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An abnormal *Emys orbicularis* (L. 1758) hatchling possibly indicating pollution in Pârâul Peţea reserve, Băile 1 Mai, Romania

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Abstract. In April 2008 an *Emys orbicularis* hatchling showing abnormal shell pattern was captured in the Pârâul Peţea natural reserve, NW Romania. Such shell aberration could be the result of pollution in the reserve, which is already subject to high anthropic influence.

Introduction

The European pond turtle *Emys orbicularis* (L. 1758) lives in most parts of South, East and Central Europe, as well as in North Africa, the Iberian Peninsula, Asia Minor and Central Asia, with post-glacial remains in Northern Europe, and it is endangered in many parts of its range (Fritz 1998, Fritz & Andreas 2000). We are not aware of studies on shell anomalies in the populations of *Emys orbicularis* from Romania. The population in Băile 1 Mai is very small, like the other Transylvanian populations (Ghira et al. 2002), and vulnerable due to intense human activities in the entire Peţea basin (Covaciu-Marcov et al. 2000).

Additional shields in chelonians are caused by genetic anomalies or by suboptimal environmental factors during the embryogenesis, and more or less shields than the standard carapacial scutation seem to have no effect on the survivorship of individuals (Ewert 1979, quoted in Bujes & Verrastro 2007).

The aim of the present paper was to record the occurrence of shell anomalies in *Emys orbicularis* in the Pârâul Peța reserve, possibly caused by known or potential pollution from the nearby human activities.

Material and methods

The Pârâul Peța reserve is located in Băile 1 Mai spa, 9 km southeast from Oradea, Romania, and was declared in 1932 around the hypothermal lake formed by some extensions of the brook (total length 1.5 km). It is situated within the borders of Băile 1 Mai spa, with a hospital, a hotel, a public pool and drainage facilities as nearby potential pollution sources on the left bank, and agricultural activities (possibly implying the use of pesticides) on the right bank.

The reserve has roughly two zones: first (A), a pond with thermal, underwater springs, having a depth of 0,1 – 3 m and an average temperature between 35 °C by the springs and 25 °C near the shore (Paina 1978). The second zone (B) is an elongated pond formed by another diverticulum of the rivulet (in 2002 it was excavated and cleaned of excessive mud and organic debris threatening to overload the biotope).

Aquatic vegetation is abundant, consisting of species of *Potamogeton*, *Typha*, *Phragmites*, *Lemna*, *Butomus*, *Alisma*, *Spirodela*, *Cabomba*, *Elodea*, and the local endemic morph *Nymphaea lotus* L. var. *thermalis* (D. C.) Tuzson 1908. The aquatic fauna includes characteristic elements such as the Cyprinid *Scardinius racovitzai* Müller 1958, endemic for the lake, and the relict snail *Melanopsis parreyssi* Philippi 1847. The herpetofauna of the reserve and its adjacent zone consists of *Lissotriton vulgaris* (L. 1758), *Triturus cristatus* (Laurenti 1768), *Bombina bombina* (L.1758), *B. variegata* (L.1758), *Bufo bufo* (L.1758), *B. viridis* Laur. 1768, *Hyla arborea* (L. 1758), *Pelophylax ridibunda* (Pallas 1771)*, Rana dalmatina* Fitzinger 1838*, Lacerta agilis* (L. 1758)*, Anguis fragilis* L. 1758*, Natrix tessellata* (Laurenti 1768)*, N. natrix* (L. 1758)*,* and *Vipera berus* (L. 1758). Other vertebrates in the reserve are *Alcedo atthis* (L. 1758)*, Nycticorax nycticorax* (L. 1758)*, Gallinula chloropus* (L. 1758), *Acrocephalus arundinaceus* (L. 1758)*, Phasianus colchicus* L. 1758, *Anas platyrhynchos* L. 1758, and *Rhodeus amarus* (Bloch 1782). Odonata and Gerromorphans are abundant in many areas of the lake, the latter including the rare *Mesovelia thermalis* Horváth 1915**,** but also several *Microvelia, Gerris* and *Hydrometra* species.

On April 23 2008 an *Emys orbicularis* female hatchling was captured by hand near the distal end of zone B, basking close to the shoreline on floating dead leaves and stems of *Typha sp*. Shell anomalies were recorded, the individual was measured, photographed, kept in captivity in an aquaterrarium, and then released at the same spot after six days.

