A new subspecies of Ottoman viper, *Montivipera xanthina* (Gray, 1849), (Squamata: Viperidae) from Geyik Mountains, Mediterranean Turkey

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Received 15 August 2019 │ Accepted by V. Pešić: 23 September 2019 │ Published online 15 October 2019.

Abstract

A new Ottoman viper subspecies, *M. xanthina varoli* n. subsp., is described from the higher altitudes of Gündoğmuş (Antalya). The new subspecies differs from the other *M. xanthina* populations by pholidosis; higher number of intercanthals and lower number of subcaudalia. Also, the whiteness between windings or spots on dorsum pattern were observed in new subspecies, similar to the southern populations. Furthermore, the spots on the ventrals became denser in the mid-body and forms darker colorization at the end of body of the males and the tail tips are yellowish-orange or light orange on both sexes.

Key words: Viperidae, new subspecies, *Montivipera xanthina varoli*, n. subsp., systematics, Antalya, Turkey.

Introduction

The Ottoman viper, *Montivipera xanthina* was firstly described by Gray in 1849 as *Daboia xanthina*, from Xanthos ruins in Muğla. The specimens collected from Jaffa (Israel) by Müller (1878) included in *Vipera* genus which was described by Laurenti (1768) and defined as *Vipera xanthina*. In later years, Boettger (1880, 1888) included specimens from Xanthos in *Vipera* genus as *V. xanthina*. Later, the nomenclature was used in systematic studies regarding the species (Werner 1898, 1914; Bodenheimer 1944; Mertens 1952, 1967; Mertens et al. 1967; Baran 1976; Nilson & Sundberg 1981; Nilson & Andren 1986; Nilson et al. 1999) for many years.

Werner (1898, 1914) first described the new species from Turkey (Southern Taurus, Bolkardağı) and Lebanon as *Vipera bornmuelleri*, then considered that Eskijeşir and İstanbul specimens in addition to Bolkar Mountains (Bolkar dağları) ones as a subspecies of *M. xanthina* (*V. x. bornmuelleri*). Bodenheimer (1944) also made evaluations without mentioning the subspecies, and he stated that *M. xanthina* is found in Western and Central Anatolia, and the one specimen from Giyi (Alanya) on Taurus mountains was included as *V. aspis balcanica*. However, Mertens (1952) pointed out that the locality of that specimen must be İstanbul and...
that specimen is defined as *V. x. xanthina*. Nilson & Andren (1986) stated that with dark skin color and high numbers of ventralia, that specimen corresponded to north population of *xanthina*.

In detailed systematic studies on both *M. xanthina* specimens (Mertens 1967; Baran 1976) and the specimens previously identified as *V. bornmuelleri* (Werner 1898) showed that Turkish specimens were different from Lebanon-distributed *V. bornmuelleri*. Thus, the nominated subspecies *M. x. xanthina* was distributed in central, western and southern Anatolia, whereas the subspecies *M. x. raddei* was in Eastern Anatolia, around Kars. Also, Mertens et al. (1967) defined a new species as *Vipera latifii* from Iran and mentioned its similarities to *raddei*.

Based on high level of morphological similarities both subspecies which are previously identified in *M. xanthina*’s distribution area (*M. x. xanthina*, *M. x. raddei* and *M. x. palaestinae*) and *M. latifii* which were considered as different species before, were evaluated as the *Vipera xanthina* complex by Nilson & Sundberg (1981). In the same study, venom proteins of the *xanthina*, *raddei* and *palaestinae* were compared and, suggested to be accepted as species as first described. In subsequent years, a comprehensive monograph on *Vipera xanthina* complex was made by Nilson & Andren (1986) and two groups were defined based on the head sculation: *xanthina* group (*V. xanthina*, *V. bulgardaghica*, *V. bornmuelleri* and *V. wagneri*) and *raddei* group (*V. latifii*, *V. albicornuta*, *V. raddei*). In the same study, *M. xanthina* was evaluated by considering the morphological characters and important intra-species variations were determined and divided into two groups as the northern and southern populations within the distribution area in Western Anatolia without any taxonomic separation.

