfassung der Daten und morphometrischer Merkmale gefangener melanistischer *P. muralis.*

Bemerkungen: Pmm_{MEL} #1: Adultes Weibchen mit intaktem Schwanz, gefangen 150 m südlich des Untersuchungsgebietes im Jahr 1987. Pmm_{MEL} #2: Adultes Weibchen mit beim Fang verlorenem Schwanz (Abb. 4/2a, 4/2b), gefangen im Untersuchungsgebiet. Das Tier wurde bis zur Regeneration des Schwanzes in Gefangenschaft gehalten und am 11. September 1998 freigelassen und gefilmt. Erneute Sichtung des Tieres am 18. October. Pmm_{MEL} #3: Adultes Männchen mit regeneriertem Schwanz (Abb. 4/1a, 4/1b), gefangen 30 m südlich des Untersuchungsgebietes.

1998, although their capture sites were about 120 m apart. This pattern is characterised by the presence of a smaller, accessory platelet, in our case a triangular one, behind the internasal shield, in between the praefrontalia. The Pmm_{MEL} #2 female found during the same season as the Pmm_{MEL} #3 male, with its capture site being only 30 m away from that of the male, had the "CI" shield pattern (Fig. 5) characterised by an elongated internasal shield, its caudal process separating the praefrontal shields.

4 Discussion

The authors observed the target population during the 1990s, and upon several encounters of melanic wall lizards in the area, in 1998 they performed regular counts and an investigation of black individuals. In the literature two occurrences of melanic *Podarcis muralis* are reported (Sound 1994, Zuffi 1986), in addition to a case where

Fig. 4/1a. Portrait of Pmm_{MEL} #3 (male).
Portrait von Pmm_{MEL} #3 (männlich).

Fig. 4/1b. Pileus pattern of Pmm_{MEL} #3 (male).
Pileus-Muster von Pmm_{MEL} #3 (männlich).

an entire subspecies is melanic (TOSINI et al. 1991, TOSINI & AVERY 1993). The population we studied has a certain degree of insular character in that it is surrounded at three sides by continuous forest. Although in the forest there are several clearings with rock outcrops and abandoned quarries some hundred metres from the study plot, melanic individuals have never been observed in these. Another insular, warm rocky slope habitat – altough that one being natural – approximately 40 km from our study spot also accomodates hundreds of *P. muralis* in a dense and easily accessible population, but no melanism has been observed there either. Accordingly, ours is apparently the first report on recurring colour polymorphism in *Podarcis muralis*. We do not discuss here the possible explanation for the occurrence of melanism in *P. muralis*, however, for us it seems plausible that such a restricted appearance of melanic specimens may be a single mutation.

Fig. 4/2a. Habitus of Pmm_{MEL} #2 (female).

Habitus von Pmm_{MEL} #2 (weiblich).

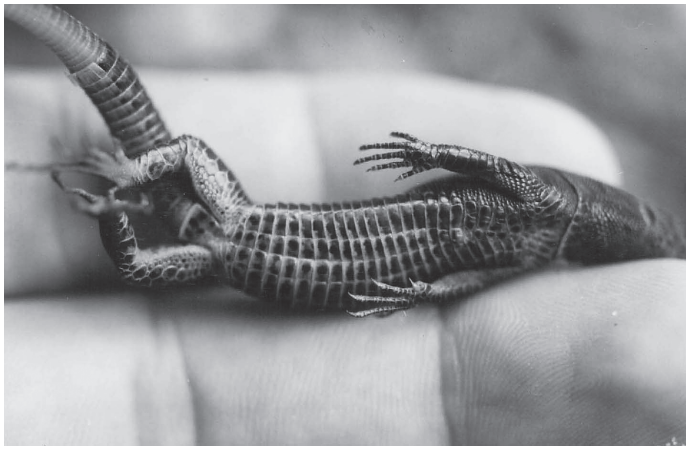

Fig. 4/2b. Ventral view of Pmm_{MEL} #2 (female).

Ventralansicht von Pmm_{MEL} #2 (weiblich).

The relatively high lizard density in the studied habitat (around 150 surveyed individuals per hectare) is possibly associated with the availability of suitable basking surfaces as well as with the apparent abundance of insects (mostly flies) which is a result of the husbandry of domestic and wild animals practised in the area. The high lizard abundance in the well-defined area may be one reason why the black individuals of very low relative frequency still do not escape attention. Numbers of observed lizards appeared to be relatively stable, with the mean value of the highest numbers of individuals on the various study days being 36.3. The number of juveniles decreased as an increasing proportion of them went to the fully grown category. The observable number of the latter in effect did not increase, possibly because of their different rate of activity.

