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Discovery of a population of the critically endangered *Vipera darevskii* VEDMEDERJA, ORLOV & TUNIYEV, 1986 in Turkey, with new elements on its identification

(Reptilia: Squamata: Viperidae)

Entdeckung einer Population der stark bedrohten *Vipera darevskii* VEDMEDERJA, ORLOV & TUNIYEV, 1986 in der Türkei, mit neuen diagnostischen Einzelheiten
(Reptilia: Squamata: Viperidae)

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KURZFASSUNG

Vipera darevskii VEDMEDERJA, ORLOV & TUNIYEV, 1986, ist eine kleine Gebirgsviper, die bisher nur von einem einzigen Fundort bekannt war, dem Berg Legli an der armenisch-georgischen Grenze. Deshalb wird die Schlange auch als in ihrem Bestand stark gefährdet eingestuft. Wir berichten über ein weiteres Vorkommen in der Nordost-Türkei, dessen Entdeckung Anlaß zur Hoffnung gibt, daß die Art tatsächlich noch weiter verbreitet ist. Die Ähnlichkeit von *V. darevskii* mit der häufigeren *V. [renardi] eriwanensis* (REUSS, 1933) und der Mangel publizierter Daten über ihre diagnostischen Merkmale mag zum Teil für das Fehlen von Nachweisen zwischen den nunmehr bekannten Fundorten verantwortlich sein. Neue bestimmungswichtige Merkmalsausprägungen werden beschrieben.

ABSTRACT

Darevsky's Viper *Vipera darevskii* VEDMEDERJA, ORLOV & TUNIYEV, 1986 is a small mountain viper previously known from a single locality, Mt Legli, on the Armeno-Georgian border. Consequently it is classified as "critically endangered". A new locality is reported here in north-eastern Turkey, giving hope that the species is actually more widespread. Similarity of *V. darevskii* with the more common *V. [renardi] eriwanensis* (REUSS, 1933) and scarcity of published information on its diagnostic characters may be partly responsible for the lack of records between these two localities. New elements on the identification of this species are given here.

KEY WORDS

Reptilia: Squamata: Serpentes: Viperidae; *Vipera darevskii*, Turkey, Zekeriya, chorology

INTRODUCTION

The poorly known *Vipera darevskii* VEDMEDERJA, ORLOV & TUNIYEV, 1986 is one of the rarest of the true vipers. It is presently known from a single locality in north-western Armenia, Mount Legli in the south-eastern part of the Javakheti range, on subalpine and alpine meadows between 2600 and 3000 m a.s.l. (VEDMEDERJA et al. 1986; ORLOV & TUNIYEV 1990), probably extending into the adjacent Georgian territory. Consequently, the species is classified as critically endangered by the IUCN (http://www.redlist.org/search/details.php?species=23000).

Published information on this species is scarce. The Mount Legli population was first documented by DAREVSKY (1956) under the name *Vipera kaznakovi dinniki* NIKOLSKY, 1913. Based on nine specimens, three of which are pictured in black and white photographs, VEDMEDERJA et al. (1986) described these animals as a new species. They provided comparisons of the principal features of this viper with *V. kaznakovi* NIKOLSKY, 1909 and *V. dinniki* NIKOLSKY, 1913 but not with the taxa of *V. ursinii* (BONAPARTE, 1835) sensu lato, as they considered the species to be part of the *V. kaznakovi* complex. ORLOV & TUNIYEV's (1990) synopsis on Caucasian vipers, combines material previously published by VEDMEDERJA et al. (1986) and additional information including a picture of a live specimen. HÖGGREN et al. (1993) provide little new information, while the voluminous synthesis of NILSON & ANDRÉN (2001) on the *V. ursinii* complex does not

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really cover *V. darevskii* as these authors do not include it in the *ursinii* complex.

For a long time, the phylogenetic affinities of *V. darevskii* have been unclear. It was usually considered a member of the *kaznakovi* complex, but often regarded as "intermediate" between the "*ursinii*" and the "*kaznakovi*" complexes. What was meant by "intermediate" is unclear, but a hybrid origin has been postulated (ORLOV & TUNIYEV 1990). "Intermediate" probably reflected the fact that its characters do not allow a precise allocation. NILSON & ANDRÉN (2001), for example, noted that its "external morphology evolved as typical for many alpine taxa within the *ursinii* complex, but shows clear similarities also with members of the *Vipera kaznakovi* group". The genetic results (JOGER et al. 2002; KALYABINA-HAUF 2004) suggest that the "*ursinii* complex" and the "*kaznakovi* complex" do not form natural groups in mitochondrial phylogeny, but that the taxa included in these assemblages constitute a monophyletic clade relative to other vipers; in their study, *V. darevskii* appears as a well differentiated species within this *kaznakovi – ursinii* complex.