Taxonomic position of *V. xanthina* complex were re-evaluated by Nilson et al. (1999) and new subgenus *Montivipera* was introduced and not only *xanthina* but also *bornmuelleri*, *bulgardaghica*, *albizona*, *wagneri*, *raddei*, *albicornuta*, *latifii* and *kurdistanica* were included in this subgenus. Lenk et al. (2001) supported this new subgenus and in following years *Montivipera* was considered as a genus by Joger & Nilson (2005). In addition, in Rajabizadeh et al. (2014) they described a new viper species, *Montivipera kuhrangica* from Central Zagros Mountains belonging to *M. raddei* complex. This species has a unique color-pattern, high count of head scales and highly projected supraoculars comparing to other taxa of the *M. raddei* complex.

A study on latest approaches in taxonomy and phylogeny of Near and Middle East vipers by Stümpel & Joger (2009) stated that *M. xanthina* (s. str.) populations in Western Anatolia has a genetic diversity which was not taxonomically described. Later, by using morphological methods, Cattaneo (2014) described Chios (Aegean Sea) population as *M. x. nilsoni* and Leros (near Bodrum, Turkey) population as *M. x. dianaet*. Molecular phylogeny and variation of genus *Montivipera* is described by detailed study of Stümpel et al. (2016) and four lineages; Aegean and Greece lineage and Lycia and Taurus were determined in “*xanthina*” group. Even though they are geographically close, it is stated that specimens from Greece and Thracian part of Turkey do not share the same clade. In parallel with Stümpel et al. (2016), Cattaneo (2017) determined morphological differences in Greek Thrace population and described the subspecies *M. x. occidentalis*. In the Stümpel et al. (2016), all known taxa (except Chios and Leros island populations) were included in the analysis, and the genetic data stated that *M. xanthina* generate a cryptic species complex with three or four new taxa. However, it is also stated that phenotypical distinction (taxonomical distinction) was not possible due to lack of material and morphological characteristics might be helpful for determining these taxa. The aim of this study is to determine the morphological characteristics of *Montivipera xanthina* specimens collected from the Geyik Mountains (Gündoğmuş/Antalya), which reveal the differences with the other populations and describe the new population as a new subspecies.

Materials and Methods

A total of four specimens [♀ (2♀ Leg. C. Varol TOK, Batuhan Y. YAKIN; Lat= 36.864081°, Long.= 32.054002°, 1601 m a.s.l.; 1♀ Leg. Murat AFSAR; Lat= 36.892066°, Long.= 32.141158°, 1930 m a.s.l.; 1♀ Leg. C. Varol TOK, Batuhan Y. YAKIN; Lat= 36.892066°, Long.= 32.141158°, 1905 m a.s.l.;] were collected during fieldworks between 2016-2017 from Mühür Mountain on Western of Geyik Mountains near Gündoğmuş, Antalya (Figure 1a, b). Except for the two male specimens, the remaining specimen found was crushed by a car on the road. Specimens were immediately photographed for color-pattern analysis when they were captured and preserved in 96% ethyl alcohol for further morphological analysis in the laboratory.
A NEW SUBSPECIES OF OTTOMAN VIPER FROM TURKEY

All specimens have been deposited in the Collection of the Molecular Zootaxonomy Laboratory of Çanakkale Onsekiz Mart University, Turkey.

Figure 1a. Localities of *M. x. varoli* n. subsp. from Geyik Mountains, Antalya, Turkey.

Figure 1b. Distribution of *M. x. varoli* n. subsp. from Geyik Mountains, Antalya, Turkey. Stars show *M. x. varoli* n. subsp. and yellow polygon shows IUCN distribution of *M.xanthina*.

