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Taxonomic Position of the *Vipera xanthina* Complex

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Zusammenfassung

Die *Vipera xanthina*-Gruppe unterscheidet sich morphologisch, genetisch, serologisch und ökologisch von *Vipera* s. str. (*aspis-ammodytes*-Gruppe), *Pelias* (*berus*-Gruppe, *ursinii*-Gruppe), *Macrovipera* (*lebetina*-Gruppe) und *Daboia russelii*. Sie stellt eine eigene evolutionäre Linie dar und wird daher als neue Untergattung *Montivipera* von den anderen Angehörigen der Gattung *Vipera* abgegrenzt.

Abstract

The *Vipera xanthina* group differs morphologically, genetically, serologically and ecologically from *Vipera* s. str. (*aspis-ammodytes* group), *Pelias* (*berus* group, *ursinii* group), *Macrovipera* (*lebetina* group) and *Daboia russelii*. It represents an evolutionary clade of its own and is therefore separated here from other *Vipera* as a new subgenus, *Montivipera*.

Introduction

The Eurasian vipers have earlier been divided into subgenera or genera. The genus *Vipera* was introduced by LAURENTI in 1768 in his description of the Italian asp viper (= *Vipera aspis francisciredi*). MERREM (1820) introduced *Pelias*, based on *Vipera berus*, for the smaller vipers of the *berus* and *ursinii* complexes. *Daboia* was originally introduced by GRAY in 1842 for *Daboia russelii*. In 1927, REUSS introduced the name *Macrovipera* for the *Vipera lebetina* group. In a recent paper (NILSON & ANDRÉN 1997) the two remaining species complexes in *Vipera* s. str. were treated as two separate systematic entities: *Vipera* 1 (= *Vipera* s. str., the *aspis/ammodytes* complex) and *Vipera* 2 (the *xanthina* complex, sensu NILSON & ANDRÉN 1986).

Two kinds of reproductive cycles, the '*aspis*' and the '*berus*' type, have been described among Eurasian viperines (SAINT GIRONS 1976, 1982; NILSON & ANDRÉN 1997). The '*aspis*' type is characterised by spermatocytogenesis and spermiogenesis from summer to autumn, with the production of ripe sperm starting already in the autumn and continuing during the spring. As a consequence, mating occurs in both autumn and spring. The '*berus*' type is characterised by autumn spermatocytogenesis and spring spermiogenesis, with the sperm not fully developed until just prior to the start of the spring mating, which in turn is triggered by the spring moult (NILSON 1980). The mountain vipers of the Near and Middle East, the *Vipera xanthina* complex (NILSON & ANDRÉN 1986), express the '*berus*'

strategy with a spring mating triggered by moulting. The different strategies can be connected to different habitat types and ecology. Members of the *xanthina* complex inhabit lowland to high mountain environments, the latter in upland and subalpine forests with extreme climatic conditions. Members of the *aspis/ammodytes* complex, exhibiting the '*aspis*' type of reproduction, are predominant in lowland temperate areas, such as southern Europe and northern Turkish Anatolia (*transcaucasiana*).

The *aspis/ammodytes* complex can be traced back to the lower Miocene by series of fossil records. *Vipera antiqua* from the lower Miocene at Dolnice, Czech Republic, is 'almost identical' to modern *Vipera ammodytes*, *V. maghrebiana* from the middle Miocene of Morocco is another member of this lineage, and *Vipera meotica* from the upper Miocene of the Ukraine shows great similarities to *Vipera aspis* (SZYNDLAR 1987, SZYNDLAR & ZEROVA 1992).

The *Vipera xanthina* complex is represented by *V. platyspondyla* from the lowermost Miocene of Dolnice, Czech Republic, which represents an early ancestral member of this lineage. Fossil remains of this species have been found together with *Vipera antiqua* in the same deposits (SZYNDLAR & SCHLEICH 1993). In the middle Miocene this lineage is represented by *V. ukrainica* from the Ukraine (ZEROVA 1992).