The viper fauna of the Anatolian-Caucasian region is characterized by its high species richness: the *kaznakovi – ursinii* complex is represented by *anatolica* EISELT & BARAN, 1970, known from one or two localities in the calcareous mountain of Elmadağ (south-western Turkey), *eriwanensis* REUSS, 1933 from the basaltic high plateaux of north-eastern Turkey and Armenia, extending to adjacent Azerbaijan, *lotievi* NILSON, TUNIYEV, ORLOV, HÖGGREN & ANDRÉN, 1995 from high altitude habitats along the ridge of the Greater Caucasus Mountains, *renardi* (CHRISTOPH, 1861) with a wide distribution in Eurasian steppes, reaching the low altitude steppe areas of the northern slopes of the Caucasus, *ebneri* KNOEPFFLER & SOCHUREK, 1955 from the high altitude areas of the Elbruz mountain range in NW Iran and SE Azerbaijan (NILSON et al. 2001), *kaznakovi* from forested habitats in the eastern Black Sea coast and western Caucasus, *dinniki* from open habitats at higher altitudes in the western and central Caucasus, and *orlovi* TUNIYEV & OSTROVSKIKH, 2001 and *magnifica* TUNIYEV & OSTROVSKIKH, 2001 from the western Black Sea coast (TUNIYEV & OSTROVSKIKH 2001). The other *Vipera* species in the area, *Vipera* [*berus*] *barani* BÖHME & JOGER, 1983 along the Black Sea coast of Turkey and *V. ammodytes transcaucasiana* BOULENGER, 1913 in northern Turkey, Georgia and NW Azerbaijan, do not belong to the *kaznakovi – ursinii* clade. The enigmatic *V. pontica* BILLING, NILSON & SATTLER, 1990, known from two specimens from NE Turkey, was recently suggested to be closely related to, or even identical with, *barani* (BARAN et al. 2001). However, we strongly disagree with this classification because the holotype of this taxon shows clearly morphological features of *V. kaznakovi* and *V. a. transcaucasiana*, which are both known to occur in the same area, but not of *Vipera berus* (LINNAEUS, 1758) s.l.

RESULTS

The authors discovered a population of vipers of the *ursinii-kaznakovi* complex in a new site situated 2 km east of Zekeriya village, ca 26 km south-east of Ardanuç, in the Artvin province, at 1970-2070 m. Six vipers were found on 18.9.2000 and two on 1.6.2002, in total three males, four females and one newborn. Three specimens were collected and deposited in the Muséum national d'Histoire naturelle of Paris (MNHN 2002.410, male), in the "Alcide d'Orbigny" collection (ASHNAO.00102, female) and in the Laboratoire de Biogéographie et Ecologie des Vertébrés de l'Ecole Pratique des Hautes Etudes, in Montpellier (BEV.8369, juvenile). All specimens were photographed and the pictures are kept in the picture collection of PG (numbers PGe 449-456).

Description

The Zekeriya vipers were easily assigned to the *kaznakovi – ursinii* complex by the general habitus and colour pattern (see figures), rounded snout and presence of large unfragmented frontal and parietal

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Fig. 1: Adult male *Vipera darevskii* VEDMEDERJA, ORLOV & TUNIYEV, 1986 from Zekeriya, Turkey (MNHN 2002.410). Photograph: PH. GENIEZ & A. TEYNIÉ.

Abb. 1: Adulte männliche *Vipera darevskii* VEDMEDERJA, ORLOV & TUNIYEV, 1986 aus Zekeriya, Türkei (MNHN 2002.410). Photo: PH. GENIEZ & A. TEYNIÉ.

Fig. 2: Adult female *Vipera darevskii* VEDMEDERJA, ORLOV & TUNIYEV, 1986 from Zekeriya, Turkey (ASHNAO.00102). Photograph: PH. GENIEZ & A. TEYNIÉ.

Abb. 2: Adulte weibliche *Vipera darevskii* VEDMEDERJA, ORLOV & TUNIYEV, 1986 aus Zekeriya, Türkei (ASHNAO.00102). Photo: PH. GENIEZ & A. TEYNIÉ.