Morphological measurements and the evaluation of pholidosis characteristics were performed according to Nilson & Andren (1986). All the measurements were taken with a digital caliper with an accuracy of 0.01 mm and the characters were measured (Table 1): total body length (TBL), snout-vent length (SVL), tail length (TL), head length (HL), head width (HW), rostrale width (RW), rostrale high (RH). Other meristic and pholidotic characters; number of ventrals according to Dowling (1951) (V), number of prefrontals (PreV), number of subcaudals (SubC), number of anterior dorsal scale row (aDSR), number of midbody dorsal scale row (mDSR), number of posterior dorsal scale row (pDSR), number of apical plates (Ap), interocular row of scales (anterior part) (aInto), number of scales between canthals, supranasal and apicals- intercanthals (IntC), number of all scales between supraoculurs (IntSup), number of canthal plates (right) (Canr), number of canthal plates (left) (Canl), first circumocular row (right) (1cirR), first circumocular row (left) (1cirL), second circumocular row (right) (2cirR), second circumocular row (left) (2cirL), shortest distance between supralabials and eye-subocular (Suboc), supralabials (right) (supR), supralabials (left) (supL), sublabials (right) (subR), sublabials (left) (subL); Index calculations were
performed according to Baran, 1976: RW/RH x 100 (Rostrale index), TBL/TL x 100 (Tail index). All the measurements and index values were compared with literature (Baran, 1976; Başoğlu & Baran 1980; Nilson & Andren 1986; 1992; Stümpel et al. 2016).

Table 1. The metric and meristic characters of M. x. varoli n. subsp. from Geyik Mountains, Antalya, Turkey.

| Characters | Geyik Mt.-1 | Geyik Mt.-2 | Geyik Mt.-3 | Geyik Mt.-4 |
|-----------|-------------|-------------|-------------|-------------|
| TBL       | 543         | 440         | 356         | 554*        |
| SVL       | 503         | 404         | 322         | 504         |
| TL        | 43          | 38          | 29          | 43*         |
| V         | 160         | 157         | 157         |             |
| PreV      | 3           | 3           | 3           | 3           |
| SubC      | 27          | 28          | 26          | 27*         |
| aDSR      | 24          | 23          | 23          | 23          |
| mDSR      | 23          | 23          | 23          | 23          |
| pDSR      | 18          | 17          | 17          | 17          |
| Ap        | 2           | 2           | 2           | 2           |
| aInto     | 6           | 6           | 7           | 6           |
| IntC      | 13          | 13          | 13          | 12          |
| Intsup    | 29          | 30          | 31          | 27          |
| Canr      | 2           | 2           | 2           | 2           |
| Canl      | 2           | 2           | 2           | 2           |
| 1cirR     | 11          | 12          | 12          | 12          |
| 1cirL     | 11          | 10          | 12          | 10          |
| 2cirR     | 13          | 16          | 13          | 12          |
| 2cirL     | 13          | 12          | 13          | 14          |
| Suboc     | 2           | 2           | 2           | 2           |
| supR      | 10          | 10          | 10          | 10          |
| supL      | 10          | 10          | 10          | 10          |
| subR      | 13          | 14          | 13          | 12          |
| subL      | 13          | 12          | 13          | 11          |
| HL        | 25.95       | 23.60       | 18.32       | 26.56       |
| HW        | 20.53       | 16.58       | 12.02       | 18.77       |
| RW        | 4.08        | 3.39        | 3.15        | 4.64        |
| RH        | 3.53        | 3.26        | 2.78        | 4.39        |
| Rostrale index | 115.58 | 103.98 | 113.30 | 105.69 |
| Tail index | 8.54   | 9.40   | 9.00   | 8.53   |

*broken tail specimen

Results

Montivipera xanthina varoli n. subsp.

Holotype and type locality: Male, collected by Cemal Varol TOK and Batuhan Yaman YAKIN on August 31, 2017, in Mühür Dağ on western of Geyik Mountains, Gündoğmuş, Antalya, Turkey 1601 m. a.s.l.

