

New locality records for four rare species of vipers (Reptilia: Viperidae) in Turkey

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We report new localities and range extensions for four vipers from Turkey. The distribution of *Montivipera wagneri* is extended substantially southwards into Muş province, showing that this species is not endemic to the Aras valley as previously stated in the literature. Similarly, an unverified photograph of *Montivipera albizona* from Erzincan province, at its currently known eastern limit, was confirmed with new material, and its range is extended substantially southwards to the Anamos (Nur) Mountains in Hatay province. Smaller range extensions are reported for *Vipera ammodytes transcaucasiana* and *V. darevskii*.

Keywords: *Montivipera wagneri*; *Montivipera albizona*; *Vipera ammodytes transcaucasiana*; *Vipera darevskii*; distribution; morphology; Turkey.

Introduction

Anatolian vipers (Reptilia: Viperidae) show a high level of endemism and diversity as a result of the complex biogeographic history of Anatolia. The taxonomy and phylogeography of Anatolian vipers is still a controversial issue (Stümpel & Joger, 2009). Altogether 14 taxa (species and subspecies) of Viperidae have been recorded in Turkey belonging to the genera *Macrovipera*, *Montivipera* and *Vipera* (Mallow, Ludwig, & Nilson, 2003; Budak & Göçmen, 2008), excluding the recently described *V. olguni* (Tuniyev et al., 2012) for which there are insufficient data (see below). Also excluded are some expected phylogenetic rearrangements and clarifications within the genera *Montivipera* and *Macrovipera*, resulting from the dissertation work of Stümpel (2012) and some preliminary genetic results (Stümpel & Joger, 2009) which are, however, without a formal presentation of new and explicit species arrangements.

We present here new locality records together with morphological details of four rare Turkish vipers, *Montivipera wagneri*, *M. albizona*, *Vipera ammodytes transcaucasiana* and *V. darevskii*, to contribute to a better understanding of their biogeographic distribution pattern. The IUCN Red List of Threatened Species (IUCN, 2014) lists *M. wagneri* and *V. darevskii* as critically endangered (CR), *M. albizona* as endangered (EN), and *V. ammodytes transcaucasiana* (listed as *V. transcaucasiana* in the IUCN Red List) as near threatened (NT), but references dealing with their distribution and

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ecology are very limited. Our new records therefore increase our knowledge of these rare Turkish vipers and may help define a basis for conservation.

Material and methods

The material was collected in central, eastern and north-eastern Anatolia in 2013. Most specimens were collected as vouchers and subsequently fixed and stored in 96% ethanol in order to keep DNA material stable for future molecular phylogenetic studies. They are deposited in the Zoology Museum of Adıyaman University (ZMADYU) in Adıyaman province, Turkey.

Metric measurements and meristic characters were recorded while the vipers were alive and are explained in the caption of Table 1. The ventral scales were counted according to Dowling (1951). Head length was measured as the distance from the posterior end of the skull to the tip of the snout using a digital calliper. Other morphometric measurements were taken with a digital calliper of 0.02 mm accuracy (Mitutoyo 500-181 U). Features of colour pattern were photographed while the animals were alive in their natural environment. The exact geographic locations are not given for conservation purposes.

Results and discussion

Montivipera wagneri Nilson & Andr n, 1984

Material: ZMADYU 2013/81, 1 ♀, Dolabaş village, Malazgirt, province Muş, 2146 m a.s.l., 18.v.2013, leg. B. Göçmen, B. Akman, N. İğci, M. A. Oğuz – 1 ♀, Camuşlu village, Kağızman, province Kars, 2008 m a.s.l., 6.vii.2013, leg. K. Mebert, M. Z. Yıldız, N. İğci, Ç. Altın. This snake was released after data recording at its point of capture. A second specimen was observed, but not captured, at the same site.