The splitting of lineages is a Paleogene or early Miocene event (SZYNDLAR & RAGE, this volume). All

extant taxa within lineages seem to share the same reproductive strategy, and reproduction thus seems to follow the evolutionary history of the different lineages. Taxa with similar reproductive systems are further united by similar adaptations to climate and habitat (NILSON & ANDRÉN 1997). The phylogenetic separation of lineages represents a major ecological shift, and the lineages exhibit their own ecological adaptations. These facts should be reflected in the taxonomy.

Genetic separation of the *Vipera xanthina* group from *Daboia*, *Macrovipera* and *Vipera* (subgenera *Pelias* and *Vipera* s. str.)

OBST (1983) had included the *xanthina* group in *Daboia* GRAY 1842. The revalidation of *Macrovipera* REUSS 1927 (HERRMANN et al. 1992b) already revealed that only *D. russelii* could be included in *Daboia*, as very large immunological distances (IDs) separate the type species from all others that OBST included in *Daboia*. The IDs of *V. xanthina* and *V. raddei* from *D. russelii* are even greater than the distances separating these species from *Macrovipera* (Tab. 1). The mean IDs of *xanthina* and *raddei* from *Macrovipera deserti* are in turn higher than those towards the rest of *Vipera*. *Vipera palaestinae* and *Macrovipera lebetina* occupy an intermediate position. Immunological data do not completely rule out an affinity of *palaestinae* to *Macrovipera* (HERRMANN et al. 1992b: Fig. 2) or of both to *Daboia* (HERRMANN & JOGER 1997: Fig. 4). Our data are not unambiguous regarding the position of *palaestinae*. The species should not be included in the *xanthina* group and may not even belong to the genus *Vipera*. We are currently sequencing mitochondrial genes in order to clarify this problem ¹.

The members of the *V. xanthina* group, however, appear still close enough genetically to other *Vipera* species to be left in that genus without deterring its monophyly. Nevertheless they occupy a peripheral position within *Vipera*. The ID values in Tab. 1, ranging between 15.4 and 19.6, should be compared with the mean ID between *V. (Pelias) berus* and *V. (Vipera) aspis/ammodytes*, which is 12.3 (adjusted to the same scale). Even higher genetic differences are revealed by DNA-DNA hybridisation of whole genomes (Tab. 2). The delta_{T50H} statistics applied have been regarded as one of the best estimates for genetic distances. SIBLEY & AHLQUIST (1983) propose for birds that a delta value above 4

Tab. 1: Relative immunological distances (means of several tests) derived from quantitative precipitation between plasma albumins of *Vipera xanthina*, *V. raddei* and other vipers. Means were calculated from reciprocal values (distances obtained from antisera against both partners) except for *D. russelii*, *V. kaznakovi* and *V. ursinii*. Values were subjected to corrections for differential reaction of antisera and for species-specific evolutionary rates according to SARICH & CRONIN (1976) and SARICH & WILSON (1967). * = means of tests involving both species.

	<i>V. xanthina</i>	<i>V. raddei</i>
<i>Daboia russelii</i>	34.4	38.1
<i>Macrovipera lebetina</i>	19.3	20.1
<i>Macrovipera deserti</i>	26.5	32.1
<i>Vipera palaestinae</i>	19.4	19.4
<i>Vipera berus</i>	16.9	16.7
<i>Vipera aspis</i> / <i>V. ammodytes</i> *	19.6	19.0
<i>Vipera kaznakovi</i>	15.4	n.d.
<i>Vipera ursinii</i>	16.4	n.d.
<i>Vipera raddei</i>	7.7	0

could hold for different genera. In primates a value of 4 separates the great apes (Hominidae) from the Gibbon family (Hylobatidae) (SIBLEY & AHLQUIST 1987). The genetic distance between *Pelias* and *Vipera* s. str. is below that value but the distance between each of them and *V. xanthina* is clearly above it. Therefore, if *Pelias* is recognised as a subgenus (all the more considering that the *Vipera ursinii* group may even be separable as another distinct subgenus, according to immunological data of HERRMANN et al. [1992a]), there can be no doubt that the *xanthina* group deserves at least the same taxonomic rank.