Paratypes: 2 ♂ and 1 ♀, collected by Cemal Varol TOK, Murat AFSAR and Batuhan Yaman YAKIN on June 01 and June 15, 2016, in Mühür Dağ on western of Geyik Mountains, Gündoğmuş, Antalya, Turkey (1601 m and 1905 m a.s.l.).
A NEW SUBSPECIES OF OTTOMAN VIPER FROM TURKEY

Figure 2. The holotype of *Montivipera xanthina varoli* (male) from Geyik Mountains, Antalya, Turkey.
Diagnosis: This subspecies has similar characteristics with those of the southern populations according to Nilson & Andren (1986). The whiteness between spots and zig-zag windings in the dorsum is more prominent in the new subspecies than in the southern population, and females have darker greyish-brown skin color than males. Whiteness between blackish spots can be also more prominent in male specimens compared to only adult female specimen. In three male specimens, there was almost no spotting and colorization under the head. The spots on ventrals became denser in the mid-body and forms darker colorization at the end of body. Also, just as stated in Nilson & Andren (1986), in three of the four evaluated specimens, they have neck spots united with the dorsal band. The tail tips of all four specimens are yellowish-orange or light orange while tail tip is yellow for other M. xanthina populations according to Nilson & Andren (1986). In addition to color-pattern properties, new subspecies are differ from M. x. nilsoni by having two series of circumocular scales which is similar to nominate subspecies; M. x. diana by having lower number of rows of dorsal scales (anterior 23-24; mid-body 23; posterior 17-18); M. x. occidentalis a higher number of intercanthals and dorsal scales rows. Also new subspecies can be distinguished from other M. xanthina populations in Turkey by both having more intercanthals (12, 13) and less subcaudalia (≤30).

Description of Holotype: COMU-ZDEU 2017/15. Adult male; TBL 440 mm, SVL 404 mm, TL 38 mm, HL 23.60 mm, HW 16.58 mm, RW 3.39 mm, RH 3.26 mm. Pholidotic characters; V 157, PreV 3, SubC 28, aDSR 23, mDSR 23, pDSR 17, Ap 2, aInto 6, IntC 13, IntSup 30, Canr 2, Canl 2, 1cirR 12, 1cirL 10, 2cirR 16, 2cirL 12, Suboc 2, supR 10, supL 10, subR 14, subL 12. Indexes; Rostrale index: 103.98, Tail index: 9.40 (Figure 2). This specimen was chosen as holotype since the larger male specimen’s tip of tail was damaged.

Dark brownish-black spots are present on dorsum on the gray ground-colour. The bands that begins at the back of the eyes have darker brownish-black colorization. Blackish-brown spots are present on the dorsum and occasionally these spots were circled blackish scales. The spots on the dorsum might be separate but they are connected especially at the end of the tails. At the connection region of spots or zig-zag windings on dorsum, a lighter white colorization is present. Large spots that are close the back of head and the first dorsal spot closest to head are not united. A small extension from dorsal spots reaches between head spots. Two small spots are present on the head close to the eyes. At the lateral sides of the body, between the two spots and zig-zag windings, there are brown spots which form a thin line that reaches to ventral. The head and back scales are carinated (Figure 2, 3A).

Ventral has yellowish white color. The under of head has fewer small spots and towards the end of body, the small point-shaped spots becomes denser. In some of the ventrals, dark spots are present in the regions that connect with the back scales. There are fewer spots under the tail and a prominent yellowish-orange colorization can be observed (Figure 3B).