Both specimens were found on a slope with a mosaic of rocks, grass and small bushes. The site near Dolabaş represents the highest published elevation recorded for this species. We recorded *Pseudepidalea variabilis*, *Testudo graeca*, *Paralaudakia caucasica*, *Ophisops elegans*, *Trachylepis aurata*, *Eirenis eiselti*, *Dolichophis schmidti* and *D. jugularis* in Dolabaş, and *Zamenis hohenackeri*, *Lacerta media* and *Darevskia unisexualis* at Camuşlu as syntopic amphibian and reptile species. Characteristics of the colour pattern (Figure 1A, 1B) and other morphological features (Table 1) are generally in accordance with those given in the previous literature (e.g., Nilson & Andr n, 1986; Mulder, 1994; Mallow et al., 2003; Baran et al., 2004) with the exception of the number of 1st circumoculars, which is lower than that given in the literature for *M. wagneri*.

The type locality of this species is given as Urmia Lake in Iran, which is probably erroneous as this served as a collective locality for samples from a larger region (P. Wagner, pers. comm.). *M. wagneri* is known only from northeastern Turkey, with previous records more or less restricted to the Aras Valley and its tributaries between Horasan and Kağızman (Figure 2, Mallow et al., 2003; Budak & Göçmen, 2008). The distribution extends towards the south of the Aras Valley according to the map given by Kaska, Kumlutaş, Avcı, and Nilson (2009), but no site-specific records or references were given. Our Malazgirt record extends its known range by ca. 90 km from the nearest locality records (St mpel, 2012). The Camuşlu specimen contributes to knowledge of the distribution area of *M. wagneri* along its eastern range limit around Kağızman and is important in narrowing the gap between its range and the western limit of *M. raddei* for our studies on contact zones and potential gene flow between these vipers near Kağızman. According to Kaska et al. (2009), *M. wagneri* favours more densely vegetated and cooler microhabitats on north-facing slopes compared to warmer south-facing slopes occupied by *M. raddei*. However, we, as well as others (unpubl. data stored in our database), have sampled *M. wagneri* on numerous south-facing slopes.



Figure 1. Vipers in their natural environment. A: *Montivipera wagneri* from Malazgirt, Muş, B: *M. wagneri* from Camuşlu, Kars, C: *M. albizona* from Kemaliye, Erzincan, D: *Vipera ammodytes transcaucasiana* from Kızılcahamam, Ankara, E: *V. ammodytes transcaucasiana* from Meydancık, Artvin, F: *V. darevskii* from Sulakçayır, Ardahan (photographs: A, B, D: Naşit İğci; C: Bayram Göçmen; E, F: Konrad Mebert).

Montivipera albizona Nilson, Andrén & Flärdh, 1990

Material: ZMADYU 2013/90, 1 ♀, Sarıççek Plateau, Kemaliye, province Erzincan, 1790 m a.s.l., 1.vi.2013, leg. Ş. Gültekin, who also provided photographs of three more specimens from the same area (one on www.turkherptil.org and one depicting a couple, pers. comm.). – 1 individual (sex unknown and not sampled) filmed and photographed in situ near the peak of Bozdağ, part of the Amanos (Nur) Mountains, province Hatay, 2200 m a.s.l., 30.x.2010, leg. Ümit Kaplan, first published on www.turkherptil.org.

Even though haplotypes (mtDNA) of *M. bulgardaghica* are nested within *M. albizona* and do not support the validity of *M. albizona* (Stümpel & Joger, 2009; Stümpel, 2012), we provisionally follow the traditional taxonomy and accept *M. albizona* as a separate taxon until a new taxonomic arrangement has gone through a peer-reviewed