Taxonomical consequences

We believe that both the '*aspis*' complex and the '*xanthina*' complex deserve at least status as subgenera ². Following the arguments illustrated above and further expressed in NILSON & ANDRÉN (1997), we consider it appropriate to separate the *Vipera aspis* complex (*V. aspis*, *ammodytes*, *latastei*, *transcaucasiana* and *monticola*) and the *Vipera xanthina* complex (*V. raddei*, *V. xanthina* and related taxa) into different subgenera, with the first group alone in *Vipera* s. str. From all investigated aspects (reproductive biology, ecology, climatic preference,

¹ First results based on cytochrome b and 16s RNA genes indicate a closer relationship of *palaestinae* to the North African *Macrovipera*, and to *Daboia russelii*, than to the *xanthina* group, the latter showing some sequence homology with oriental *Macrovipera* (Lenk et al., in prep.).

² If the high genetic distances between members of the *berus* and *ursinii* complexes, as revealed by immunological comparisons of albumins, hold true, the *ursinii* complex would deserve subgenus rank, too, an available name being *Acridophaga* REUSS 1927. Moreover, the affinities of the *kaznakovi* group (to *Vipera*, *Pelias* or *Acridophaga*) remain undetermined.

Tab. 2: Genetic distances derived from DNA-DNA hybridisation experiments of whole genomes after separation of multiple-copy genes ($\Delta_{T_{50H}}$ = temperature difference for 50% hybridisation compared to self-hybridisation) for *Vipera xanthina*, *V. (Pelias) berus* and *V. (Vipera) aspis/ammodytes**. Data from HERRMANN et al. (1987).

* = means of tests involving both species

Hybridised pairs	Range of values	Mean
<i>xanthina</i> – <i>berus</i>	5.02–5.66	5.34
<i>xanthina</i> – <i>aspis</i> / <i>ammodytes</i>	3.97–6.42	5.20
<i>berus</i> – <i>aspis</i> / <i>ammodytes</i>	1.77–2.76	2.36

genetic distances, fossil history etc.) the old genus *Vipera* is a collection of five or more different lineages each with its own evolutionary history (HERRMANN et al. 1992a, NILSON & ANDRÉN 1997).

Based on earlier classifications these lineages were listed as *Pelias* (the *berus* and *ursinii* complexes), *Vipera* 1 (the *aspis* complex), *Vipera* 2 (the *xanthina* complex), *Macrovipera* (the *lebetina* complex) and *Daboia* (taxon *russelii*). *Macrovipera* and *Daboia* have currently been treated as genera (cf. GOLAY et al. 1993) while *Pelias* was considered a subgenus (cf. SZYNDLAR & ZEROVA 1992).

It may be a purely academical question whether the recognised taxonomic entities should be treated as full genera or subgenera, but we consider it evident that to date we still have two lineages retained in *Vipera* s. str., and as *Vipera* 1 and *Vipera* 2 are not related this should be made obvious. Therefore we rename *Vipera* 2 *Montivipera* n. subgen., thereby erecting a new subgenus within the genus *Vipera*.

Montivipera n. subgen.

Species typica: *Daboia xanthina* GRAY 1849 (= *Vipera xanthina*).

Derivatio nominis: Translation of the vernacular name 'mountain viper', referring to the preferred habitat of these vipers in rocky, mountainous areas.

Diagnosis: A taxon comprising medium-sized snakes mostly with pronounced and spectacular colour patterns. Normally 23 midbody scale rows, totally fragmented head scales except for big and well-developed supraoculars. Nasal and prenasal united ventrally. A double subocular row. Snout not protruding. Two apicals in contact with nasal. Ovoviviparous mountain-dwellers. Maximum size normally less than one metre (Greek insular *V. xanthina* is an exception; see JOGER & NILSON in press). The following taxa are included in this subgenus: *xanthina*, *bornmuelleri*, *bulgardaghica*, *albizona*, *wagneri*, *raddei*, *albicornuta*, *latifii* and *kurdistanica*. Description of external morphology can be found in NILSON & ANDRÉN (1986).

