

Triturus vulgaris x *T. montandoni* hybrids in disturbed habitats in the Piatra Craiului Massif (Romania)

The southern Carpathians of Romania are the tallest mountains in this country, and accordingly they support a wide diversity of habitats, distributed along an altitudinal gradient: mixed deciduous forest downhill, beech forest to about 1,000 m, then mixed beech and spruce, pure spruce, "crawling" mugo pines and alpine pastures up to the 2,000 m and higher summits. The region we have investigated comprises the adjacent Piatra Craiului, Bucegi, Baiului and Ciucaş massifs, which are mostly composed of crystalline and limestone rocks, Piatra Craiului being unique in that it is a huge rocky ridge of pure limestone, reaching above 2,000 m and harbouring spectacular karst and other erosion-created landforms. As expected, the amphibians and reptiles of this region are those of Central European upland habitats: *Salamandra salamandra*, *Triturus alpestris*, *T. cristatus*, *T. montandoni*, *T. vulgaris*, *Bombina variegata*, *Bufo bufo*, *B. viridis*, *Hyla arborea*, *Rana temporaria*, *Lacerta agilis*, *Lacerta vivipara*, *Podarcis muralis*, *Anguis fragilis*, *Natrix natrix*, *Coronella austriaca*, *Vipera berus* (FUHN 1960; FUHN & VANCEA 1961; GHIURCĂ et al. 2003; IFTIME 2003). Breeding habitats for newt species are ponds, either temporary or permanent, formed by rainwater or snow-melt, or even by overflow of rivers; if "optimal" large ponds with good cover and plentiful invertebrate prey are not available, newts will also breed in slow-moving streams, roadside puddles, ditches and other sub-optimal habitats. Unfortunately good quality breeding ponds are becoming scarce as more and more of this habitat, offering a flatter surface, is being drained to make place for various constructions, such as villas, chalets or even shepherds' huts and pens. This kind of development occurs preferentially along some river valleys, where there has been intense investment in tourism; but recently it has begun to expand along previously pristine valleys, disturbing or altogether erasing the breeding habitat of amphibians. Such a place, now being developed, is Bârsa Mare valley, on

the northern slope of the Piatra Craiului massif, where in but a few years a lot of new villas, chalets, logging camps and shepherds' huts and pens have appeared. Our study focused upon the situation of the newt populations in this disturbed region, as compared with other similar, but less disturbed, habitats in the neighboring massifs, and tried to establish a correlation between the disturbance degree, the condition of the *Triturus vulgaris* (LINNAEUS, 1758) and *T. montandoni* (BOULENGER, 1880) populations, and the frequency of occurrence of hybrids. *Triturus montandoni* is to be found in the southern Carpathians, which are its southernmost area of occurrence (COGĂLNICEANU 1997) sympatrically and syntopically with the widespread *T. vulgaris* (represented here only by *T. vulgaris vulgaris*), the two species meeting at altitudes between 500 and 1,500 m. Below 500 m only *T. vulgaris* is found, whereas above 1,500 m only *T. montandoni* occurs. Hybrids are known to occur in the "contact" regions, firstly recorded by HOFMANN (1908) from the Carpathians of present-day Ukraine; they were later found in the Nemira massif (FUHN et al. 1975); the fertility of hybrids and the possibility of recombination were demonstrated (KOTLIK & ZAVADIL 1999).

The author and his wife have undertaken field surveys of amphibians and reptiles in the above-mentioned region during the spring, in 2000, 2001, 2002 and 2003, surveying a total of five water bodies: two in the Piatra Craiului massif (approximate coordinates 45°35' N / 25°15' E; the two localities at Plaiu Foi 1,000 m a.s.l. and on the Bârsa lui Bucur, 980 m a.s.l.), one in the Baiului massif (at Arinişul de la Sinaia, approximate coordinates 45°20' N / 25°30' E, 800 m a.s.l.), and two in the Ciucaş massif, both near Cheia (approximate coordinates 45°27' N / 25°55' E, 900 m a.s.l.). The ponds were selected as to harbour or to have harboured syntopic populations of *T. montandoni* and *T. vulgaris* (most of them also contain *T. alpestris*). All water bodies were assessed a disturbance degree, from very disturbed to nearly pristine; the newts in all water bodies were searched when at the "peak" of the breeding season, as to comprise most of the sexually active adults; as

Table 1: The occurrence of newt species and hybrids in the investigated ponds in the Piatra Craiului Massif (Southern Carpathians, Romania).