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Table. 1: Main morphological features of our eight Turkish specimens of *Vipera darevskii* VEDMEDERJA, ORLOV & TUNIYEV, 1986. SVL - snout-vent length (mm); TL - tail length (mm); Dors - number of dorsal scales rows at midbody; Vent - number of ventral plates; SC - number of pairs of subcaudal plates; Apic - number of apical scales; Supl - number of supralabial scales on one side; Circ - number of circumocular scales on one side, * - tail incomplete.

Tab. 1: Morphologische Hauptmerkmale unserer acht türkischen Exemplare von *Vipera darevskii* VEDMEDERJA, ORLOV & TUNIYEV, 1986. SVL - Kopf-Rumpf-Länge (mm); TL - Schwanzlänge (mm); Dors - Anzahl Rückenschuppenlängsreihen in Rumpfmitte; Vent - Anzahl Bauchschienen; SC - Anzahl Unterschwanzschildpaare; Apic - Anzahl Apicalia; Supl - Anzahl Supralabialia einer Seite; Circ - Anzahl Circumorbitalia einer Seite, * - Schwanz unvollständig.

SVL	TL	Dors	Vent	SC	Apic	Supl	Circ
345	60	19	138	38	2	9	9
353	40	19	144	33	1	9	10
390	50	19	143	31	2	7	10
360	50	19	136	33	2	9	9
330	35	19	133	26	2	8	10
109	22	21	137	39	2	8	10
390	60*	21	129	29*	2	9	9
340	40	21	139	31	2	8	10

scales on the pileus. The only vipers of this complex known from NE Turkey at the time were *eriwanensis* and *kaznakovi*. The observed vipers nevertheless looked different from these taxa, which we had seen in the field several times before (see below). The principal features of these vipers are the small size (max. 45 cm, cf. table 1), 19 (in 5 specimens) or 21 (in 3 specimens) longitudinal rows of dorsal scales at midbody, a relatively big head with rather angular canthus rostralis, one series of large oval vertical dark blotches on each flank, often two bright yellowish dorso-lateral stripes (greyer in some females), sometimes with clear-cut anterior edge as in *Vipera kaznakovi* and *V. dinniki* (figs. 1 to 3), a dark to very dark pileus, pale labials with dark sutures in all but one specimen, and a mostly dark belly, dark-grey with numerous black dots and whitish scale edges. The general tint of the body is yellowish in males with a dark vertebral zigzag band, greyer in females with a brown zigzag band, sometimes connected with the dark headed-pattern (on 3 specimens). The newborn specimen was very small (total length 13.5 cm). The venom of all specimens was yellow. Additional scale characters are given in table 1.

Comparisons

In order to establish the identity of these vipers, we compared their characters with the information available on the morphology of the other viper taxa of the region, and with our own observations of specimens of these taxa in captivity, in the field, and from published and unpublished color photographs.

Most of the other vipers of the *kaznakovi – ursinii* complex known from this region could be easily excluded by these characters: *kaznakovi* and the closely related *orlovi* and *magnifica* live in very different habitats, have a very different color pattern, a relatively larger head, a different head shape with more pronounced canthus rostralis, more perioculars (11-12 [NILSON et al. 1995] versus 9-10), *dinniki* has a gold-edged iris (NILSON et al. 1995) and a head shape rather similar to *kaznakovi* (ORLOV & TUNIYEV 1990; pers. obs.), with a very pro-

Figs. 3 - 6 (opposite page) / Abb. 3 - 6 (gegenüberliegende Seite): *Vipera darevskii* VEDMEDERJA, ORLOV & TUNIYEV, 1986 and *Vipera eriwanensis* (REUSS, 1933). Photos: PH. GENIEZ & A. TEYNIÉ.

Fig. 3: Adult female *Vipera darevskii* from Zekeriya, Turkey (PGe.451).
Abb. 3: Adulte weibliche *Vipera darevskii* von Zekeriya, Türkei (PGe.451).

Fig. 4: Geographical distribution of *Vipera darevskii*.
● - Mount Legli locality in Armenia; ★ - the new site near Zekeriya, Turkey.
Abb. 4: Geographische Verbreitung von *Vipera darevskii*.
● - Mount Legli Fundort in Armenien; ★ - der neue Fundort bei Zekeriya, Türkei.

Fig. 5: Female *Vipera eriwanensis* (REUSS, 1933) from Arpaçay, NE Turkey, (PGe.439).
Abb. 5: Weibchen von *Vipera eriwanensis* (REUSS, 1933) von Arpaçay, NE Türkei, (PGe.439).