Vipera palaestinae is here excluded from the *xanthina* complex, i.e. from *Montivipera*. Despite various facts pointing in other directions, characters like big size, scalation, oviparity, colour pattern (compare *mauritanica*), habitat and ecology suggest an affinity with *Macrovipera*. However, for the time being the phylogenetic position of *Vipera palaestinae* remains unresolved (but see above under 'Genetic separation ...').

Montivipera differs from *Macrovipera* ecologically in inhabiting rocky habitats at higher altitudes, mostly in temperate areas with a pronounced hibernation period. In contrast *Macrovipera* inhabits deserts, semi-deserts and steppe habitats (less pronounced in *Macrovipera schweizeri*). Moreover, *Montivipera* contains ovoviviparous taxa (*Macrovipera* is oviparous) and is also genetically well separated from *Macrovipera* (see above). The new subgenus has a fossil history of its own, although the stability of palaeontologists' opinions regarding this seems to vary to some extent from time to time. *Montivipera* can easily be distinguished from *Macrovipera* by the presence of well-developed supraocular plates.

From *Vipera* s. str. (= the *aspis* complex; '*Vipera* 1' sensu NILSON & ANDRÉN 1997) *Montivipera* differs ecologically in that it inhabits habitats at somewhat higher altitudes. It contains taxa that are genetically well separated from *Vipera* s. str. (see below) and shows the '*berus*' type of reproductive strategy while *Vipera* s. str. displays the '*aspis*' reproductive strategy (NILSON & ANDRÉN 1989, 1997; and unpublished data). *Montivipera* has a fossil history that is well separated from that of *Vipera* s. str. (see SZYNDLAR & RAGE, this volume) and can easily be distinguished from *Vipera* s. str. by the absence of a protruding snout.

The difference of *Montivipera* from *Pelias* is defined by the former having a complete head scale fragmentation (except for supraoculars), 23 dorsal scale rows, subunited nasal-prenasal plates, a double row of subocular scales between orbit and supralabials, a much stouter body and broader head. Moreover the two subgenera represent well-separated lineages genetically, osteologically and based on the fossil record.

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Vipers of Caucasus: Taxonomic Considerations

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Zusammenfassung

Die Vipern (Viperinae) sind in der Kaukasusregion durch zehn Taxa vertreten. Die meisten von ihnen gehören zur Untergattung *Pelias* (*renardi*, *kaznakovi*, *lotievi*, *dinniki*, *ebneri*, *darevskii* und *eriwanensis*), während *Vipera transcaucasiana* die östlichste Vertreterin der Untergattung *Vipera* ist und *V. raddei* zur Untergattung *Montivipera* zählt. Nur eine Art gehört zur Gattung *Macrovipera* (*M. lebetina obtusa*). Fünf Arten sind entlang des Großen Kaukasus verbreitet und sieben Taxa kommen zwischen dem Kleinen Kaukasus und dem transkaukasischen (Armenischen) Hochland vor. Verschiedene taxonomische und nomenklatorische Fragen (*V. eriwanensis* – *V. darevskii* – *V. (ursinii) ebneri* sowie *M. lebetina* aus Dagestan betreffend) bleiben unbeantwortet. Ein Neotypus wird für das Taxon *eriwanensis* festgelegt.

Abstract

Viperine snakes of the Caucasian Isthmus are represented by ten taxa. The majority of them belongs to the subgenus *Pelias* (*renardi*, *kaznakovi*, *lotievi*, *dinniki*, *ebneri*, *darevskii* and *eriwanensis*), whereas *Vipera transcaucasiana* is the easternmost example from the subgenus *Vipera* and *V. raddei* is a member of the subgenus *Montivipera*. Only one species belongs to *Macrovipera* (*M. lebetina obtusa*). Five species are distributed along the Greater Caucasus and seven taxa occur within the Lesser Caucasus and the Transcaucasian (Armenian) Highland. Several taxonomic and nomenclatural questions (concerning *V. eriwanensis* – *V. darevskii* – *V. (ursinii) ebneri* as well as *M. lebetina* from Dagestan) remain unanswered. A neotype is selected for the taxon *eriwanensis*.