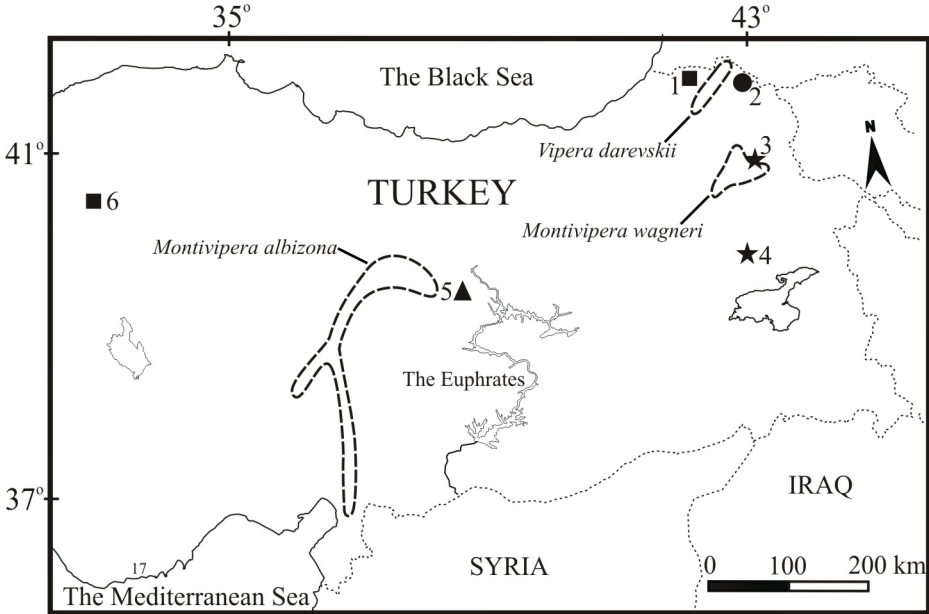


Figure 2. Distributions of *Montivipera albizona*, *M. wagneri* and *Vipera darevskii* according to the literature (but excluding localities outside Turkey and the IUCN map, see text) mentioned in the text and our new localities (solid symbols): stars *M. wagneri*, triangles *M. albizona*, squares *V. ammodytes transcaucasiana*, and circle *V. darevskii*. 1: Meydancık, Şavşat, province Artvin, 2: Sulakçayır, Hanak, province Ardahan, 3: Camuşlu, Kağızman, province Kars, 4: Dolabaş, Malazgirt, province Muş, 5: Sarıççek Plateau, Kemaliye, province Erzincan, 6: Çukurca, Kızılcahamam, province Ankara.

publishing process. *M. albizona* is an endemic Turkish mountain viper, which was first described from the Kulmaç Mountains (province Sivas, central Anatolia). Published records indicate that its distribution appears to relate to the Anatolian Diagonal as far east as Yama Mountain, Sivas province (Figure 2, Nilson et al., 1990; Mulder, 1994; Mallow et al., 2003; Göçmen et al., 2009, Tok et al., 2009). Our *M. albizona* record from near Kemaliye extends the eastern limit by ca. 50 km. Putative locality records another 55 km further east need identity verification, as they are based on (a) shed skins that are no longer available (Mulder, 1994; Mulder, pers. comm.), and (b) a photograph by Celal Çiçek of a specimen from Hengirvan, Tunceli province with *wagneri*-like lateral stripes (Seyhan Yürek, in litt. and on www.turkherptil.org, but see below). The Hatay record is the first specimen from the Anamos (Nur) Mountains and represents the southernmost record, with a range extension of ca. 90 km from the nearest record in Kahramanmaraş (Göçmen et al., 2009). Taking into account the previous records and our present records, the distribution range of this species possibly includes the entire Anatolian Diagonal and approaches the range of *M. wagneri*, but a gap of approximately 300 km without records still remains.

The specimen of *M. albizona* from Kemaliye was found in an alpine habitat with rocks and small bushes. It shows partial vertical stripes on the flanks (Figure 1C), a character more common in *M. wagneri* (Mulder, 1994 and pers. data) but which occurs occasionally in specimens associated with *M. albizona* (from Kahramanmaraş, Erzincan, and possibly Tunceli provinces depicted on www.turkherptil.org). Other

Table 1. Metric and meristic characters of examined specimens. 1: Snout-vent length (mm), 2: tail length (mm), 3: rostrum width (mm), 4: rostrum height (mm), 5: pileus length (mm), 6: dorsals (in the anterior-middle-posterior part of the body), 7: preventrals, 8: ventrals, 9: subcaudals (left/right), 10: supralabials (left/right), 11: sublabials (left/right), 12: first circumoculars (left/right), 13: second circumoculars (left/right), 14: canthals (including supranasal, left/right), 15: apicals, 16: crown scales, 17: number of zigzag windings on dorsum (excluding tail).