When censusing basking lizards by visually observing them, the recorded percentage of the true population remains uncertain (AVERY & PERKINS 1989). Accordingly, our

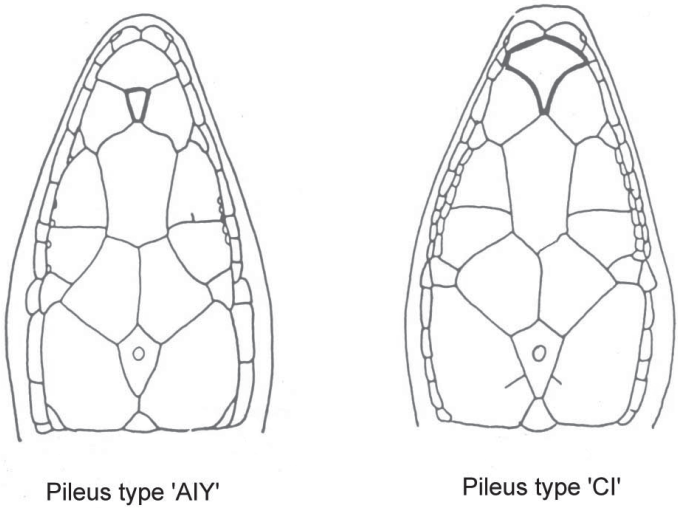

Fig. 5. Shield pattern types of DELY & STOHL (1982) occurring among the captured black lizard individuals.

Schuppenmuster-Typen der gefangenen schwarzen Tiere nach DELY & STOHL (1982).

figures refer to, both in the case of normally coloured and melanic individuals, the population of observed (i. e. basking or otherwise active) lizards.

In the morphometrically analysed melanic individuals polymorphic head scalation was noted which we interpret as phenotypic variation in the population, not linked to the observed colour polymorphism. However, our data are insufficient for statistical evaluation in this respect. There were no microfragmented, excess scales (which would suggest inbreeding), on any inspectd individual.

It is generally believed that melanism in the genera *Lacerta* and *Podarcis* is either an alpine or insular (microinsular) characteristic, arguably related to thermal ecology and its functional adaptive implications (TOSINI et al. 1991). TOSINI & AVERY (1993) found that the surface temperature of melanic lizards was higher than that of normally coloured ones, but the heating rates of differently coloured experimental animals did not differ. In our study we looked at temperatures at which the lizards were most abundant, but that range was exceeded by temperature points at which the melanic individuals were seen active. To address this difference statistically, further studies are needed.

Acknowledgements

The authors wish to express their sincere thanks to JÓZSEF PÁL for his persistence in assisting data collection and for utilising his practical experience in wall lizard capturing, to SÁNDOR KALMÁR for his help in capturing the first melanic lizard individual in the study, and GYŐZŐ HORVÁTH for on-spot assistance and suggestions on population estimation. We also acknowledge the thoroughness of PÉTER HANNY, in preserving the first ever black lizard found in the study area for museal and

scientific purposes. Sincere thanks are due to the Danube-Drava National Park Directorate and the Zoological Garden of Pécs for facilitating the studies.

Wiederholtes Auftreten von Melanismus in einer Population der Mauereidechse: Häufigkeit und Phänotypen

Es wird erstmals erstmals vom Vorkommen melanistischer Mauereidechsen (*Podarcis muralis*) in Ungarn berichtet. Die Population in den Mecsek Hügeln, Südungarn, die mehrfach komplett schwarze Tiere hervorbrachte, wurde im Jahr 1998 anhand morphometrischer Daten gefangener Tiere und durch Zählungen untersucht. Die Größe der Population im semi-urbanen Untersuchtungsgebiet wird auf etwa 250 Tiere geschätzt, mit Maximaldichten von 0,36 Individuen/m². Von insgesamt vier beobachteten melanistischen Tieren im Untersuchungsgebiet und in dessen Nähe konnten zwei gefangen werden. Ein weiteres melanistisches Exemplar wurde in früheren Jahren gefangen. Die Frequenz melanistischer Tiere wird auf 1-2 % geschätzt.

Schlüsselwörter: Reptilia: Sauria: Lacertidae: *Podarcis muralis*; Melanismus; Populationsökologie; Morphometrie.

References

ARNOLD, N., D. OVENDEN & G. CORBET (1985): Field guide to the wild animals of Britain and Europe. – London (Treasure Press), 128 pp.