Introduction

In this study of Viperinae, the region referred to as "Caucasus" comprises the range of the former Soviet Union excluding the Turkish and Iranian parts of the Lesser Caucasus, but including the Armenian Highland. Viperinae are represented by ten taxa in the Caucasian Isthmus, which is about 30% of the total Caucasian ophidofauna. The majority belongs to the subgenus *Pelias* (with *renardi*, *kaznakovi*, *lotievi*, *dinniki*, *ebneri*, *darevskii*, *eriwanensis*). A single species from the genus *Macrovipera* (*M. lebetina obtusa*) is present, while *Vipera transcaucasiana* and *V. raddei* are examples of the subgenera *Vipera* and *Montivipera*.

The occurrence of two additional species of Viperinae can be expected: *V. pontica* might be found in the Adjarisckhale river gorge (Choroch river basin) and *V. wagneri* may inhabit the Akhurian river gorge (left tributary of Araz river).

Results

Species distribution is uneven along the Caucasian Isthmus. Five species are known from the Greater Caucasus. Moreover, *Vipera kaznakovi* inhabits only the western Caucasus, while *Macrovipera lebetina* occurs at the easternmost end of the Main Ridge. *Vipera renardi*, *V. lotievi* and *V. dinniki* populate almost the whole area of the Greater Caucasus as

vicariant species of different ecological and altitudinal belts.

Seven taxa occur within the Lesser Caucasus and the Armenian Highland. Again, *Vipera kaznakovi*, *V. darevskii* and *V. transcaucasiana* are restricted to the western sector, *V. raddei* and *V. eriwanensis* populate the central part, while the taxon *ebneri* is distributed in the eastern corner of the Caucasian Isthmus. In the recent past, *Macrovipera lebetina* was a rather widespread species in the foothills of eastern Transcaucasia.

Open taxonomic questions

Several taxonomic and nomenclatural questions within Caucasian Viperinae are still unresolved. In the major parts of the Caucasian region, *Macrovipera lebetina obtusa* seems to be a stable taxon, but in the isolated northernmost part of the range (Dagestan) the population is of uncertain taxonomic status. In some morphological characteristics (pholidosis, coloration) it seems to be close to *Macrovipera lebetina turanica* s. l. (unpublished data). This similarity becomes more understandable if we consider conclusions by N. Ananjeva (see ANANJEVA & ORLOWA 1979) on *Laudakia caucasia* from the same isolated locality. According to these authors, the Dagestan agamid lizards are closer to

animals from Turkmenistan (Balkhan and Kopetdag) than to Transcaucasian agamas. This is one taxonomic question under study and we prefer not to draw any taxonomical conclusion at present or to speculate on possible relationships for this Dagestan population.

Many articles devoted to *Vipera kaznakovi* have been published in recent times, and particularly the morphological differences of the geographically separated Russian (North Colchian) and Turkish (Adjara-Lazistan) populations have been stressed. Thus we did not record completely melanistic specimens in the southern population while those are frequent in the northern one. Further in this southern part of the area polymorphism is not developed as in the northern region. Additionally, differences are present in pholidosis and allozymes (NILSON et al. 1995).

Taking into consideration the long time of isolation, these two macropopulations might be well-founded subspecies. However, in the northern Colchian part of the species distribution area, we are confronted with a quite complicated situation. Following the continuous distribution from Inguri River north-west to Tuapse there is a chain of isolators with the north-westernmost point on the mountain Papay. Specimens from this westernmost locality differ morphologically from 'typical' *kaznakovi*. Animals have a pronounced light-coloured back, characteristic for the '*ursinii*' complex. They have a very light head and neck with white canthals, and a dorsal pattern consisting of a narrow band with sharp zigzag whorls. We also found similar specimens on an isolated meadow on top of the mountain Bolshoy (Great) Pseushkho. The warm and wet adapted *Vipera kaznakovi* is distributed in the same type of habitat today, but these northern populations live in a semi-dry east-Mediterranean landscape. The taxonomic status of these populations is still open.