Characters																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
<i>Montivipera wagneri</i> , ZMADYU 2013/81																
725	60	5.4	4.9	-	23-23-18	4	168	27/27	9/9	12/12	12/11	15/15	2/2	3	47	32
<i>Montivipera albizona</i> , ZMADYU 2013/90																
523	45	4.36	4.02	-	23-23-17	4	156	26/26	9/9	11/11	12/12	14/16	2/2	2	53	33
<i>Vipera darevskii</i> , ZMADYU 2013/76:1-4																
314	49	2.7	2.7	10.8	21-21-17	5	135	34/33	9/10	10/11	10/10	-	2/2	1	10	67
330	49	2.7	3.1	11.3	20-21-17	5	133	30/30	9/9	10/10	9/9	-	2/2	1	9	58
430	50	3.0	3.7	12.1	21-21-17	4	135	28/27	8/8	9/9	9/8	-	2/2	1	6	65
345	53	3.9	3.2	10.8	19-19-17	4	132	28/28	9/9	9/9	8/8	-	2/2	2	5	68
<i>Vipera ammodytes transcaucasiana</i> , ZMADYU 2013/51:1-4																
483	60	3.4	4.5	-	21-21-17	3	150	35/34	9/9	10/11	11/10	12/13	4/4	1	48	49
213	33	1.9	3.0	-	21-21-17	4	146	36/36	9/9	11/11	11/10	15/15	4/4	2	47	50
210	30	2.4	2.6	-	21-21-17	3	149	34/33	8/8	9/9	10/10	14/15	4/4	2	56	40
525	65	3.6	4.6	-	21-21-17	5	156	34/35	10/9	11/11	12/11	14/15	4/4	1	47	46
<i>Vipera ammodytes transcaucasiana</i> , ZMADYU 2013/77																
495	67	3.6	4.2	-	21-21-17	4	144	35/35	9/9	10/10	11/12	14/13	4/4	2	60	47

morphological features relate more to *M. albizona* (Nilson, Andrén, & Flärdh, 1990; Mulder, 1994; Mallow et al., 2003; Göçmen et al., 2009). For example, it has wide orange-brown blotches at mid-body (10 scales), a low number of ventral and inner circumocular scales (see Table 1), and occipital marks not connected to the first dorsal blotch (connected in 40–50% of *M. wagneri*, Mulder, 1994 and pers. data).

Vipera ammodytes transcaucasiana Boulenger, 1913

Material: ZMADYU 2013/51:1-4, 1 ♀, 1 ♂, 2 juv., Çukurca village, Kızılcahamam, province Ankara, 1325 m a.s.l., 28.iv.2013, leg. B. Göçmen, B. Akman, N. İğci, M. A. Oğuz – ZMADYU 2013/77, 1 ♀, Meydancık, Şavşat, province Artvin, 1360 m a.s.l., 16.v.2013, leg. B. Göçmen, K. Mebert, M. Z. Yıldız, N. İğci, B. Akman, M. A. Oğuz.

We found the specimens from Kızılcahamam in a relatively dry, rocky habitat with bushes and a few trees. The specimen from Meydancık, a 40 km eastern range extension from the nearest Aralık record (Ursenbacher et al., 2008), was found in a more humid habitat with dense bushes and trees near a river. We observed *Lacerta media* in very high numbers as a syntopic reptile species in Kızılcahamam, whereas *Darevskia rudis*, *Coronella austriaca*, and *Anguis fragilis* were found syntopically at Meydancık.