Pond and year of search	Size (cm)	Depth (cm)	Description including disturbance	<i>T. alpestris</i>	<i>T. vulgaris</i>	<i>T. montandoni</i>	<i>T. vulgaris</i> x <i>T. montandoni</i> hybrids
Platu Foi 2003	1,000 x 30	5	Roadside ditch bordered by grass, alders, dusty road between new chalets. Disturbance great; many areas cleared around, houses were built.	2	-(known from the region from previous searches)	-(found in previous years in the region)	1
Bârsea lui Bukur 2003	700 x 60	30	Drainage ditch in riverside waterlogged grassland with alder coppices and tall herbs. Disturbance moderate; drainage ditches were dug, some logging.	35	-	-	1
Sinaia 2000	1,000 x 400	40	Marsh fed by a permanent spring, in alder coppice, near a road, with logging and lots of garbage.	-	-(mentioned in the literature)	1	-
Cheia 1, 2001	1,100 x 650	50	Oxbow marshy pond in alder coppice by a river, some logging close (some sawdust in the water).	21	5	25	-
Cheia 1, 2002	As above	As above	As above	12	10	7	-
Cheia 1, 2003	As above	As above	As above	18	12	9	-
Cheia 2, 2000	400 x 150	20 to 80	Pond near beech forest edge, formed by seasonal stream, fed by rain and snowmelt; some garbage.	10	6	2	-
Cheia 2, 2001	As above	As above	As above	20	11	17	-
Cheia 2, 2002	As above	As above	As above	31	22	26	-
Cheia 2, 2003	As above	As above	As above	26	19	22	-

many newts as possible were specifically identified by their external morphological features, and counted by the total count method (counting all specimens in the water body) facilitated by the relatively small size of the water bodies involved. The specimens were counted from the edge of the water. Some specimens were captured by means of a small dip-net for close examination. The tabulated results are one-day counts for each water body (i. e. all tabulated specimens were found at the same time together in the water), and for some ponds there are results from several years. Careful search was performed to identify all hybrids (once again, only external morphological features were considered). The behaviour (especially the sexual behaviour) of newts was watched (three to six hours per day and pond) in order to observe possible inter-specific fertilizations or attempts at fertilization, and other inter-specific interaction.

The occurrence of newt species and hybrids is summed in table 1. The two hybrids were both males and had clearly intermediate phenotypic traits; in sharp contrast, all specimens morphologically assigned to either *T. vulgaris* or *T. montandoni* exhibited the typical phenotypic traits for their species, as recorded, among other authors, by FUHN (1960); or, were it to use the morphological hybrid index as used by BABIK et al. (2003), all specimens but the two hybrids would have scored as "pure" (see table 2 for comparison of characters in hybrid and "pure" males). No females with intermediate morphological features were seen at any site. The characters of females of the parental species are seen in table 3.

As for the behaviour, we have watched the interaction between *T. montandoni* and *T. vulgaris* in ponds (such as Cheia 1 and Cheia 2) where both species were present in copious numbers; out of ca. 100 courtship sequences, not all of them successful, we have seen no determined, attempt at courtship by either *T. montandoni* males towards *T. vulgaris* females, or *T. vulgaris* males towards *T. montandoni* females. The specimens of each newt species kept performing their courtship displays towards their own conspecifics, seeming to ignore the other species altogether, as they also did to *T. alpestris*. In a few cases *T. vulgaris*

Table 2: Comparison of characters in hybrid (*Triturus vulgaris* x *Triturus montandoni*) males and "pure" males of the parental species.