The high-mountain vipers – *Vipera dinniki* and *V. lotievi* – display a complex situation with great intraspecific variability. It is possible right now to describe at least two subspecies for each species. Both vipers have such a pronounced mosaic distributional pattern along the Greater Caucasus that even in closely adjacent populations (for instance in the Caucasian Reserve) we have demonstrated considerable differences in morphology and allozymes (NILSON et al. 1994, 1995). The westernmost locality for *Vipera dinniki* is known to be Fisht Mountain. However, we have recently found several local populations further west on the westernmost subalpine tops of the Main Caucasian Ridge. In addition we pay special attention to the intraspecific status of different populations of *Vipera dinniki* as well as to *Vipera lotievi* from western Caucasus. *Vipera lotievi* was earlier known only from the semi-arid central and eastern Caucasus.

The mountain vipers of the Near and Middle East, the *Vipera xanthina* complex, form a unique evolutionary lineage (see NILSON & ANDRÉN 1997 and references therein). We consider it appropriate to separate this lineage as a distinct subgenus *Montivipera* (NILSON et al. 1999). The Transcaucasian representatives of this lineage are *V. raddei* and *V. wagneri*.

Type specimen of *Vipera eriwanensis*

It is necessary to focus on some problems with the naming of *Vipera eriwanensis*. Originally, REUSS described *Acridophaga renardi eriwanensis* in 1933 with the type locality near Yerevan at about 2000 m altitude. The description was very short and stated "*A. (renardi) eriwanensis* nov. subsp. mit rotgelber Kehle, 21 Sg., 140+1 Ventr., 9 Slb., bei Eriwan in ca. 2000 m Höhe". This original description is based on a male specimen. It could actually fit other Transcaucasian taxa as well. In 1935, REUSS again presented *Acridophaga eriwanensis* with a slightly longer description of the type and depicted a head of a specimen belonging to the '*ursinii*' complex. Further in the same article it is stated that the type specimen had been collected in 1929/30. In 1929, REUSS had published a photo of a live viper from this area, which, according to personal information from the late Mr. Erich Sochurek, shows the type specimen of *eriwanensis*. Actually this photo of a live specimen shows a viper of the *kaznakovi* complex. *Vipera darevskii*, which has some morphological affinity, is distributed in north-western Armenia, although not close to Yerevan. However, the specimen depicted could equally well be a specimen of *Vipera pontica* or the eastern morph of *Vipera dinniki*. Thus it seems that the type series consisted of more than a single specimen, as different individuals are depicted in the 1929 and 1935 papers by REUSS. All specimens are lost; the description is short and mentions characters not unique to the *ursinii* complex. The 1935 article, however, shows a viper of the '*ursinii*' complex, and we see no reason for a change in nomenclature. Also the 1929 photo was published prior to the original description in 1933, in which there is no reference to this earlier photo. The name *eriwanensis* has been referred to the single taxon occurring in close vicinity of the town Yerevan, i.e. *ursinii* s. l. (= *renardi*, in earlier literature). It was raised to valid status by JOGER (1984) who stated that "Though REUSS' type specimen is lost, there can be no doubt about its identity, as no similar viper occurs in the Eriwan area". The picture of the head of the REUSS type is somewhat more similar to a potential '*ursinii*' than the photo of the entire viper. Also this 'head picture' seems to be a drawing. The type specimen is lost, and the brevity of the description and the number of 'type specimen pictures' create a certain unreliability. In

Fig. 1: *Vipera (Pelias) (Acridophaga) eriwanensis* from Ara Iler, north of Yerevan, Armenia. This is a topotypical specimen.



the absence of any type material, and for reasons of stability, we consider it appropriate to select a neotype for *Acridophaga (renardi) eriwanensis* (*Vipera eriwanensis*) from the Yerevan area.

The designated neotype is a male from Mt. Ara-Iler, north of Yerevan, deposited in the Göteborg Natural History Museum and carrying the number Re.ex. 5158.