Results

Measurements: maximum linear length of the carapace 25.5 mm.; maximum linear length of the plastron 24.9 mm.; maximum linear width of carapace 24.7 mm.; maximum linear width of plastron 19.7 mm. Compared to the normal shell pattern for the species (Fuhn & Vancea 1961), the individual presented a supernumerary complex with nine vertebral scutes, with the second, third and fourth presenting a diagonal division that split the shield in two, and the fifth being split asymmetrically in two; marginal and plastron shields did not show any alteration (Fig. 1).

The carapace was light brown, with all marginal shields marked by distinct semicircular orange spots, characteristic to *E. o. hellenica* (Valenciennes 1832), the yellow-throated population from Eastern Europe, although the individual had only a larger yellow spot and several small ones on its throat, a character which may include it in the transitory population with yellow-spotted throat (Fritz 1992). The latter is a southeastern European population from Greece, Bulgaria, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Macedonia, Slovenia, European Turkey, and northeastern Italy, transitory between *E. o. orbicularis* (L. 1758) (dark-throated) and *E. o. hellenica* (Valenciennes 1832) (yellow-throated), and its range is reaching up to the region south to Budapest (Fritz 1992, 1996). The nuchal shield of the specimen had parallel sides, which is rather rare in *E. o. hellenica* but more frequent in *E. o. orbicularis* (Fritz 1995, 1996), and the plastron was yellow with a very large, central black spot, characteristic of *E. o. orbicularis*.

Discussion

The mixed morphological features of the specimen could possibly suggest hybridization between *E. o. orbicularis* and *E. o. hellenica,* such a hybrid population (or at least showing some characters of *E. o. hellenica*) being recorded in Turkey, Greece, Bulgaria and southern Romania (Fritz 1994, 1995, Fritz & Obst 1995). But *E. orbicularis* populations in the Aegean region of Turkey show high variation of morphological characters (Ayaz et al. 2004), and in the populations from Crimea,

Ukraine, no haplotypes for *E. o. hellenica* have been recorded, even though individuals resembled *E. o. hellenica* morphologically (Kotenko et al. 2005). Thus the possible inclusion of the studied hatchling to a transition population between the nominotypical subspecies and *E. o. hellenica* should be treated with caution.

In chelonians, accessory or asymmetric scutes occur in approximately 15

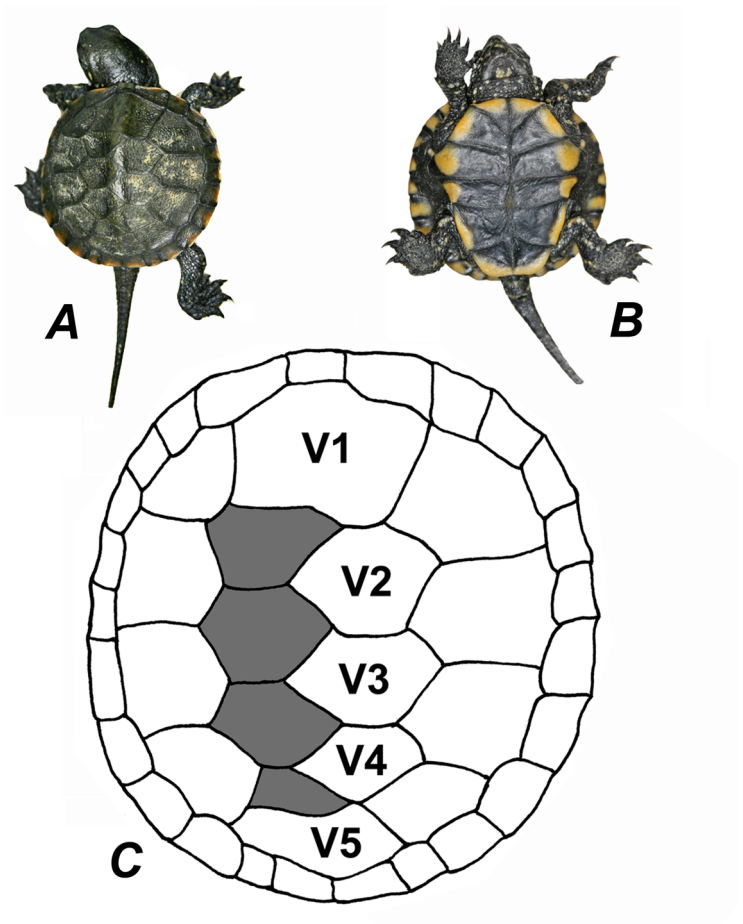

Fig. 1. Abnormal scute pattern in an *Emys orbicularis* hatchling in Pârâul Peței reserve: A – dorsal view; B – ventral view; C – representation of the carapace (V1-V5 vertebral scutes; supernumerary scutes in grey).