AVERY, R.A. & C.M. PERKINS (1989): The use of faecal counts for estimating populations of wall lizards (*Podarcis muralis*) – Journal of Zoology, London, **217**: 73-84.

BROWN, R.W., M.J. LAWRENCE & J. POPE (1984): The country life guide to animals of Britain and Europe. – Middlesex (Country life Books), 320 pp.

DELY, O.G. & G. STOHL (1982): Pileusbeschilderung und phylogenetische Beziehungen innerhalb der Lacertiden. – Vertebr. hung., **21**: 85-109.

FEJÉRVÁRY-LÁNGH, A.M. (1944): Die schwarze Ringelnatter als systematisches und biologisches Problem. – Fragm. faun. hung., **7**(2-3): 60-63.

GRUBANT, V.N., A.V. RUBAYEVA & V.I. VEDMEDERJA (1973): O sistematicheskoi prinadlezhnosti chernoi formi obiknovennoi gadiuki. [On the systematic position of the black form of the common adder] – Voprosy gerpetologii, Moskva, pp. 68-71.

GUILLAUME, C.P. (1997): *Podarcis muralis* (LAURENTI, 1768). – pp. 286-287 in GASC, J.-P., A. CABELA, J. CRNOBRNJA–ISAILOVIC, D. DOLMEN, K. GROSSENBACHER, P. HAFFNER, J. LESCURE, H. MARTENS, J.-P. MARTINEZ RICA, H. MAURIN, M.E. OLIVEIRA, T.S. SOFIANIDOU, M. VEITH & A. ZUIDERWIJK (eds.) (1997): Atlas of amphibians and reptiles in Europe. – SEH & Museum National d'Histoire Naturelle, Paris.

GVOZDIK, L. (1999): Colour polymorphism in a population of the common lizard, *Zootoca vivipara* (Squamata: Lacertidae). – Folia zoologica, **48**(2): 131-136.

KRECSÁK, L. & T. HARTEL (2001): Fekete színű fürge gyík a Szent Anna-tó környékéről [A black specimen of the sand lizard from the region of St. Anna Lake]. – Terrárium, **3**(3): 12-23.

MARIÁN, M. (1952): Ein Fund von der *Vipera berus* var. *prester L.* im Komitat Somogy. – Rippl-Rónai Múz. Kaposvár, pp. 1-2.

MATEO, J.A. & L.F.L. JURADO (1994): Variaciones en el color de los lagartos ocelados; aproximación a la distribución de *Lacerta lepida nevadensis* BUCHHOLZ 1963. – Revista Española Herpetología, Barcelona, **8**: 29-35.

SOUND, P. (1994): Fund eines vollmelanistischen Exemplars der Mauereidechse (*Podarcis muralis*) im Mittelrheintal. – Salamandra, Bonn, **30**(3): 221-222.

TOSINI, G. & R. AVERY (1993): Intraspecific variation in lizard thermoregulatory set points: a thermographic study in *Podarcis muralis*. – Journal of Thermal Biology, **18**(1): 19-23.

—, B. LANZA & M. BACCI (1991): Skin reflectance and energy input of melanic and non-melanic populations of wall lizard (*Podarcis muralis*). – pp. 443-448 in KORSÓS, Z. & I. KISS (eds.): Proceedings of the Sixth Ordinary General Meeting – Budapest (SEH–HNHM).

ÚJVÁRI, B., I. LAZÁNYI, B. FARKAS & Z. KORSÓS (2001): An isolated adder (*Vipera berus*) population in Hungary. – pp. 127-135 in LYMBERAKIS, P., E. VALAKOS, P. PAFILIS & M. MYLONAS (eds.): Herpetologia Candiana. – Irakleio (Natural History Museum of Crete & SEH).

VEDMEDERJA, V.I., V.N. GRUBANT & A.V. RUDAYEVA (1986): K voprosy o nazvanii chernoi gadiuki lesostepy evropeiskoi chasti SSSR. [On the identity of the black vipers of the European part of the Sovietunion] – Vestnik Charkovsogo Universiteta, **288**: 83-85.

ZUFFI, M. (1986): Su *Podarcis muralis maculiventris* (WERNER 1891) melanica in risaia a Bereguardo (Pavia). – Atti Soc. ital. Sci. nat. Museo civ. Stor. nat. Milano, **127**(3-4): 293-296.

Manuscript received: 27 November 2002

Authors: BALÁZS TRÓCSÁNYI, Danube-Drava National Park Directorate, Tettye tér 9, H-7625 Pécs, Hungary; ZOLTÁN KORSÓS, Hungarian Natural History Museum, Budapest, Baross u. 13, H-1088 Budapest, Hungary.