Description of the neotype: An adult male (labnr. 322) collected on the mountain Ara-Iler, Armenia, to the north of Yerevan in May 1972. Donated by the Zoological Institute, St. Petersburg, to the Göteborg Natural History Museum. Total length 401 mm, tail 49 mm, the latter amounting to 12.2% of total length. Length of head (from posterior border of parietals to tip of snout) 11.4 mm, breadth of head (at position of eyes) 8.8 mm, size of eye horizontally 2.2 mm and vertically 1.7 mm, distance between eye and border of mouth 1.9 mm. Anterior head flat to weakly concave and covered by rather large scales or plates. Two large supraoculars and one large frontal plate on top of head, parietals unfragmented, frontal separated from supraoculars by one longer anterior and one smaller posterior scale on each side, one canthal and one supranasal scale on each canthus rostralis, and a single apical; five intercanthals and five intersupraoculars. Height/depth of rostral 3.2/2.6 mm, it is bordering two supralabials, two internasals and the apical; eye surrounded by ten circumoculars on each side, four loreals on right side and five on left, upper preocular separated from nasal on both sides, nasal undivided at upper edge, nine supralabials, with the fourth one below eye, and

ten sublabials on each side, anterior supralabials not much enlarged compared to posterior ones, four second chinshields bordering anterior ones, and three and four scales on right and left side, respectively, in the mental row.

Two preventrals and 136 ventrals, 37 + 1 subcaudals, 21 dorsal scale rows at midbody and on neck one head-length behind the head, 17 dorsal scale rows one head-length anterior to anal, scale reduction from 21 to 19 dorsal scale rows at ventral 97.

Dorsal pattern consisting of a zigzag band with 70 windings, lateral body pattern weakly developed and consisting of short narrow longitudinal stripes. Head pattern consists of two dark oblique bands which do not unite, but are just in contact with the dorsal band on both sides. A posterior band from eye to corner of mouth, labial pattern consisting of weak bands on all labial sutures, ground colour light brown with dorsal pattern dark brown and black, ventral side light but with blackish marbling, throat light.

Synonyms:

Acridophaga renardi eriwanensis Th. REUSS 1933. – Nachr. Bl. Aquar. Terrar.-Ver., 1933: 372-373; Berlin. Terra typica: Yerevan (at 2000 m altitude), Armenia.

Vipera ursinii renardi (part). – KRAMER 1961; Rev. Suisse Zool. 68: 627-722.

Vipera ursinii eriwanensis. – JOGER 1984; Tübinger Atlas des Vorderen Orients, Beiheft 12 A: 115 pp.

Vipera eriwanensis. – HÖGGREN et al. 1993; Herpetological Natural History 1 (2): 11-19.

Diagnosis (from NILSON & ANDRÉN in press): It is a small to medium-sized taxon. Maximum total

length is 44.7 cm for males (of which tail length is 5.7 cm), and 50.1 cm for females (tail 6.3 cm).

Head pattern present, while lateral body pattern absent or more weakly developed. Belly pattern whitish. Labial sutures absent in half of the specimens or weakly developed; occipital and postorbital stripes on lateral and dorsal sides of head present; weakly developed bilineated ground colour; dorsal pattern consists of a zig-zag band with rounded corners of windings (Fig. 1).

Usually nine supralabials on each side (occasionally eight or ten) with the fourth under orbit. Two to nine loreals on each side. Nasal mostly undivided, occasionally with an upper nasal split (in less than 30% of the cases); upper preocular mostly not in contact with the nasal; parietals occasionally divided (in around 20% of the cases).

A markedly late reduction of dorsal scale rows (from 21 to 19 rows at an average position near the 95th ventral) i.e. 21 dorsal scale rows on neck, anterior part and midbody, and 17 anterior to anal plate. High number of ventrals. High number of subcaudals.

A taxon of the *Vipera ursinii* complex characterised by a unique serum albumin, most similar to the serum albumin pattern of *renardi*, and to that of the eastern populations of this taxon (see also JOGER et al. 1992, NILSON et al. 1993). Judging by immunological results, the species is possibly most closely related to lowland *renardi*, as is also indicated by electrophoretic studies of isoenzymes (NILSON et al. 1994, 1995).

External morphology evolved as is typical for alpine taxa of the *ursinii* complex; similar to *ebneri*, *lotievi* and to Central Asian mountain meadow vipers in various characters but differing from all in the unique combination of characters (ventral numbers, labial colour, head scalation characters). Differs from alpine European and western Asian populations in the number of midbody scale rows.

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