The viper taxon *transcaucasiana* was first introduced by Boulenger as *Vipera ammodytes transcaucasiana*. It is considered as a good species by some authors (Mallow et al., 2003). Nevertheless, its taxonomic status is still controversial. There seems to be sufficient morphological and genetic evidence to give populations from Sivas province (central Anatolia) to the Black Sea region and northeastern Anatolia subspecies status (Tomovic, 2006; Ursenbacher et al., 2008). Our specimens from Kızılcahamam and Meydancık exhibit transverse dark bands on their dorsum (Figure 1D, 1E), a characteristic pattern of *V. ammodytes transcaucasiana* (Başoğlu & Baran, 1977; Mallow et al., 2003; Tok & Kumlutaş, 1996; Tomovic, 2006), in comparison to the rather continuous zigzag stripe and yellowish green tail tip of *V. ammodytes meridionalis* from far western Anatolia. The darker colour of our Meydancık specimen (Figure 1E) is the result of its pre-ecdysis status. All our specimens have 9 scales on their “nasal horn” (except one juvenile from Kızılcahamam which has 8 scales), arranged in 2 horizontal rows. There are three transverse scale rows on the horn of the Meydancık and two (1 male, 1 juvenile) of the Kızılcahamam specimens, and 2 rows for the other two Kızılcahamam specimens. Additional morphological characters are given in Table 1.

Afşar, Çiçek, Dincaslan, Ayaz, and Tok (2012) reported this taxon in Kızılcahamam based on a juvenile specimen, and they classified the specimen as *V. ammodytes* cf. *transcaucasiana*. Similarly, comparing the meristic characters of our specimens with those given in the literature (Kutrup, 1999; Mallow et al. 2003; Tomovic, 2006), we found a general concordance with the *transcaucasiana* type (e. g., 2 horizontal scale rows on the “nasal horn”, transverse narrow bands on the dorsum rather than a continuous zigzag stripe). We therefore conclude that the Kızılcahamam population and the Meydancık specimen can be phenotypically classified as *V. ammodytes transcaucasiana*.

Vipera darevskii Vedmederja, Orlov & Tuniyev, 1986

Material: ZMADYU 2013/76: 1-4, 3 ♀, 1 ♂, Sulakçayır village, Hanak, province Ardahan, 15.v.2013, leg. B. Göçmen, K. Mebert, M. Z. Yıldız, N. İğci, B. Akman, M. A. Oğuz, Ç. Altın.

We found four *V. darevskii* in an alpine habitat at varying altitudes between 2250 and 2520 m (a.s.l.). Syntopic reptiles were *Lacerta agilis* and *Darevskia armeniaca*. Figure 1F shows the general characteristics of the colour pattern of a live animal, while morphological characters are given in Table 1.

This rare viper is distributed in northeastern Anatolia and Armenia, with possible populations occurring in adjacent Georgia (Figure 2, Mallow et al., 2003; Tuniyev et al., 2012). There are two published localities in Anatolia, one near Zekeriya village in Artvin province (Geniez & Teynié, 2005), and the second around Posof in Ardahan province (Tuniyev et al., 2012), which is 20 km away from our collection locality.

Recently, the Ardahan populations were described as *Vipera (Pelias) olguni* by Tuniyev, Avcı, Tuniyev, Agasian and Agasian (2012) based on morphological comparisons. Although they did not include specimens from Zekeriya in their statistical analyses, they concluded that those are closer to typical *V. darevskii*. When we compare the meristic characters with those given by Tuniyev et al. (2012), our Sulakçayır specimens, which originate from the same mountain range as *V. (Pelias) olguni*, resemble the Armenian *V. darevskii* by having a higher number of preentrals, sublabials and zigzag windings, and a lower number of first circumoculars and supralabials. Our morphological results, the low number of independent (i.e., no offspring) adult samples (2-6 per gender and site) and sites (only 2) in Tuniyev et al. (2012), as well as the disregard of ecophenotypic correlations or influences (e.g., Golay et al., 2008), and confusing results of mixed genotypes among several Caucasian vipers, such as *V. darevskii*, *V. dinniki*, *V. lotievi* and *V. kaznakovi* (Zinenko et al., 2013), render the erection of a separate species, *V. olguni*, premature. But it certainly emphasises the need for more detailed morphological and genetic analyses of Anatolian *V. darevskii* to evaluate the degree of gene flow and geographic variation between environmentally distinct and geographically distant sites, in order to confirm if there is a cryptic speciation pattern.

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