Fig. 6: Male *Vipera darevskii* from Zekeriya, Turkey (PGe.450).
Abb. 6: Männchen von *Vipera darevskii* von Zekeriya, Türkei (PGe.450).

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minent canthus rostralis above the nostril (pers. obs.). In addition, the Zekeriya vipers are smaller than all these taxa (compare table 1 with data in ORLOV & TUNIYEV 1990) and the specimens with pale pileus have a fronto-parietal ocellated spot, which is absent in the other taxa (see NILSON & ANDRÉN 2001).

In *lotievi*, *anatolica* and *ebneri* there is almost always one apical scale (NILSON & ANDRÉN 2001) versus two in six of the Zekeriya vipers (table 1), the upper preocular is generally in contact with the nasal (NILSON & ANDRÉN 2001; no contact in our eight specimens), the belly is white, the body coloration grey even in males (yellowish in males of the Zekeriya vipers), the pileus is generally pale (dark in four Zekeriya specimens), there is usually no dark suture on the labials and the dark dorsal zigzag band is never in contact with the dark parts of the pileus (present in three of our specimens). These latter two characters distinguish the Zekeriya vipers from *renardi*, which on its part has clear marks on labials and throat, a single apical scale and in general the upper preocular and nasal in contact with each other. When following the key in NILSON & ANDRÉN (2001), the specimens characterized by having 21 dorsal scale rows are *eriwanensis*.

Thus, correct determination would have to decide between the two taxa whose distribution areas come closest to this new locality: *eriwanensis* (known from this region, but not from this locality) and *darevskii*, whose known range lies just some 130 km from Zekeriya (fig. 4). In the field the general impression of a snake similar to *Vipera ursinii* s.l. but with a larger head, more robust body and yellowish coloration in males strongly spoke in favour of *Vipera darevskii*. Unfortunately, we were unable to obtain or look at any specimens of *darevskii* for comparison from the collections of the Zoological Institute, Russian Academy of Sciences, St Petersburg and Naturhistoriska Museet, Göteborg, so identification had to be based on published information and pictures.

There is little published information on the characters which separate *eriwanensis* from *darevskii*. NILSON & ANDRÉN (2001) mention that in their key *darevskii* will fall out as *eriwanensis* (as was the case in the Zekeriya vipers). ORLOV & TUNIYEV (1990) mention that *darevskii* has, compared with *eriwanensis*, (1) a relatively high head with a much less pointed upper anterior snout edge, (2) yellowish general coloration, (3) clear contrasted pattern and (4) different pholidosis, but no information is given on these pholidotic characters. Compared to *eriwanensis*, our Zekeriya vipers have clearly a larger head, with a wider and more rounded snout, and males have a yellowish coloration with a more contrasted zigzag band (pure black) in males. This would thus correspond to characters of *darevskii*.

In addition, differences in color pattern are also apparent: in the majority of the Zekeriya vipers the flanks have a series of large dark blotches (usually two series of smaller dots in *eriwanensis*, fig. 5) (pers. obs.) and the neck pattern is more contrasted, with clear-cut dark lines and a wide intrusion of the pale flank coloration onto the sides of the neck (compare both taxa in figs. 6 and 7). In some specimens, the dark vertebral zigzag band meets the dark coloration of the pileus, a condition that we

Figs. 7 - 10 (opposite page) / Abb. 7 - 10 (gegenüberliegende Seite): *Vipera darevskii* VEDMEDERJA, ORLOV & TUNIYEV, 1986 and *Vipera eriwanensis* (REUSS, 1933).
Photos: 7, 8, 10 - PH. GENIEZ & A. TEYNIÉ; 9 - P.-A. CROCHET.

Fig. 7: Male *Vipera eriwanensis* from Arpaçay, NE Turkey (PGe.438).
Abb. 7: Männchen von *Vipera eriwanensis* von Arpaçay, NE Türkei (PGe.438).

Fig. 8: Ventral view of a male *Vipera darevskii* from Zekeriya, Turkey (PGe.450).
Abb. 8: Ventralansicht eines Männchens von *Vipera darevskii* von Zekeriya, Türkei (PGe.450).

Fig. 9: Ventral view of a male *Vipera eriwanensis*
from 4 km north of Ölçek on the road to Posof, NE Turkey (PGe.440).
Abb. 9: Ventralansicht eines Männchens von *Vipera eriwanensis*
von 4 km nördlich Ölçek, an der Straße nach Posof, NE Türkei (PGe.440).