![Figure 3. The holotype of Montivipera xanthina varoli (preserved) from Geyik Mountains, Antalya, Turkey (A-Dorsal, B-Ventral).](image-url)
A NEW SUBSPECIES OF OTTOMAN VIPER FROM TURKEY

3.15 mm and 4.64 mm, RH 2.78 mm and 4.39 mm. Pholidotic characters; V 157 and 157, PreV 3 and 3, SubC 26 and 27*, aDSR 23 and 23, mDSR 23 and 23, pDSR 17 and 17, Ap 2, aInto 7 and 6, IntC 13 and 12, IntSup 31 and 27, Canr 2 and 2, Canl 2 and 2, 1cirR 12 and 12, 1cirL 12 and 10, 2cirR 13 and 12, 2cirL 13 and 14, Suboc 2 and 2, supR 10 and 10, supL 10 and 10, subR 13 and 12, subL 13 and 11. Indexes; Rostrale index: 113.30 and 105.69, Tail index: 9 and 8.53. The values of the only examined female: TBL 543 mm, SVL 503 mm, TL 43 mm, HL 25.95 mm, HW 20.53 mm, RW 4.08 mm, RH 3.53 mm. Pholidotic characters; V 160, PreV 3, SubC 27, aDSR 24, mDSR 23, pDSR 18, Ap 2, aInto 6, IntC 13, IntSup 29, Canr 2, Canl 2, 1cirR 11, 1cirL 11, 2cirR 13, 2cirL 13, Suboc 2, supR 10, supL 10, subR 13, subL 13. Indexes; Rostrale index: 115.58, Tail index: 8.54.

In male specimens, the dorsum ground-colour is brownish-grey. The spots and zig-zag windings are blackish brown, and darker scales are present around it. These spots can be connected or separated. At the connection points of dorsal spots, there is a lighter white colorization. Two large oblique spots on the backsides of the head are united with back pattern at the neck and form a “Y” shape. Following this Y shape, the spots with the shape of quadrangle, circular or half-moon shaped form zig-zag bands especially in male specimens and turn into a straight line on the tail. On the lateral side, the spots with the same color as dorsal spots form a line towards ventrals. The ventral is yellowish white, and under head it is almost spotless, towards the tail the spots continuously increase but there are almost no spots, or fewer spots under the tail. Less prominent little dark spots make a line on each side of the ventrals. Anal plate has less spots, however between midbody to anal plate spot the density is very high. Towards the tip of the tail, yellowish-orange colorization is present, and it is especially prominent below the tail.

The only female specimen has the brownish-grey dorsal background, and dark black spots and, darker scales around the spots. At the connection points of dorsal spots and zig-zag windings, a lighter whitish colorization can be observed. Dorsal spots and zig-zag windings continues after midbody in a separated manner and forms a line at the tip of tail. Large spots that are close the back of the head and neck are united with the first dorsal spot close to the neck and forms a “Y” shape (Figure 4A).

Ventral background color is yellowish white and dark spots are present in the sides of ventrals close to the dorsal scales. In some ventrals, the middle sections also have dark spots. The tail has a prominent colorization with yellowish-orange color and very few spots under the tail (Figure 4B).

![Figure 4. A female paratype of *Montivipera xanthina varoli* from Geyik Mountains, Antalya, Turkey (A-Dorsal, B-Ventral).](image)

**Habitat and Distribution:** The specimens were collected in rocky areas with subalpine herbaceous plant vegetation on mountain slope on Mühür Mt. on western of Geyik Mountains, Gündoğmuş/Antalya, Turkey (Figure 5). *Euphorbia nicaeensis* is common, and *Verbascum* sp. is also observed in the area. In addition, *Astragalus* sp. and *Juniperus oxycedrus* are also seen. There are steppe areas in the higher parts, and moist areas in the regions close to the valley floor. Other sympatrically living reptiles are; *Testudo graeca*, *Anatololacerta pelasgiana*, *Stellagama stellio*, *Eirenis modestus*, *Platyceps najadum* and newly described
critically endangered viper subspecies *Vipera anatolica senliki*. Also, *Pelophylax bedriagae* and *Ablepharus budaki* were given as sympatric species in Göçmen et al. (2017).