Character	<i>T. vulgaris vulgaris</i> males	<i>T. vulgaris</i> x <i>T. montandoni</i> hybrids (males)	<i>T. montandoni</i> males
Dorsal coloration	Brown to greyish-brown, large round black spots	Golden-brown, with indistinct round spots	Brown to yellow-green, with darker indistinct spots and vermiculations
Ventral coloration	Whitish with median dull orange stripe and many black spots	All bright orange, with a few black spots	All bright orange, without spots
Dorsal crest	Tail, with crenate margin all along	Low, tallest above cloaca; straight edged or crenated only above cloaca	Absent
Paravertebral canthi	Absent	Present but inconspicuous	Present, well marked
Tail-tip filament	Absent	Present	Present
Hind toes	Webbed	Webbed	Not webbed
Stripes on head	Paired subocular, ocular and supraocular; unpaired median	An ocular stripe	Sometimes an ocular stripe
Gular fold	Absent	Absent	Present
Cloaca	Brown	Black	Black
Lower tail	Shows white, blue, black and red	Shows white, blue, black and orange-red	Shows yellowish-white and blackish-brown
Lateral tail	Brownish	Reddish brown	Reddish to purplish brown

males approached *T. montandoni* females and closed their snouts to the females' cloacal region, but immediately retreated without further attempt at courtship display. The only other interspecific interaction were two instances of *T. montandoni* males repeatedly butting their snouts into the tails and flanks of *T. vulgaris* males, and succeeding in driving them off a particular spot, but with no apparent subsequent "conflict". One of the hybrid males endeavoured without success to initiate courtship with a female *T. alpestris*, the only other newt which was present at that time in the same water body.

In less disturbed ponds with co-occurring numerous populations of both *T. vulgaris* and *T. montandoni* no hybrids were encountered and no interspecific courtship acts have been observed in watching sessions in three or four consecutive years; whereas in disturbed water bodies we encountered isolated hybrids and none or extremely few of the parental species. We have not been able to assess the genetical hybrid nature of specimens that seemed "pure" by morphological standards but might have a hybrid genotype (see BABIK et al. 2003), but an altogether lack of intermediate phenotypes in mixed populations of both parental species points to hybridization as a rare event under "natural" conditions (i.e. abundant, stable populations in optimal biotopes), especially as a morphologically intermediate individual needs not be an F1 hybrid but may also be an F2 or later recombinant (KOTLIK & ZAVADIL 1999). The occurrence of hybrids in disturbed habitats, where both parental populations are much reduced in number, might indicate that hybridization occurs more frequently in such conditions, possibly because the low availability of partners limits the possibilities of mate choice, a hypothesis that is not inconsistent with either the emphasis set by MICHALAK et al. (1997) on mate choice as the main factor of sexual isolation between *T. vulgaris* and *T. montandoni*, or the observation of BABIK et al. (2003) that in some regions previously heavily settled by people (but depopulated by war) a high level of genetic introgression found in newts seems to point to more intense hybridization events in the past.

Table 3: Comparison of characters in female *Triturus vulgaris* and *T. montandoni*.

Character	<i>T. vulgaris vulgaris</i> females	<i>T. montandoni</i> females
Dorsal coloration	Brown to yellowish-brown, sometimes with thin, interrupted longitudinal stripes	Brown to yellow-green, with darker indistinct spots and vermiculations, sometimes a marbled pattern or two irregular paravertebral stripes
Ventral coloration	Whitish with median dull orange stripe and small black spots	All bright orange, without spots
Limit of flanks and abdomen	Two rows of dark spots between which an unspotted strip can usually be discerned	Irregularly disposed dark spots, from very few to numerous, never disposed into two distinct rows
Paravertebral canthi	Absent (they sometimes seem present in dehydrated preserved specimens)	Present, well marked
Gular fold	Absent	Present

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First record of the Wall Lizard *Podarcis muralis* (LAURENTI, 1768), from the Ionian Island of Corfu

In the southern Balkan Peninsula *Podarcis muralis* (LAURENTI, 1768) inhabits mainly higher elevations and is very rare along the coast because of dry climate and competitive disadvantage with other laceratids (GRUSCHWITZ & BÖHME 1986). The occurrence of this lizard on the Ionian Island of Corfu (Greece) was never mentioned so



Fig. 1: Male hybrid newt (*Triturus vulgaris* x *Triturus montandoni*), Plaiu Foi, Piatra Craiului massif, May 2003; photo by A. IFTIME.

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