Fig. 10: Habitat of *Vipera darevskii* in Zekeriya, Turkey.
Abb. 10: Lebensraum von *Vipera darevskii* in Zekeriya, Türkei.

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never observed in *eriwanensis*. Some specimens (figs. 1, 2, 6) have a coloration that is strikingly different from any *eriwanensis*, while others (fig. 3) look more similar but with a more contrasted head and neck pattern. The ventral coloration of the Zekeriya vipers is grey to dark grey with numerous black dots and whitish scale edges (fig. 8). The impression is of a dark belly, very different from the mostly pale belly of *eriwanensis* (fig. 9). Last, the corners of the dorsal band windings are less rounded in the Zekeriya vipers than in *eriwanensis*.

Although these differences are not listed in the few published accounts of *darevskii*, they correspond well with the published pictures. The dark belly is shown in figures 10 and 11 of ORLOV & TUNIYEV (1990), as well as the series of large dark blotches on the flanks and the contrasted, more geometric neck pattern. The contact of the vertebral zigzag band with the dark pileus is shown in fig. 12 of the above publication. Note also striking similarity between the *darevskii* specimen in NILSON & ANDRÉN (2001, fig. 64) and our figure 1.

Pholidotic features of the Zekeriya vipers correspond well also with the published data for *darevskii* (ORLOV & TUNIYEV 1990): 19 or 21 dorsal scales, two apical scales in the majority of specimens, frontal usually larger than parietals, 129-144 (average 137) ventrals, nostril usually piercing the lower part of the nasal. The main difference concerns the contact between the upper pre-ocular and the nasal, present in the majority of *darevskii* from Mount Legli but absent in the eight Zekeriya specimens.

DISCUSSION AND CONCLUSIONS

In summary, the morphological features of the Zekeriya vipers separate them from all known viper taxa except *darevskii* while their features correspond well with what is known about *darevskii*. The known records of *darevskii* lie only 130 km from Zekeriya, much closer than those of the other taxa except *eriwanensis*, from which they clearly differ in body proportions and coloration. We therefore conclude that the Zekeriya vipers constitute an additional population of *Vipera darveskii*.

As in Armenia, the Zekeriya population of *darevskii* lies on the northern edge of the distribution of *eriwanensis*. The closest known site of *V. eriwanensis* in Turkey is north of Kömürlü (vilayet of Erzurum), 25 km SE of Zekeriya (BRUNO 1985, pers. obs.). The habitat at Zekeriya differs from those in all known Turkish localities of *eriwanensis*, which are on basalt substratum (TEYNIÉ 1987, pers. obs.) by being calcareous, with short, heavily grazed alpine meadows and numerous piles of stones, above the upper altitudinal limit of the forest (fig. 10). This corresponds well to the habitat at Mount Legli as described in ORLOV & TUNIYEV (1990) although the Mount Legli habitats are also on volcanic substratum. The herpetological community observed at the Zekeriya locality was rather poor: *Rana macrocnemis camerani* BOULENGER, 1886 (four individuals) and *Anguis fragilis colchicus* (NORDMANN, 1840) (three individuals).

In our opinion, the morphological characters of *darevskii* do not link it with the *kaznakovi – dinniki* subgroup, in contrast to what has been previously published. Our observations fit well with the recent genetic results (JOGER et al. 2002; KALYABINA-HAUF 2004). To the characteristics discussed above, we can add that our juvenile specimen (apparently recently born) was very small (13.5 cm total length), much smaller than is typical for newborn *kaznakovi* which are from 160 mm (pers. obs.) to 145 mm (MALLOW et al. 2003). The new characters to identify *V. darevskii* are: (1) a rather angular canthus rostralis, (2) one series if large oval vertical dark blotches on each flank, (3) the two contrasted light dorsolateral stripes, (4) the clear-cut anterior edge of the vertebral zigzag, (5) the very little size of the newborn and (6) the yellow coloured venom.

Discovery of the Zekeriya population has important consequences for the conservation of *Vipera darevskii*, since the species was previously known from a single locality only. The considerable range extension associated with this new site raises the possibility that the species occurs elsewhere in the mountain ranges between Mount Legli

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and Zekeriya. Future investigations should be directed at high altitude meadows, especially dry alpine meadows with short, grazed vegetation and bare grounds, probably a habitat probably rarely visited by herpetologists and snake enthusiasts in NE Turkey. Although this discovery provides evidence that the area inhabited by *Vipera darevskii* is larger than previously realized, we wish to stress that collecting for whatever purpose should be avoided given the present uncertainties on the species' prospects.

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