**Figure 5.** Habitat of *M. x. varoli* n. subsp. from Geyik Mountains, Antalya, Turkey.
A NEW SUBSPECIES OF OTTOMAN VIPER FROM TURKEY

Derivatio nominis: The newly described subspecies were named in honor of Prof. Dr. Cemal Varol TOK who made valuable contributions to Turkish Herpetofauna and also the word “var’ol” is a verb that means “to exist, to stay alive, to be in existence”.

Table 2. The comparison of some characteristics of new subspecies, north and south populations of M. xanthina and M. bulgardaghica stated in Nilson ve Andren (1986). N-xanthina= M. xanthina (northern populations), S-xanthina= M. xanthina (southern populations), Min= minimum, M= median, Max=maximum.

| Characters                  | Present study | Nilson ve Andren (1986) N-xanthina | Nilson ve Andren (1986) S-xanthina | Nilson ve Andren (1986) M. bulgardaghica |
|-----------------------------|---------------|-------------------------------------|-------------------------------------|-----------------------------------------|
|                             | M xanthina varoli | (Min-Max), M                        | (Min-Max), M                        | (Min-Max), M                           |
| Subcaudals_m                | 26, 28, 27** (Geyik Mt:2,3,4) | (30-37) 34.3                        | (30-37) 32.1                        | (29-33) 31                              |
| Subcaudals_f                | 27 (Geyik Mt.1)   | (27-36) 31.2                        | (27-32) 29.8                        | 26                                      |
| Apicalia                    | 2              | 2.13                                | 2                                   | 2.67                                    |
| Subocular* rows             | 4              | 3.96                                | 4                                   | 2.67                                    |
| frist circumocularia*       | 22.5           | 24.5                                | 24.2                                | 20.00                                   |
| 2nd circumocularia*         | 26.5           | 29                                  | 29.8                                | 22.3                                    |
| Supralabialia*              | 20             | 19.9                                | 19.7                                | (9-9) 18                                |
| Sublabialia*                | 25.25          | 25.1                                | 25                                  | 23                                      |
| Apicalia                    | 2              | 2                                   | 2.1                                 | 3                                       |
| Cantalia                    | 2 (according to Baran, 1976) | 2*                                 | 2.1*                                | 2*                                      |
| Scales in interocular row   | 6.25           | 6.6                                 | 6.9                                 | 6                                       |
| Intercanthals               | 12.75          | 10.07                               | 11.4                                | 10.7                                    |
| Intersupraocular            | 29.25          | 30.8                                | 30.9                                | 30                                      |
| Dorsal coloration           | female are darker than males | often darker and marbled in females | normally light grey in both sexes | curved dorsal band to the right or has partially dark-spotted more or less round or quadrangular shape |
| Ventral pattern             | The under the head and the beginning part of the ventrum unspotted or less spotted in males. Concentrating spots from the middle of the ventrum to the tail end creates a more blackish dark discoloration | not mentioned | not mentioned | not mentioned |
| neck pattern                | The combined state of the patterns on the head in the examined samples is generally 75% less often united with dorsal pattern (< 16 %) | often united with dorsal pattern (> 50%) | -                                      |
| Tail tip                    | yellowish orange or light orange | yellowish | yellowish | red (in live) |
| ventralia male              | 157            | (158-167) 163.5                     | (151-159) 155.5                     | 150,154                                 |
| ventralia female            | 160            | (156-169) 161.2                     | (147-159) 153.4                     | 145                                     |

*Sum of left and right sides according to Nilson&Andren, 1986.
** Broken tail specimen
**Discussion**

The new subspecies are similar to descriptions in Baran (1976) and Başoğlu & Baran (1980), however in these studies, the Turkish specimens were considered without a taxonomic distinction. In the previous studies, researchers did not collect samples from the localities where our new subspecies live for the morphological analysis. The one specimen from Giyi (Alanya) on Taurus mountains which was included as *V. a. balcanica* by Bodenheimer (1944), reevaluated by Mertens (1952) and described as *V. x. xanthina*, but it was pointed out that the locality of the specimen must be Istanbul. This opinion was also supported by Nilson & Andren (1986) and they noted that the dark background color and high number of ventralia correspond to the northern population of *M. xanthina*.