% of individuals, but in *Emys orbicularis* populations such anomalies are rare (Najbar & Maciantowicz 2000, Mosimann 2002). Such abnormalities could be caused by: chemical pollution, especially heavy metals and pesticides; by inbreeding de-

pression due to small population size, or by outbreeding depression (contact of very dissimilar genomes); and/or by suboptimal temperature or humidity during incubation (Ayres Fernández & Cordero Rivera 2004). In *Chrysemys picta* (Schneider 1783), scute anomalies are more common at the northern limit of the range, possibly caused by suboptimal temperatures during incubation (MacCulloch 1981). Pesticides and heavy metals are known to cause a higher rate of scute anomalies in *Emys orbicularis* in Northern Spain (Ayres Fernández & Cordero Rivera 2004), and abnormal development in eggs in the *Chelydra serpentina* (L. 1758) population from the Great Lakes region (Bishop et al. 1998).

The low density and small size of the isolated subpopulation in the reserve may support genetic drift or a negative genetic impact of allochtonous individuals. But the presence of human sources of pollution near the reserve (Danciu 2005) could be consistent with the hypothesis of chemical pollution causing shell anomalies. In 2002, an accidental pollution with oily products was observed, and in the following year a treatment with the common pesticide Roundup was applied against invading *Typha*. As experimental data proved Roundup to be highly lethal to amphibian larvae and juveniles (Relyea 2005), its negative effect on reptiles may also be supposed. An experiment to distinguish between the potential causes of shell anomalies, by incubating eggs from the Pârâul Peștea reserve in controlled conditions, could not be undertaken yet, as nesting sites within the reserve are still unidentified.

Nesting sites being used during long periods (up to 10 years) by at least some of the females, knowledge about nesting site conditions is essential for protection of *Emys orbicularis* populations, especially since the ecological parameters of nesting areas could change during the long lifespan of the turtles, thus forcing females to look for new nesting areas (Mitrus 2005). Most nests are localized within 150 m from water bodies, but some females could use more distant sites even if there were good nesting areas close to the water; nesting sites are used repeatedly as long as they retain ecological features suitable for egg incubation, and they are changed when disturbed by man or shaded by growing vegetation (Lindeman 1992), or sometimes even after no visible changes in the environment (Mitrus 2005). Therefore, the contribution of suboptimal nesting conditions to the scute anomalies should not be excluded, in addition to the known pollution with the Roundup pesticide.

Hatchlings may have even more stringent microhabitat requirements than juveniles or adults; they prefer temporary ponds or small, similar areas in the big ponds, with shallow water and dense vegetation, close to the nesting area in order to avoid competition with adults and to reduce the risk of drowning and

predator attacks, and they exhibit fidelity to such optimal patches of habitat (Ayres & Cordero 2007). In the absence of temporary ponds in the area, this description fits the capture site for the abnormal hatchling in the Pârâul Peţea reserve.

Seams in the superficial keratinous layer of the shell of chelonians, which are weak points compared to the interdigitations of the sutures of bony plates, are only occasionally coincident with such sutures of the underlying bones (Pritchard 1988). Therefore, since the examined individual could not be assigned to the variations in bony plate pattern and their respective functions as discussed by Pritchard, and since bones were more important than the keratinous scutes in determining shell strength in most chelonians, the adaptative value of scute anomalies and their impact on turtle biology remain uncertain.

In the absence of data from chemical analysis of water and soil from the Pârâul Peţea eserve concerning pesticides (and heavy metals), which are the more probable pollutants from the known sources near the reserve, as well as the more probable cause for scute anomalies, their hypothesized negative effect on turtle shell, nesting and habitat, as well as their potential negative impact over the biotope need further clarification.

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