As is mentioned in the diagnosis, it is obvious that the new subspecies *varoli* is distinct from other populations of the *Vipera xanthina* group by color-pattern and meristic characteristics (Table 2). New subspecies *varoli* is similar to the southern populations since females have 27-32 subcaudalia, however since subcaudalia of males of southern populations 30-35, in new subspecies’ males are not closely less than 30, the new subspecies has a higher number of intercanthals (scales between canthals, apicals and supranasals) and the slightly white coloration between dorsal spots or zig-zag windings that are mentioned by Nilson & Andren (1986) *xanthina* for the southern populations are more distinct and also have different in spot or zig-zag windings shape (Table 2). Furthermore, the latest molecular studies pointed out that *M. xanthina* specimens have to be comprehensively evaluated based on their morphology and it is distributed as a cryptic species complex with three or four new taxa by Stümpel et al. (2016). Specimens evaluated in this study were collected from around Geyik Mt as stated in Stümpel et al. (2016) and they belong to Taurus group of *xanthina* clade since they have the color-pattern showed in that study. Three of four of the specimens showed neck spots united with the dorsal band whereas the ratio of this property is 56% for the southern population in Nilson & Andren (1986).

The new subspecies differs from *M. b. bulgardaghica* which has a distribution on the eastern part and included in nominate subspecies by Stümpel et al. (2016) by following characteristics: dorsal pattern, [According to Nilson & Andren (1986) dorsum pattern has a dorsal band that is inclined towards the right side or partly round or rectangular with dark spots], apicalia is 2 (3 in *bulgardaghica*), supralabialia is 10 on both sides (9-9 in *bulgardaghica*), ventralia is 157 in males and 160 in the female (*bulgardaghica* has lower numbers: 150-154 in males, 145 in females). In conclusion, we believe that the examined species should be considered as a separate taxon based on color-pattern and pholidolial features differing from known *M. xanthina* populations.

**Key for the identification of subspecies of Montivipera xanthina** (Gray, 1849) (revised from Cattaneo, 2017)

1. Specimens with 23 midbody scale rows and 17 scale rows on posterior part of body; generally more than 10 intercanthals......................................................... 2
2a. Specimens trend to 3 rows of circumocular scales. Distribution: Aegean Island of Chios.......................................................... *Montivipera xanthina nilsoni*
2b. Specimens with 2 rows of circumocular scales. Distribution: Other Turkish populations and NE Greece (south-eastern Evros).......................................................... *Montivipera xanthina xanthina*
2c. Specimens with 17-18 scale rows on posterior part of body, generally less subcaudalia (≤30), yellowish-orange or orange coloration at the tip of the tail. Distribution: Geyik Mt./Turkey ................................................................................................................................... *Montivipera xanthina varoli* n. subsp.
3. Specimens with 23-25 (24,3) midbody scale rows; generally, less than 10 intercanthals;17-19 (17,8) scale rows on posterior part of body. Distribution: Aegean Island of Leros .................................................................................................................................. *Montivipera xanthina dianae*
4. Specimens with 21-23 (22,0) midbody scale rows; generally less than 10 intercanthals; 15-17 (16,6) scale rows on posterior part of body. Distribution: south-eastern Greek Rhodopes........... *Montivipera xanthina occidentalis*

**Acknowledgment**

The data contained in this study were reached within the scope of a project entitled “The Task of Inventory and Monitoring of the Biological Diversity of the Terrestrial and Inland Water Ecosystems in Antalya Province”, funded by the 6th Regional Directorate of the Ministry of Forestry and Water Affairs. We would like to thank the establishment concerned and Turunç Peyzaş Inc. Co. for the support to the study. While deciding the description of new subspecies, we inspired by the results of Stümpel et al. (2016).
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224
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